

REPUBLIC OF INDIA
STATE OF ASSAM, DEPARTMENT OF FISHERIES

**REPUBLIC OF INDIA
THE PREPARATORY SURVEY ON ASSAM
FISHERIES DEVELOPMENT AND
LIVELIHOOD PROJECT
FINAL REPORT
(ADVANCED VERSION)**

FEBRUARY 2025

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

OAFIC CO., LTD.

INTEM CONSULTING INC.

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Project Location Map

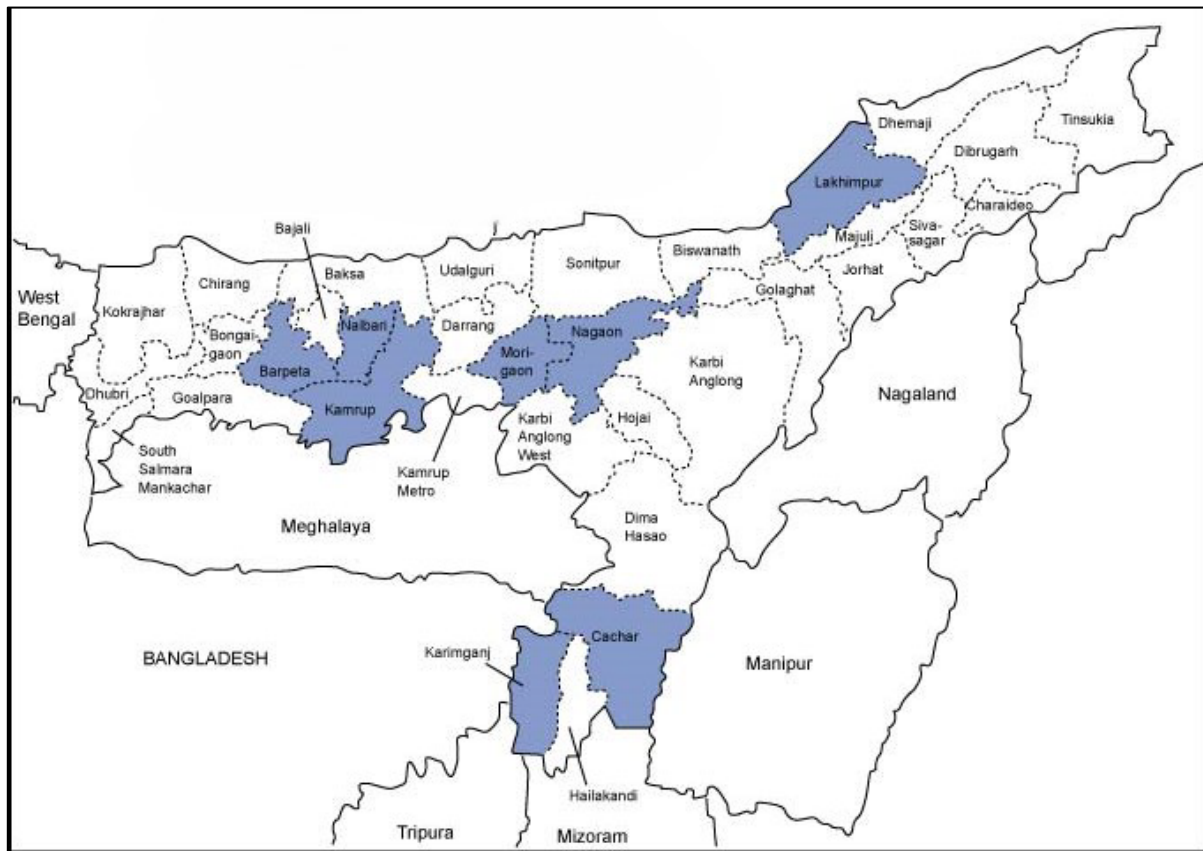


Figure: Project Location Map¹

Source: Tracing https://d-maps.com/carte.php?num_car=31175&lang=en Maps

Photographs

Aquaculture species



Catla (*Catla catla*)



Rohu (*Labeo rohita*)



Mrigal (*Cirrhinus murigala*)



Common carp (*Cyprinus carpio*)



Grass carp
(*Ctenopharyngodon idella*)



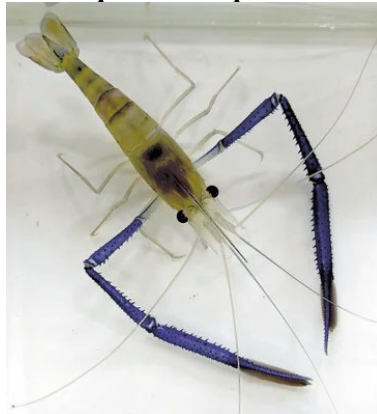
Silver carp
(*Hypophthalmichthys molitrix*)

Source: Anujjindal.in

Target species for aquaculture promotion in the Project



Pangasius (catfish)
(*Pangasianodon hypophthalmus*)



Freshwater prawn (Scampi)
(*Macrobrachium rosenbergii*,)



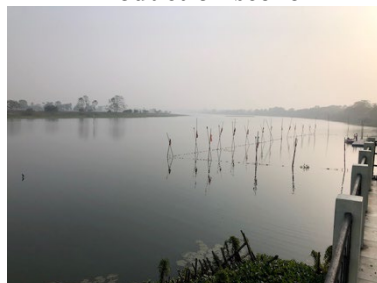
Sarana
(*Puntius sarana*)

Source: Pangasius and Scampi :Anujjindal.in/ Sarana: <http://www.fishbiosystem.ru>

Production scene



Charan Beel, Morigaon district



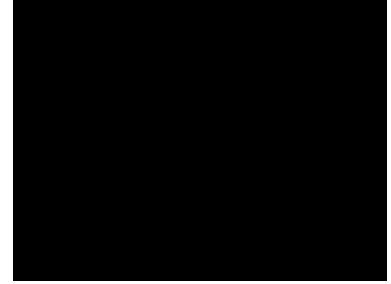
Water quality control of Beel



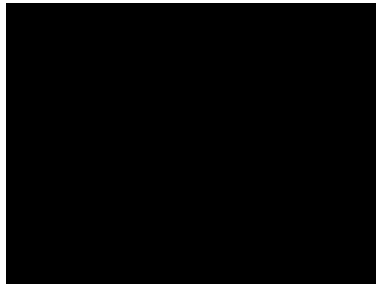
Community tank (pond)



Finance board for pond construction



Harvest preparation with sein net



Small scall feed mill plant



Floating feed produced in Odisha state



Carp hatchery system



Circular concrete tank with biofloc system

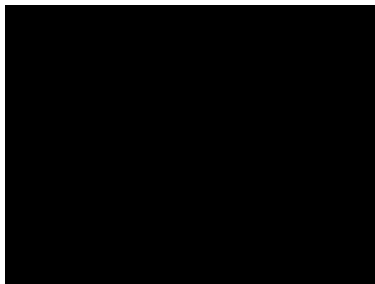


RAS

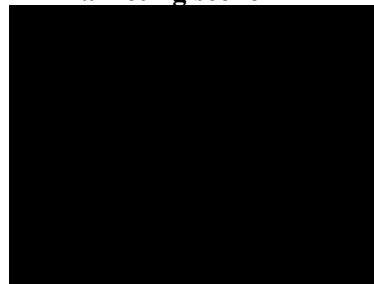


Ornament fish tank

Marketing scene



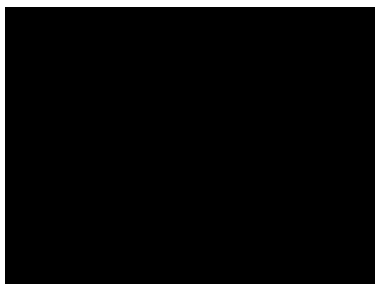
Semi-urban fish market (retail)



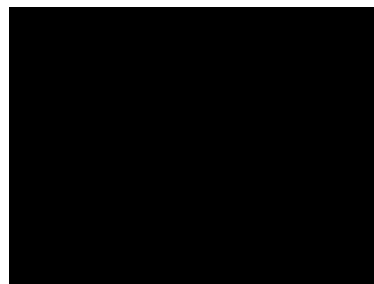
Fish vender with balance



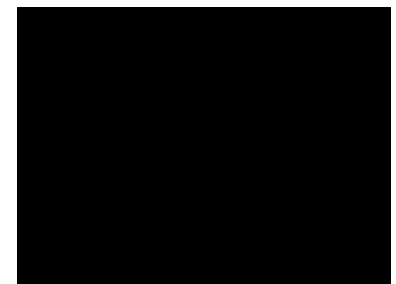
Dried fish



Live fish transportation with moto between farm and market



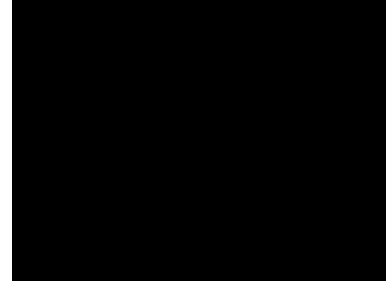
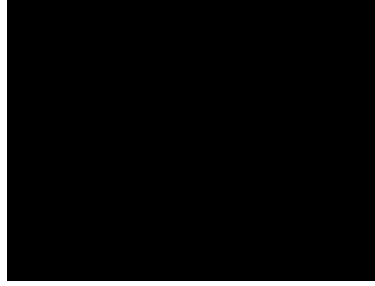
Live fish transportation truck with manual aeration system



Live fish transportation truck with mechanical aeration system



Wholesale salani fish market
(packed in stylofoam box with ice)



Retail fish market



FISHFED outlet



FISHFED fish delivery moto

Training facilities



Kalong-Kapili (NGO)



RFTI (Amranga)
Regional Fisheries Training Institute



State Government demonstration farm

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List of Abbreviations

AACP	Assam agricultural Competitiveness Project by World Bank
AAU	Assam Agricultural University
ADB	Asian Development Bank
AFDC	Assam Fisheries Development Corporation Ltd.
APART	Assam Agribusiness and Rural Transformation project
APFBCS	Assam project Forest and Biodiversity society
ARIAS	Assam Rural Infrastructure and Agricultural Service
ARIASP	Assam Rural Infrastructure and Agricultural Services Project
ARSAC	Assam Remote sensing Application Center
ASSAC	Assam State Space Application Centre
AWC	Angwadi Centers
AWP	Annual Work Plan
B/C	Cost-Benefit ratio
B2B	Business-to-Business
B2C	Business-to-Consumer
BBBP	Beti Bachao, Beti Padhao means Save girl child and Educate girl child
BDC	Beel Development Committee
BFRI	Bangladesh Fisheries Research Institute
BLS	BaseLine Survey
BMX	Body Mass Index
BOD	Block Development Officer
BODs	Board of Directors
BR	Biosphere Reserves
CBBO	Cluster-Based Business Organization
CD	block Community Development bloc
(ICAR-)CIFA	Central Institute of Freshwater Aquaculture, Indian Council of Agriculture Research
(ICAR-)CIFRI	Central Inland Fisheries Research, Indian Council of Agriculture Research
(ICAR-)CIET	Central Institute of Fisheries Technology
CIG	Common Interest Groupe
MSGUY	Chief Ministers' Samagra Grammya Unnayan Yojana
CNNS	Comprehensive National Nutrition Survey
CRPs	Community Resource Persons
CRZ	Costal Reserve Zone
CTG	Community Tank Group
CDCSDO	Civil Deputy Commissioners and Sub-Divisional Officers
CPCB	Central Pollution Control Board
DAC	Department of Agriculture and Cooperation
DC	Deputy Commissioner
DCF	Discounted Cash Flow
DFDO	District Fisheries Development Officer
DMOC	De-oiled MOC
DORB	De-oiled Rice Bran
DPDPA	Digital Personal Data Protection Act
DPIIT	Department for Promotion of Industry and Internal Trade
DPMUs	District Project Management Units
DPR	Detailed Project Report prepared by DoF
DRDM	Revenue and Disaster Management Department
DX	Digital Transformation
DoES	Directorate of Economics and Statistics
DoF	Directorate of Fisheries, State Government of Assam
DRP	District Resource Person

EAC	Environmental Appraisal Committee
EC	Executive Committee
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EM	Effective Microorganismes
EMP	Environnemental Management Plan
EMRO	EM Research Organization
ER	Elephant Reserve
ESAF	Environmental Social Assessment Framework
F/C	Foreign Currency
FA	Fishers' Associations
FAO	Food and Agriculture Organization
FD	Fisheries Demonstrator
FDIF	Fishery and Aquaculture Infrastructure Development Fund
FDO	Fisheries Development Officers
FF	Fact Finding
FIRMS	Application developed by GIZ
FIRR	Financial Internal Rate of Return
FISHED	Fish Marketing & Processing Federation Ltd. under the Department of Fisheries
FPOs	Farmer Producer Organization
FSSAI	Food Safety and Standards Authority of India
FSV	Fish Seed Villages
FY	Female Welfare
GB	General Body
GC	General Condition
GDP	Gross Domestic Product
GGPGGM	Ghare Ghare Pukhuri Ghare Ghare Maach
GIZ	German Corporation for International Cooperation
GMC	Guwahati Municipal Corporation
GMDA	Guwahati Metropolitan Development Authority
GoI	Government of India
GSDP	Gross State Domestic Product
GST	Goods and Services Tax
GSVA	Gross State Value Added
HEC	Human-Elephant Conflict
HVF	High Value Fishes
ICDS	Integrated Child Development Scheme
IEC	Information, Education, Communication
IFA	Iron and Folic Acid
IMC	Indian Major Carps
INR	Indian Rupee
IOCL	Indian Oil Corporation Limited
IPR	Intellectual Property Rights
JBIC	Japan Bank for International Cooperation
JPY	Japanese Yen
JICA	Japan International Cooperation Agency
JV	Joint Venture
L/C	Local Currency
LCB	Local Competitive Bidding
KP	Knowledge Product
M&E	Monitoring & Evaluation
M&O	Maintenance & Operation
MAFF	Ministry of Agriculture, Forestry and Fisheries, the Government of Japan
METT	Ministry of Economy, Trade and Industry
MFIs	Microfinance Institutions

MIS	Management Information System
MOC	Mustard Oil Cake
MoEF&CC	Ministry of Environment, Forest and Climate Change, Government of India
MPCE	Monthly Per Capita Consumption Expenditure
MSMEs	Ministry of Micro, Small & Medium Enterprises
MT	Metric Ton
MeitY	Ministry of Electronics and Information Technology
MoA	Memorandum of Agreement
MoU	Minutes of Understanding
MRP	Minimum Retail Price
NABARD	National Bank for Agriculture and Rural Development
NBA	National Biodiversity Authority
NBFCs	Non-Banking Financial Companies
NBFGFR	National Bureau of Fish Genetic Resources, Lucknow
NCDC	National Cooperatives Development Corporation
NEDFi	North East Development Finance Corporation Ltd.
NFDB	National Fisheries Development Board
NFHS	National Family Health Survey
NGO	Non-governmental Organization
NHE	Nutrition and Health Education
NIAM	National Institute of Agricultural Marketing
NIC	National Informatics Centre
NIQ	Notice Inviting Quotation
NP-NSPE	National program of nutritional support to Primary Education
NSSO	National Sample Survey Organization
NWCP	National Wetlands Conservation Program
NWMP	National Water quality Monitoring Programme
O&M	Operation and Maintenance
ODA	Official Development Assistance
OGD	Open Government Data
OSC	One Stop Centre
P & RD Deptt.	Panchayat and Rural Development Department
PAN	Protected Area Network
PG	Producer Group
PM-POSHAN	Pradhan Mantri Poshan Shakti Nirman
PMC	Project Management Consultant
PMMSY	Pradhan Mantri Matsya Sampada Yojana
PMU	Project Management Unit
POSHAN	Prime Minister's Overarching Scheme for Holistic Nourishment
PPR	Preliminary Project Report
PRA	Participatory Rural Appraisal
R&D	Rehabilitation and Development
R&R	Rehabilitation and Resettlement
RAS	Recirculatory Aquaculture System
RD	Regional Directorate
RDA	Recommended Dietary Allowance
RFTI	Regional Fisheries Training Institute, Assam
RGCA	Rajiv Gandhi Centre for Aquaculture
RI	Resource Institution
RIDF	Rural Infrastructure Development Fund
RKVY	Rastriya Krishi Vikas Yojana
RO	Regional Office
Robic	Rufarm Robic Rufarm Indea
SAFAL	Sustainable Aquaculture for Food and Livelihood (GIZ)
SAG	Scheme for Adolescent Girls

SBB	State Biodiversity Boards
SC	Scheduled Castes
SCF	Standard Conversion Factor
SDGs	Sustainable Development Goals
SEAC	State Level Expert Appraisal Committee
SEIAA	State Level Environment Impact Assessment Authority
SFAC	Small Farmers Agriculture Consortium
SHG	Self Help Group
SIA	Social Impact Assessment
SMEs	Small and Medium Enterprises
SOPD	State Own Priority Development
SPCB	State Pollution Control Board
PMU	State Project Management Unit
SRCW	State Resource Centre for Women
SSO	Single Sign On
ST	Scheduled Tribes
SWA	Single Window Agency
SWIFT	Sustainable Wetlands and Integrated Fisheries Transformation Project
SaaS	Software as a service
SWR	Shadow Wage Rate
TCPC	Training cum Production Center, DoF
THR	Take Home Ration
TOR	Terms of Reference
TR	Tiger Reserves
UN-IAEG	United Nations Inter-Agency Expert Group
UNESCO	United Nations Educational, Scientific and Cultural Organization
UT	Union Territory
UTEIAA	Union Territory Level Environment Impact Assessment Authority
UTPCC	Union Territory Pollution Control Committee
VC	Value Chain
WITS	World Integrated Trade Solution
WLS	Wildlife Sanctuary
WPR	Worker Population Ratio

Measurement Units and Currency

Area

cm ²	=	Square-centimetre(s)
m ²	=	Square-metre(s)
km ²	=	Square-kilometre(s) (1,000,000 m ²)
ha	=	Hectare(s) (10,000 m ²)

Length

cm	=	Centimetre(s)
m	=	Metre(s)
km	=	Kilometre(s) (1,000 m)

Currency

US\$	=	United State Dollars
		US\$1.0 = Yen 150 = INR 84 (as of November 2024)
Yen	=	Japanese Yen
INR/Rs.	=	Indian Rupee

Indian Numbering

Lakh(s)	=	Hundred Thousand (100,000)
Crore(s)	=	Ten Million (10,000,000) or 100 lakhs

Weight

μg	=	Microgram(s) (0.000001 gr.)
mg	=	Milligram(s) (0.001 gr.)
g	=	Gram(s)
kg	=	Kilogram(s) (1,000 gr.)
ton	=	Metric Tonne(s) (1,000 kg)
t	=	Metric Tonne(s) (in Table)

Volume

m ³	=	Cubic-metre(s)
ml	=	Milliliter(s) (1 cm ³)
l	=	Litre(s) (1,000 cm ³)

Number

MPN	=	Most Probable Number
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Summary

Chapter 1 : Introduction

1. This final report was created according to the contract agreement between the Japan International Cooperation Agency (JICA) and JV of OAFIC CO., LTD., INTEM Consulting Inc. and Nippon Koei Co., Ltd. On 4th December 2023. The report presents the results from the Survey Works conducted over fifteen months from December 2023 to February 2025 for Assam State Livelihood Improvement Project in India. This project is to be funded by JICA's Official Development Assistance (ODA) loan. The aim is to gather information for the ODA loan assessment and enhance the Detailed Project Report prepared by Assam Department of Fisheries. The survey will assess challenges in India and Assam's aquaculture sectors, review project components, schedules, procurement, construction, costs, environmental and social aspects, and gauge its economic/financial viability.

Chapter 2 : Socio-Economic Status and Natural Condition of Assam

2. Natural condition
 - Geographic features
In terms of topography, Assam the state has been classified into three main regions - the Brahmaputra River valley in the north, the Barak River valley (upper Surma River) in the south and the hill areas between Meghalaya (in the west) and Nagaland and Manipur (to the east) in the south-central parts of the state.
 - Climate and rainfall
The climate of Assam is tropical monsoon climate with moderate temperatures for most of the year, with slight variations across seasons and elevations. During the summer months (March to June), temperatures can soar, especially in the plains, with highs reaching up to 35-40°C (95-104°F). The winter months (December to February) are relatively mild, with temperatures ranging between 10-20°C (50-68°F).
The state is situated in high rainfall zone with annual average rainfall of 2,297.4 mm. The state normally receives 2 percent of the total rainfall in the winter season (January-February), 25 percent in the summer season (March-May), 65 percent in the monsoon season (June-September) and 7 percent in post-monsoon season (October-December).
3. Economic and social situation
 - Population
Assam is a state of heterogeneous population with socio-cultural and ethnic diversity. According to the latest census of India, 2011 the population of Assam was 312.05 lakh of which 159.39 lakh were male and 152.66 lakh were female. The decadal growth rate of the state population during 2001-2011 was 17.07% against 17.68% growth for the country as a whole. By looking at the population distribution of the rural and urban areas, 86% of the population lives in the rural setting and the rest of the 14% population lives in the urban setting of the state. According to the statistics in 2020, Fishers' population in Assam was 2,524,106 (male 1,624,059 and female 900,047) including 696,294 (male 362,157 and female 334,137) of the population engaged in inland fisheries activities.
 - Economy
The state economy of Assam indicates during the period from FY 2016/17 to FY 2022/23, the growth rate of the Gross State Domestic Product (GSDP) had increased from 11.6% to 19.9 %, which is larger than the Gross Domestic Product (GDP) of all India. The sectoral contribution of an economic indicator, the Gross State Value Added (GSVA) shows steady growth in recent years, and each composition that is 22.10% of agriculture and allied sector, 30.75% of industry sector, and 42.25% of service sector. The sectoral compositions of the agriculture, forestry and fishing in Assam, 22.1% is larger than the percentage of all India, 18.4%. The per capita income in Assam

has grown at the annual rate of 15.74% from FY 2021/22 to FY 2022/23 and reached INR 120,336 per capita.

- Poverty

The poverty rate in Assam remains higher than all India average, which is 27.3% as opposed to the national average of 20.7% in 2015-2016. Moreover, after the pandemic of Covid-19, the poverty headcount rate increased from about 40% up to 50% in Assam.

Chapter 3 : Present Condition and Problem Analysis of Inland Fisheries & Aquaculture Sector in Assam

4. Fisheries Policy

The fisheries sector has been emerging as one of the most potential sectors in the state with immense natural resources in the form of ponds, derelict water bodies and beels/ flood plain wetlands etc. covering 2.59 lakh hectares. The following are some of the characteristics and strengths of the fisheries industry in Assam that are worth mentioning.

- ✓ Creating job and employment

The fisheries sector creates job for 2,524,106 people in Assam (DPR P.17, 2019-20).

- ✓ Contribution to the State's economy

The contribution of fishery and aquaculture sector to the State's GSDP at current price was Rs. 1,989,719 lakhs for the year 2022-23 (QE), accounted for 3.05% of GSDP, with a growth rate of 16.38% over the previous year.

- ✓ Fish production at national level

Assam State is the 4th largest states in inland fish producing (4.17 Lakhs tons) state at National level (2021-22) following by Andhra Pradesh (42.19Lakhs tons), West Bengal (16.52Lakhs tons), Odisha (7.89Laks tons).

However, considering the current state of undeveloped waters as fishing or aquaculture ground, there is still a lot of capacity to develop furthermore. Responding to this situation, the Government of India has launched Blue Revolution Initiative from 2014 to enhance sustainable and environmentally friendly development toward increasing the production, productivity, export income and enhancing national food and nutrition security.

Vision of the Department of Fisheries, Government Assam is "Maximize sustainable production from fisheries sector for nutritional security and economic prosperity.

Mission states 'facilitating long-term overall development' through increased production and productivity of fish and other aquaculture commodities, integrated approach for infrastructure development, extension services and market linkages; creating opportunities for employment generation, adoption and promotion of innovative and frontline technologies; conservation and judicious exploration of fish and fisheries resources, preservation of genetic resource base and development activities with eco-friendly approaches.

5. Administrative Structure

Department of Fisheries, Government of Assam constitutes of three organizations namely Directorate of Fisheries (DoF), Assam Fisheries Development Corporation Limited (AFDC) and Fish Marketing & Processing Federation Ltd. (FISHFED). DoF has established Divisional Fisheries Development Offices (DFDOs) in each district to enforce the administration at the district level.

Major functions of the Department for overall development of the fisheries sector includes;

- ✓ increase in fish and quality fish seed production in the state with optimum utilization of resources,
- ✓ implementation of fisheries related schemes of the Government of Assam and Government of India,
- ✓ identification and promotion of research and studies on fisheries and fisheries related areas so that benefit can be disseminated to the grass root level users,

- ✓ collection, compilation, and analysis to make available adequate/relevant statistical and other information for proper planning to promote fish farming and related industries/activities,
- ✓ preparation/support in reports and proposals related to Fisheries and fisheries related industries, and
- ✓ providing extension services to Fish farmers/fishermen and fisheries entrepreneurs.

6. Inland fishery and aquaculture

• Brief History of Recent Development

The state of Assam is advancing fast from traditional farming systems to modern practices in recent times. This has resulted in considerable increase in marketing volume of locally produced fish and thereby reducing inflow of fish from other state. Various fisheries-related projects, either implemented by the Government of India or international donors have played important roles for current development, although there are still a lot of issues to be solved.

• Fisheries and Aquaculture Production

Total fish production in the state during the year 2022-23 was 443,250 tons, out of which capture fisheries contributed 143,870 tons (32.5%) while culture fisheries contributed 299,380 tons (67.5%). Major fish production areas can be consolidated as shown in the table below.

Table Fisheries and aquaculture clusters in Assam

Cluster	Geographical location	Main Districts
Central-Western Assam	Brahmaputra river basin (midstream in the state)	Nagaon, Hajai, Morigaon, Darrang, Kamrup metro, Kamrup, Nalbari and Barpeta
Northeastern Assam	Brahmaputra river basin (upstream in the state)	Lakhimpur, Dibrugarh and Tinsukia
Southern Assam	Barak river basin	Cachar, Hailakandi and Karimganj

• Examination on the per capita fish consumption/production

Per capita fish consumption of India is linearly increasing to be 7.9kg/person in 2020, which is however still quite low comparing to neighboring fish-eating countries such as Myanmar (45.9 kg) and Bangladesh (26.3kg) (FAO statistics 2020). Although that of Assam State is significantly higher as 11.89 kg and ranked 10th among the 36 states in India (Fishery statistics 2022, India), it shall be noted that per capita fish consumption of Assam is less than half of neighboring Tripura State as well as the neighboring divisions of Bangladesh.

• Recent Aquaculture Activities

Target Species:

Three Indian Major Carps (IMC), namely Rohu, Catla and Mrigal, and common carp are overwhelmingly accepted and largely cultured in all production clusters. Other 3 Chinese carps such as Silver Carp, Grass Carp, and Big Head are well accepted in Central-Western Assam and North-Eastern Assam, but only partially cultured in the Southern Assam.

Seed production:

Private sector is actively leading seed production. Nagaon district and Barpeta district in the Central-Western cluster, and Karimganj district in the Southern cluster produced 90.8% of the state's total production of 182,187 million in 2021-22. Seeds from West Bengal state is also popular in Assam. They are brought to Assam by small four-wheelers and distributed directly to grow-out farmers or via Rangia fish seed market, Kamrup district.

Fish feed and feed production:

Regular feeding of farm-made feed, particularly mustard oil cake (MOC) and rice polish are widely performed as the normal practice in the state. In recent years, with the advent of commercial farmers, they started gradually application of formulated pelleted feed of national brands, procured from Andhra Pradesh and West Bengal mostly by traders.

At present there are a total of 41 feed mills for aquaculture in Assam with production capacity of less than 1 ton/day. They produce grinded powder mix feed, not a form of pellet. There are 4 large-

scale feed manufacturing units primarily cater to livestock feed. They are producing sinking pellets for fish culture. There is no feed factory producing floating pellets in Assam state.

Aquaculture Calendar

Breeding season of IMC and many other culture species starts from March and lasts until August. Spawn produced at hatchery is nursed in earthen pond and sold to grow-out farmers according to their demands on size and amount. Spawn taken in the late spawning season are used for production of stunted seeds or large-sized seeds in the next year.

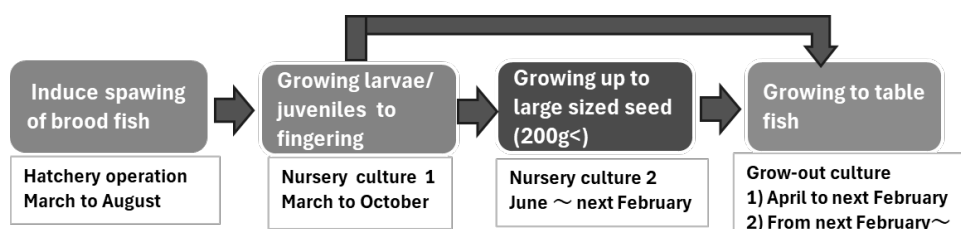


Figure: Common aquaculture production flow for IMC and other target species in Assam State

- **Capture Fisheries Activities**

Assam is a land locked state. Hence fisheries activities are carried out in various types of freshwater entities such as wetlands called “beel” and rivers under ownership of the Government. The Revenue and Disaster Management Department and the Assam Fisheries Development Corporation Ltd (AFDC) manage beels and lease them on a 7-year basis for revenue generation mostly. The lessees who are usually the head of the fishing cooperative employ fishermen and implement fishing exclusively in the beel. Fishermen are either employed at very low wages or receive approximately 50% of the harvest as income. Beel fisheries produced 47,688 tons occupying 10.8% of total fish production of Assam in the year 2022-23.

Fishing activities in waters other than registered beels such as river, derelict water bodies/swamps, paddy fields, wetland in the forestry etc. are not pronounced in terms of production.

7. Fisheries Value Chains/Industrial Policy

- **Fisheries Value Chain**

Despite increasing total fish production in Assam during 2022-23, demand continues to outstrip supply, necessitating imports from other states such as Andhra Pradesh, Uttar Pradesh, and West Bengal. Additionally, foreign fish from coastal regions, Bangladesh, and Myanmar are imported via West Bengal and Andhra Pradesh. Interestingly, even though Assam cannot fully meet its internal demand, the state also exports fish. Over the past five years, exports have shown steady growth at an average annual rate of 2.21%, the main export fish species from Assam are Pangasius, IMC (Catla, Rohu, Mrigal), Magur and ornamental fish.

Key challenges in Assam's fish supply chain include insufficient aquaculture infrastructure and technology, limited participation of women, lack of access to high-quality seeds and feed, inadequate processing and distribution infrastructure, shortage of technical knowledge, and restricted access to finance.

To address these issues, the study recommends several measures, including capacity building for farmers, marketing support and market linkage enhancement, promotion of value-added products, and improved access to finance. The study also emphasizes the importance of leveraging data analysis and DX promotion, strengthening government policy support, and promoting inclusive and integrated business models.

- **Industrial Policy**

Assam's industrial policy focuses on:

- Strengthening transportation infrastructure: Improving roads, railways, waterways, and air transport to facilitate the movement of goods and raw materials.
- Promoting small and medium enterprises (SMEs): Emphasizing the development of small and medium-scale processing units for fisheries and other agricultural products, sericulture, horticulture, floriculture, handlooms, and textiles, particularly in the rural economy. The policy

aims to maximize the potential of micro, small, and medium enterprises (MSMEs) to drive Assam's industrialization.

Assam has implemented various policy documents other than Assam 2030 which is the development plan at state level:

- i) The 2014 Assam Industrial Investment Policy Operational Guidelines emphasize the importance of industrial infrastructure and aim to create suitable industrial estates and parks.
- ii) The Assam Biotechnology Policy (2022-2027) aims to foster a dynamic biotechnology sector through research, innovation, and business establishment.

These policies aim to promote economic growth and job creation in Assam while creating a conducive business environment. However, challenges remain in assessing the current status of small enterprises and establishing quantifiable targets or indicators to measure progress in both MSMEs and the transportation system.

8. Farmers Organization/Gender/Nutrition

In Assam, 305 cooperative societies (registered under FISHFED), 27 Farmers Producer Companies (FPCs), and 5 Farmers Producers Organizations (FPOs) have been established in the fisheries sector. Among 305 cooperative societies, 171 remain inactive due to lack of capacity for the management and members' inactivity resulting from fewer benefits of participation. FPC/FPO is a relatively new form of farmers organization along with the national policy. Establishment of FPC is the mainstream of Assam and 25 FPCs out of 27 are established under the Assam Agribusiness and Rural Transformation Project (APART) funded by the World Bank. There are many female members in these farmers organization, but more efforts could be made to encourage active participation of women.

In aquaculture, both men and women involve in aquaculture at household pond/tank, and mainly men involve in the community pond/tank. Challenges for women's empowerment and gender equality in the fisheries sector of Assam are confirmed i.e. gender-based perception such as "fishing is men's job," women's less involvement in decision making on expenditure of household, unequal share of burdens on housework and childcare, and lack of opportunities for Fishery Development Officers (FDOs) to receive gender trainings.

Main health issues in Assam are confirmed as below:

- 1) more than every third of children face stunting and underweight,
- 2) increasing population of obesity and consequent life-style diseases, and
- 3) every second woman of reproductive age is anemic. Improvement of consumption method of traditional Assamese fish as well as intake of nutrient rich small fish could contribute to better health and nutritional status.

9. Private Sector Partnerships/Entrepreneurship Support

• Current Status of Private Sector Partnerships/Entrepreneurship Support

In the fisheries and aquaculture sector in Assam, the national flagship program PMMSY and the World Bank-backed APART program have provided grants for facilities of private companies, including feed mills, hatchery ponds, RAS/bioflock/pen culture system, transportation vehicles, etc. NABARD's RIDF also provided funds for fish feed plants and vehicles.

In addition to those grants and funding supports to private companies in the sector, startup/entrepreneurship support programs have also been provided through PMMSY and APART as well as through GIZ's SAFAL and Startup Assam.

• Current Status of Local Private Sector Enterprises

In the aquaculture production of Assam, feed costs account for 60-80% of production costs of aquaculture farm, making feed suppliers (mills, dealers, and retailers) crucial players in the industry. Local commercial floating pellet feeds production does not exist, relying on this kind of feeds from other states. Also, in case of introducing advanced aquaculture technologies like bioflock and RAS, those devices/equipment should be purchased from the other states or foreign countries.

- Indian Startups and Enterprises who are interested in expansion into Assam States
 - Aqua Connect: Provides AI and satellite-based digital solutions for the aquaculture industry, operating in multiple states, including Assam. Aqua Connect offers comprehensive support from input supply to market access, and also provides services to government sector, like making the inventories of pond, quality analysis through satellite imagery.
 - SNRAS Systems: They design, build, and install RAS system, and they also have developed a platform that ensure high-quality live fish distribution for fish food consumption and for seedlings.
 - Challenges
 - i) Limited Number of Investable Enterprises:

There is a need to identify and train new entrepreneurs, as existing enterprises are few. Expanding training opportunities to include business preparation stages for a broader range of potential small-scale entrepreneurs is essential.
 - ii) Access to Finance:

Many local enterprises rely on self-financing or informal sources. Providing low-interest loans and grants for new ventures, along with training in basic business finance, is crucial for sustainable growth.
 - iii) Opportunities to Learn and Adopt Technologies:

Farmers have limited chances to learn about and compare new technologies. Government and extension services should verify and promote effective technologies for smallholder farmers. Organizing an Assam Aquaculture Fair could facilitate exposure to advanced technologies and business opportunities.
10. Pilot Project (Recording, E-commerce)
- JICA loan project aims to incorporate digital transformation (DX) technology and promote startups and private partnerships in Assam state. To verify the benefits and challenges of DX and startup inclusion, two pilot projects were implemented during the feasibility study period. The objective was to assess the feasibility and usefulness of digital technologies for stakeholders in the fisheries industry.
- Based on the findings, JICA loan project will take the following approaches:
- i) Mobile Fish Farm Recording:
 - Incorporate improved functionality in the digital system under the DX component
 - Simplify recording items and improve the user interface for both administrators and users
 - Provide training to fish farmers to ensure proper data collection
 - ii) E-commerce and Supply Chain Improvement:
 - Prioritize physical infrastructure development for fish supply chain improvement
 - Utilize online sales platforms for specific components:
 - a) Fish seeds village component: Introduce online platforms for sales of fish seeds to local farmers
 - b) Entrepreneurship program: Support startups or entrepreneurs of online platforms to expand their business in Assam state
- The project recognizes that while there is potential for digital solutions in the fisheries industry, implementation must be carefully designed to address the specific challenges and needs of the local context. By combining improved physical infrastructure with strategically implemented digital tools, the JICA loan project aims to enhance the livelihood of aquaculture farmers and strengthen the overall fish supply chain in Assam.
11. Data Utilization and DX
- There are 2 varieties of digitalization to be considered for development of fisheries sector in Assam state. One is the digital technologies for government, in which the digital technologies will be utilized to improve governmental functions. The other is the digital technologies for fisheries businesses in Assam state, in which the digital technologies will be adopted to improve fisheries businesses, including both production and supply chain.

- i) **Data Utilization and DX for Governmental Functions**
Under central government, some departments and organizations, such as DoF, NFDB, are pivotal in developing digital infrastructure and e-governance solutions for fisheries industry in India. Also, digital technologies are being utilized in some development schemes and projects. PMMSY, which is the scheme of department of fisheries, exemplifies digital adoption through its portal for small enterprises and emphasis on technology in fisheries management. Assam state government utilizes digital platforms like ePrastuti for digital integration across departments. Projects like SAFAL and GGPGGM incorporate geo-tagging and mobile apps (Matsya Baibhav) for effective project monitoring and management.
 - ii) **Data Utilization and DX for Fishery Businesses**
Some startups and private companies are pioneering digital tools to enhance production and supply chain operations. For production stage, digital technologies include IoT-based water quality systems (e.g., AQU by Ambrotechs), mobile apps for fish farm management, e-learning tools (Matsya Setu) for aquaculture education, etc. In value chain stage, E-commerce platforms (FISHFED Mart, Minbury) and business matching services (Aqua-partner, Aqua-bazaar by Aqua-connect) are facilitating trade and market linkages nationwide.
 - iii) **Legal and Regulatory Framework for Data Utilization and DX**
India lacks specific laws for digital transformation in fisheries but applies general data protection laws (Digital Personal Data Protection Act, 2023). Intellectual property rights safeguard innovations, while infrastructure challenges persist in IT adoption by governmental bodies like the Directorate of Fisheries.
 - iv) **Challenges for Data Utilization and Digital Transformation**
First of all, infrastructure gaps (hardware, software) hinder digital progress of governmental organizations. And most of the functionalities of the government have not been digitalized or only partially utilized digital systems. Digital service expansion (e.g., online training, market services) and integration of the systems would be the opportunities for digital transformation. When it comes to digital technologies for fisheries industry, limited funding and technical know-how are currently barriers to broader digital adoption. Government support and enhanced private sector engagement could realize the acceleration of digital transformation.
12. **Fisheries-related projects by the Govt. of India and other donors/intl. organizations**
The major fisheries-related projects of the Government of India and other donors/international organizations being implemented in Assam State as of 2024 are listed below.
- PMMSY (Pradhan Mantri Matsya Sampda Yojana)
 - APART (Assam Agribusiness & Rural Transformation Project)
 - RIDF (Rural Infrastructure Development Fund)
 - CMSGUY (Chief Ministers' Samagra Grammya Unnayan Yojana)
 - SOPD (State Own Priority Development)
 - SWIFT (Sustainable Wetlands and Integrated Fisheries Transform action Project (in preparation))
- In particular, in order to avoid duplication of project component in considering this project plan, the beel development-related component, which was initially included in the project DPR, will be excluded from the project component as it will be carried out under the SWIFT project.

Chapter 4 : Outline of the Project

13. **Analysis of core issues**
Current issues and challenges faced by the fisheries sector in Assam are summarized for each of the major sub-sectors as shown in the table below.

Table: Issues and challenges of fisheries sector of Assam State

Sub-Sector	Issues and Challenges
Capture fishery	• Deterioration of fishing ground • Decrease of fisheries resources
Aquaculture	• Productivity is low • Insufficient supply of quality and large size seeds • Diversification of aquaculture species is not enough • Lack of introduction of new aquaculture techniques • Insufficient of feed production and supply
Marketing	• Insufficient hygienic market infrastructure • Insufficient cold chain infrastructure • Immature live fish transportation techniques
Extension	• Insufficient extension infrastructure, staff's capacities and training materials
Organization/ Gender	• Ineffective function of producers' organizations (FPO, FPC, etc.) • Insufficient women's participation in fisheries sector
Others	• Difficult access to financial institutions including credit condition • Absence of income source diversification other than fisheries activities • Insufficient administrative system (especially for registration of the pond/tank, statistical data collection and storage, etc.)

Source: JICA survey team

14. Review of Preliminary Project Report (PPR)

Prior to the Study, the DoF formulated the "Assam Fisheries Development and Livelihood Project" (December 2022). The project paper was reviewed in this study as a Preliminary Project Report (PPR).

Review is conducted from 2 perspectives: cost and content.

The DoF made a large-scale adjustment by removing some sub-components of JICA project such as beel fishery, new aquaculture technologies etc. in consideration of the demarcation from some similar projects that are being implemented in parallel.

On the other hand, based on the results of study on current condition and problem analysis in the fisheries sector in Assam, some of the sub-components, which are field demonstration of newly introduced aquaculture fish, certification and accreditation of fish hatcheries, and business investment exploration, were added.

15. Structure of proposed project

Through the analysis and review described in above 13 and 14, the contents of the proposed project are designed as follows.

Table: Components of the Project

Project Component	Sub-component		
1	Improvement of aquaculture productivity		
1-1	Promotion of feed-based aquaculture and semi-intensive aquaculture	(1) Productivity enhancement of existing community/institutional tanks	
		(2) Productivity enhancement of existing individual ponds of progressive fish farmers	
		(3) Productivity enhancement in existing individual ponds of small fish farmers	
1-2	Development of fish seed village	(1) Development of fish seed production village	
		(2) Fish seed transportation vehicle	
		(3) Certification and accreditation of fish hatcheries	
1-3	Credit linkage to fish farmers		
1-4	Field Demonstration	(1) Promotion of high yield varieties of Pangasius catfish in existing individual ponds	
		(2) Promotion of freshwater prawn (Scampi) culture in polyculture system (semi-intensive culture with formulated feed)	
		(2) Promotion of freshwater prawn (Scampi) culture in polyculture system (semi-intensive culture with local feed)	
		(3) Promotion of indigenous fish species in polyculture	

1-5	Research and Development	Need based research studies (R&D) as per project requirement			
2	Development of Aquaculture Supply Chain				
2-1	Development of fish supply chain & market infrastructure	(1) Aquaculture Business unit (Individual) (2) Upgradation of Existing semi-urban hygienic fish market			
2-2	Assam-Japan business investment exploration				
3	Diversification of fisheries-based livelihood				
3-1	Development of Blue Tourism for livelihood enhancement of target group				
3-2	Entrepreneurship Development				
4	Extension and capacity building				
4-1	Infrastructure development for aquaculture extension, training & capacity building	(1) Aquaculture Laboratory (2) Strengthening of training cum production centre (TCPC) (3) Upgradation of DFDO Office & conference hall			
4-2	Innovative and advance technology adoption for data management in fisheries sector in Assam (DX)				
4-3	Capacity building of farmers and stakeholders				
5	Institutional development for project management				
5-1	Establishment and Management of PMU/DPMU	(1) PMU (2) DPMUs (3) Project management information system			
5-2	Capacity building of management units officers	(1) Technical training for officers (2) Exposure visit			
5-3	Monitoring & Evaluation	(1) Baseline survey (2) Mid-term survey (3) Endline survey			

16. Project components and sub-components

Component 1. Improvement of aquaculture productivity

【1-1】 Promotion of feed-based aquaculture and semi-intensive aquaculture

To increase productivity of pond and tank aquaculture through:

- introduction quality fish seed of large size including genetically improved strain of IMC such as Jayanti Rohu and improved Catla, and
- provision of formulated feed as well as local feed.

This component will adopt 2 development approaches for improvement of existing pond culture. One is to encourage semi-intensive culture with formulated feed, and the other is to support semi-intensive culture with local feed.

【1-2】 Development of fish seed village

To realize efficient supply chain of large-size quality seeds or yearling of IMC and other carp species including recommended improved varieties through establishment of seed production clusters called Fish Seed Villages (FSV).

Under this component, existing seed growers operating in closed vicinity are to be identified as a cluster, namely as a Fish Seed Village (FSV) and selected FSV will be provided with inputs for seed production, fish seed transportation vehicle and support for obtaining national certification and accreditation of fish hatcheries.

【1-3】 Credit linkage to fish farmers

This component aims to support the input costs of aquaculture activities and strengthen the local farming economy through the provision of funding to farmer's groups. In particular, it will focus on developing a financial support scheme to facilitate the transition to feed-based aquaculture and to purchase the necessary feed.

【1-4】 Field demonstration

Pangasius catfish and freshwater prawn (Scampi) are known to be commercially important aquaculture species and are actively farmed in South-East Asian countries. P. sarana is an

indigenous Indian freshwater fish species, which is traded at a high value, and, on the other hand, aquaculture development is expected in terms of sustainable use of natural resources.

In Assam State, only small-scale aquaculture of these fish species is being attempted by a few aquaculture farmers, and this component will promote aquaculture through inputs such as seed and feed.

【1-5】 Research and development

To obtain basic knowledge required for further development and improvement of aquaculture and relevant socio-economic activities, the Project will provide budgetary support for various relevant research studies as per the proposal by the relevant organization such as detailed study on production, marketing, fish consumption, trading, fish feed, biofloc system, farmer's organization etc.

Component 2. Development of aquaculture supply chain

【2-1】 Development of fish supply chain & market infrastructure

To promote aquaculture as a whole supply chain by developing various related infrastructures from production to sales of farmed fish.

i) Aquaculture business unit

This sub-component covers the gear for harvesting fish, nutritional supplements to be mixed with feed, and pharmaceuticals for aquatic organisms.

ii) Semi-urban hygienic fish market

A small retail fish market will be constructed in the village area.

It will have sanitary water supply and drainage facilities, an administrative office, equipment storage, and restrooms. Aeration piping for live fish will also be provided.

【2-2】 Assam-Japan business investment exploration

To promote investment in fisheries sector in Assam, the project will hold the seminar and site-visit tour during the project implementation. Participants (Indian and Japanese private companies who may concern or have interest in the business in fisheries sector in Assam) are presented not only the project outline but also the information related to the fisheries sector and business environment in Assam.

Component 3. Diversification of fisheries-based livelihood

【3-1】 Development of blue tourism for livelihood enhancement of target group

This component will use abundant water resources and high untapped tourism potential in Assam and attract tourists from in and out of the state, thereby stimulating the local economy and diversifying income sources for communities dependent on fishing. Potential components are restaurants, amusement boats, angling sets, aquarium, infrastructure development (access roads, electricity supply, water supply, etc.), administrative facilities etc.

【3-2】 Entrepreneurship development

To strengthen technology adoption of Assam aquaculture sector, for the entrepreneurs, the project provides seed funding and business trainings (financial access, basic accounting, business planning, etc.).

Component 4. Extension and capacity building

【4-1】 Infrastructure development for aquaculture extension, training & capacity building

The objective is to expand education, training and field-level technology extension services for DoF staff, fisheries & aquaculture producers, distributors and processors.

This component plans:

- i) Aquaculture laboratory
A simple laboratory for analyzing pond water and bottom sediment such as pH, dissolved oxygen, phosphate, nitrate and nitrite etc. will be established at district level for the purpose of assisting in the management of in-pond culture environment.
- ii) Strengthening of Training cum Production Center (TCPC)
This is an education and training facility for DoF staff, fisheries & aquaculture producers, distributors and processors in Assam, and will be constructed on a site adjacent to the DoF headquarters.
- iii) DFDO office & conference hall
This is the DFDO's district Office & conference hall equipped with ICT facilities, providing a place and facilities where meetings and training sessions can be held to bring together fish farmers in the district.

【4-2】 Innovative and advance technology adoption for data management in fisheries sector in Assam (DX)

Through DX, DoF and fisheries stakeholders enhance their capacity and create value to foster development of fisheries sector in Assam state.

Under this component, SaaS (software as a service) platform will be developed under administration of DoF to digitalize its functionalities and provide digital services to fish farmers, department officers as well as stakeholders.

The major services in this platform will be:

- User management, farmers' ID and pond health card
- Project management system
- Training and extension services
- Statistics and Publication services etc.

【4-3】 Capacity building of farmers and stakeholders

This component aims at capacity building of famers, which will be beneficiaries of the Project, in order to enhance the efficiency of the Project and to achieve the overall goal. The training subjects will cover not only technical topics but also management guidance to strengthen the sustainability of activities, promotion of gender equality and women's empowerment, and awareness raising of nutrition.

Component 5. Institutional Development for Project Management

【5-1】 Establishment and management of State Project Management Unit (PMU) and District Project Management Units (DPMU)

Two levels of the project implementation body will be established and PMU and DPMU will conduct project management will be done in this component. After being established, this management body will carry out the management activities as shown below.

- (1) Preparation for project management including project operation manual
- (2) Preparation, monitoring, and updating of annual action plan
- (3) Procurement of necessary equipment
- (4) Development of Project Management Information System (PMIS) (Outsourced)
- (5) Monitoring/Evaluation of the project components

【5-2】 Capacity building of management units officers

This component aims at capacity building of officers involved in project management and implementation at both PMU and DPMU in order to enhance the efficiency of the Project and to achieve the overall goal. The training subjects will cover not only on the technical topics but also on the management guidance for sustainability of production activities and strengthen community groups (FPO/FPC/CS etc.) in overall resource management.

【5-3】 Monitoring & evaluation

Concerning the evaluation of the project, baseline survey, midline survey and endline survey will be carried out by out-sourcing to local consultant under the responsibility of PMU and DPMU.

17. Selection of target districts

8 target districts (Cachar, Karimganj, Morigaon, Nagaon, Barpeta, Nalbari, Kamrup and Lakhimpur) were selected based on the criterias shown in the below table.

Table: Criteria to select target districts

Parameter	Value
a) Annual aquaculture production	More than 10,000 tons
b) Annual seed production	More than 500 million fish seed
c) FDO (district and block)	More than 7 officials
d) Population	More than 950,000
e) Cooperative	More than 10 coop.

Chapter 5 : Implementation Plan

18. The overall project organization structure is proposed as shown below figure.

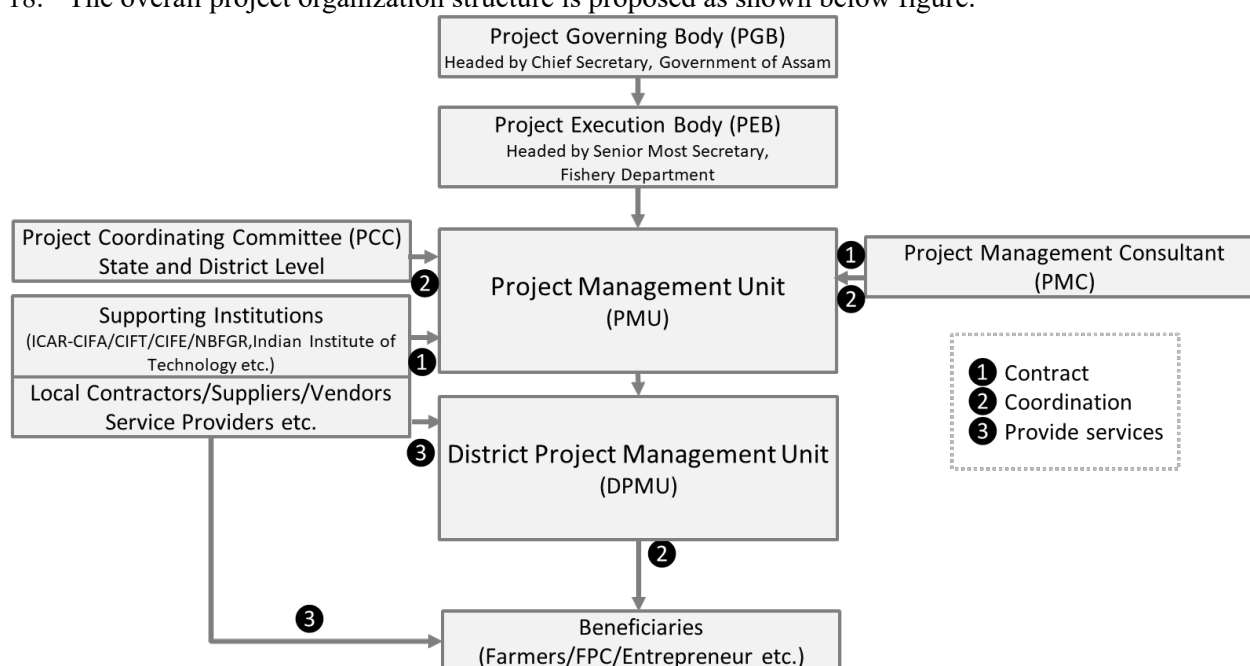


Figure: Overall Organization Structure for Project Implementation

19. Project Governing Body (PGB) will be headed by the Project Governing Body (PGB) chaired by the Chief Secretary, Government of Assam. The PGB will consist of senior most secretaries to the Government of Assam in the related departments. The progress of the Project will be reviewed at least every 6 months by PGB based on the report from PEB. PGB shall ensure effective inter-departmental coordination for the smooth project implementation.
20. Project Executive Body (PEB) will be headed by the Senior Most Secretary to DoF to the Government of Assam. Other members of the body consist of representatives of the related departments of the state government. The progress of the Project will be reviewed at least every 3 months based on the report from PD.
21. Project Coordinating Committee (PCC) will be headed by the Project Director and consist of technical officers and engineers of the DoF, DFDOs of the project districts and PMU officials, and expert(s) recommended by the Project Director. PCC will be responsible for monitoring and coordination of project activities and it's meeting will be held every month principally.

22. State level's Project Management Unit (PMU) has the structure as shown in the figure. PMU is the core body to implement, monitor and evaluate the project component in consultation with Project Management Consultants (PMC).

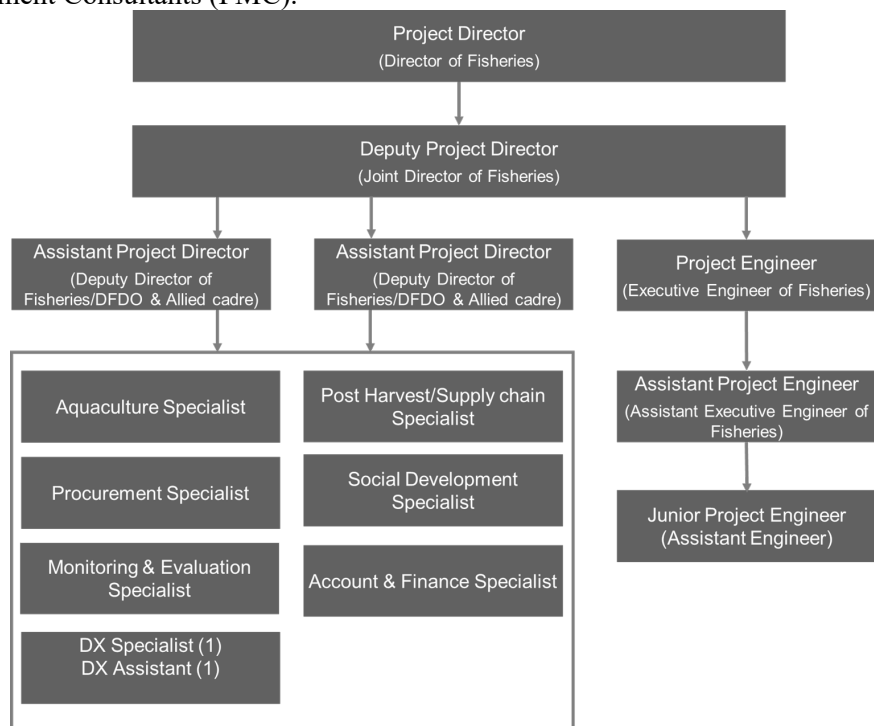


Figure: Structure of PMU

23. District Project Management Unit (DPMU) is headed by DFDO of selected district and consist of the members such as Deputy District Project Officer, Block Project Officer, Fisheries Experts, Account & MIS consultant. This unit is in charge of;
- Report the project progress to PMU on monthly basis
 - Ensure quality assurance of input procured and instruct bank to pay input suppliers
 - Ensure timely report submission
 - Supervising the implementation and progress of the project activities and work closely with beneficiaries at ground level
24. Project Management Consultant (PMC)
The Project Management Consultant (PMC) will be procured by the PMU to reinforce their implementation capacity, particularly to ensure technical and management support for the Project. The PMC will assist the PMU in the improvement of process and procedures for project implementation at the state, district, and block levels.
25. Procurement plan
The Project intends to procure construction works, goods and services. The PMU will prepare detailed plans and descriptions for these, adhering to international or national technical standards. Environmental legislation will be respected in procurement descriptions, and international and local competitive bidding, quotations and direct undertakings will be used. Local procurement will primarily follow the procurement rules/regulations in Assam.
26. Implementation schedule
Project implementation period will be 5 years starting from April in 2025.

Table: Implementation schedule of the Project

Project component	2025	2026	2027	2028	2029
1. Improvement of aquaculture productivity Component					
1.1 Promotion of feed-based aquaculture and semi-intensive aquaculture					
1.2 Development of fish seed village					
1.3 Credit linkage to fish farmers groups					
1.4 Field demonstration					
1.5 Research and Development					
2. Development of aquaculture value chain Component					
2.1 Development of fish value chain and market infrastructure					
2.2 Assam-Japan business investment exploration					
3. Diversification of aquaculture value chain					
3.1 Development of blue tourism for fish farmers' livelihood enhancement					
3.2 Entrepreneurship development					
4. Extension and capacity building Component					
4.1 Infrastructure development for aquaculture extension, training & capacity building					
4.2 Innovative and advance technology adoption for data management in fishery sector					
4.3 Capacity building of fish farmers					
5. Institutional Development for project management Component					
5.1 Establishment and management of PMU/DPMU					
5.2 Capacity building of management units officers					
5.3 Monitoring and evaluation					

Chapter 6 : Project Cost

27. Project cost



Chapter 7 : Project Evaluation

28. Project economic benefit and evaluation



29. Operation/effect indicators for Project Monitoring

Operational indicators are 1) Aquaculture productivity, 2) Number of large size fish seed (over 100g/indi.) produced and delivered to grow out fish farms, 3) Number of certified hatchery, 4) Number of farms who grow high yield varieties, 5) Number of aquaculture administration systems digitalized and maintained and 6) Number of aquaculture supporting infrastructure.

Effect indicators are 1) Annual aquaculture production, 2) Employment in aquaculture sector and 3) Household income/year of aquaculture farmers.

30. Risk Management

Risks of the Project are identified and assessed from the viewpoints of 1) stakeholder risk, 2) executing agency risk, and 3) project risk based on JICA's Risk Management Framework, and each treatment for risks to be conducted by the Project are proposed.

Chapter 8 : Environmental and Social Considerations

31. India, there are a number of ministries, departments, institutions, autonomous bodies and agencies that are involved in environmental management, monitoring and surveillance. The Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India (GoI) is the apex body in the country, in charge of regulating and ensuring environmental protection including planning, promotion, coordination, and supervision of environmental policy/program for implementation. The Central Pollution Control Board (CPCB) under MoEF&CC at the union level and the State Pollution Control Board (SPCB) at the state level together form the regulatory and

administrative core of this sector, which are mainly responsible to periodically monitor pollution levels.

In 1994, for the first time, the EIA Notification, under the Environmental (Protection) Act (1986), was formulated. The EIA Notification was revised in 2006, and subsequently the draft EIA Notification 2020, were issued with further improvements in the EIA procedure. Further, an effort has also been made to make the EIA procedure more transparent and to provide societal vigil of projects affecting the environment through public hearing/consultation by moving the environment protection agenda into public domain. In the draft notification (2020), revised threshold criteria were introduced for different categories of projects.

Referring to the EIA Notification (2020), all projects and activities are broadly categorized into three categories, i.e., Category A, B1, and B2, based on the spatial extent of potential impacts on human health as well as natural resources. In case a project is classified as Category B2, environmental survey and environmental clearance issued by the State Environment Impact Assessment Authority are not necessary. The Project has several activities, e.g., construction of facility etc, but the area of the subcomponent is not large, the largest facility in the subcomponent is only 350 m². Therefore, the Project might be classified as Category B2. However, Installation and construction of facilities may cause noise and working accident regardless of the scale. Therefore, environmental and social impacts should be considered after the selection of subcomponent site with further information.

JICA Environmental and Social guidelines will classify the project as Category C. The JICA Guidelines do not require Initial Environmental Examination (IEE) for Category C projects. This project aims to be funded by JICA, at present, the sub-component is not yet decided, it will be Category FI under the JICA Guidelines. However, the project should involve stakeholders and fully explain the project at the subcomponent sites.

In the addition, as final location and contents of the subcomponents would not be determined before the JICA loan agreement, the IEE cannot be conducted during this survey stage. This survey will review the environmental and social impact assessment framework and collect information on environmental and social considerations so that necessary mitigation measures will be taken just after specifying the subcomponents. If a subcomponent is regarded as Category A or B, the project is required to conduct environmental and social considerations study.

Chapter 9 : Recommendations

32. Implementation of technical cooperation project

[REDACTED] The number of months of PMC assignments has to be reduced due to budgetary constraints, and it is anticipated that almost of the assignments will be spent on the smooth operation of the activities of sub-components.

The sub-components concerning the hatchery certification system, blue tourism, and the private partnerships including Japanese companies are areas where the precedent and knowledge accumulation is particularly limited in Assam. On the other hand, since these fields are the ones in which Japan has a wealth of knowledge, it is therefore desirable to dispatch individual experts in accordance with the implementation of this project with the aim of maximizing and consolidating the project effects by providing technical advice and transfer.

33. Implementation of second phase

[REDACTED] In order to achieve balanced fisheries development in Assam State as a whole, it is essential to implement the second phase of the project based on the results of the Project first phase. Specifically, it is proposed;

- i) To expand the target districts with maintain the productivity realized by first phase.
- ii) To exploit derelict water body and convert them to aquaculture ponds so that ponds area would be increased, and fish production could grow more.

- iii) To add/adopt the components demonstrated in sub-components 1-4 (new species in polyculture) and findings in sub-components 1-5 such as efficient production by using biofloc
34. Flexible project implementation considering seasonality of activities
It is advisable to flexibly adjust the implementation plan to avoid the low temperatures period as much as possible for production of fries. In addition, infrastructure construction and other works should be avoided as much as possible during the summer monsoon season.
35. Collaboration with relevant organizations in India
India has excellent research and technology development institutions in the country such as CIFA which promotes the breeding of aquaculture species and supplying quality varieties to the private sector. It is important to work closely with these relevant institutions and actively promote the use of quality breeds.
36. Collaboration with relevant fisheries development schemes in and out of the country
As for fisheries promotion schemes in Assam, SWIFT and PMMSY are working concurrently, and it is essential to work in collaboration or in different ways on a case-by-case basis.
37. Increasing the number and strengthening the capacity of DoF staff
Currently, the number and capacity of DOF staff is extremely weak, especially at the district and block level. The State Government of Assam should first increase the number of staff and promote human resource development.

Chapter 1 Introduction

1.1 Applied contract terms

This final report is prepared following the terms of reference (TOR) of the contract agreement between the Japan International Cooperation Agency (JICA) and JV of OAFIC CO., LTD., INTEM Consulting Inc. and Nippon Koei Co., Ltd. On 4th December 2023 for Preparatory Survey on Assam State Livelihood Improvement Project. The report presents the results from the Survey Works conducted over fifteen months from December 2023 to February 2025 for Assam State Livelihood Improvement Project in India

1.2 Background of the survey

The final report is for the preparatory survey (hereinafter referred to as “the Survey”) on Assam Fisheries Development and Livelihood Project (hereinafter referred to as “the Project”) to be funded under JICA. The objective of the Survey is to provide the necessary information and data for an ODA loan appraisal and make the required proposal to refine the Detailed Project Report (DPR) prepared by the Department of Fisheries, executing agency in the state government of Assam (DoF). The Survey analyzed the issues in Assam’s aquaculture sector. Also, the Survey extracted lessons learned from the preceding ODA loan project, review the proposed DPR, validates the project components, implementation schedule and organization, procurement procedure, construction method and plan, project cost, the environmental and social consideration of the project, economic/financial feasibility and operation/effect index, etc.

1.3 Objective of the survey

The survey aims to review the project details described in DPR, focusing on technical and economic feasibilities and eligibility to be implemented as an ODA loan project through field survey at the Project site, interviews with the stakeholders, and discussion with the implementation agency, DoF, supported with JICA.

1.4 Survey area

The main target survey area is the whole districts of Assam state. In addition, necessary information will be collected in other states of India such as Andhra Pradesh, and neighboring countries such as Bangladesh and Bhutan (Refer to “Project Location Map”).

1.5 Scope of the survey

The scope of this survey is to undertake the survey works to achieve the objectives stipulated in 1.3. While conducting the survey, the survey team shall consider the survey approach and points, prepare reports as scheduled in the work plan, and explain and discuss the methods to achieve the objectives with the implementation agency.

1.6 Work schedule of the survey

The survey is conducted from December 2023 to January 2025 for 14 months. The outline of the work schedule is indicated in table 1-1.

Table 1 - 1 Work Schedule

Work Contents	Year	2024											2025		
	Month	12	1	2	3	4	5	6	7	8	9	10	11	12	1
[1] 1st works in Japan															
(1-1) Collection, organize and analysis of existing information															
(1-2) Preparation of subcontract survey instructions															
(1-3) Discussion on co-management of fisheries resources and SHEP approach															
(1-4) Preparation and review of Inception Report (IC/R)															
[2] 1st Field survey works															
(2-1) Explanation of IC/R															
(2-2) Confirmation of the background and necessity of the project and analysis of core issues															
(2-3) Fisheries Value Chain Survey															
(2-4) Demand forecast															
(2-5) Interviews with private enterprises (including entrepreneurs)															
(2-6) Discussion on brand development															
(2-7) Consideration of cooperation measures with educational institutions related to fisheries and aquaculture															
(2-8) Visit to advanced producer organizations															
(2-9) Review of Detailed Project Plan (DPR)															
(2-10) Problem analysis and proposal for modifying the DPR															
(2-11) Formulation of a pilot project implementation plan															
[3] 2nd works in Japan															
(3-1) Review and proposals for modification of DPR															
(3-2) Explanation to JICA of the policy for the second field survey															
[4] 2nd Field survey works															
(4-1) Explanation of the 2nd field survey plan															
(4-2) Formulation of revised DPR															
(4-3) Preparation of project implementation schedule															
(4-4) Submission and explanation of the Interim Report (IT/R)															
(4-5) Estimation of project cost															
(4-6) Institutional arrangement for implementation, monitoring, operation and maintenance of the project															
(4-7) Procurement plan															
(4-8) Development of specific action plan															
(4-9) Environmental and social considerations															
(4-10) Project effects															
(4-11) Impacts of climate change on fisheries and aquaculture															
(4-12) Preparation of the TOR for consulting services															
(4-13) Risk management															
(4-14) Implementation of the pilot projects															
[5] 3rd works in Japan															
(5-1) Preparation of Draft Final Report (DF/R)															
(5-2) Update the DPR based on survey results															
[6] Third Field Survey															
(6-1) Discussions toward preparation of Final Report (F/R)															
[7] Fourth domestic work															
(7-1) Finalization of F/R															
Attendance and support for JICA fact finding missions															
Reports															

Chapter 2 Socio-Economic Status and Natural Condition of Assam

2.1 Area and demography

Assam is a state in the northeastern India. Assam covers an area of 78,438 km² of which 98.4% area is rural. Assam has a population of approximately 31.21 million people in 2011 according to the latest census of India (2011). It is the second largest state in northeastern India by area and the largest in terms of population. The state is bordered by Bhutan and Arunachal Pradesh to the north; Nagaland and Manipur to the east; Meghalaya, Tripura, Mizoram and Bangladesh to the south; and West Bengal to the west via the Siliguri Corridor, a 22-kilometre-wide (14 mi) strip of land that connects the state to the rest of India. Assam has 35 districts namely, Bajali, Baksa, Barpeta, Biswanath, Bongaigaon, Cachar, Charaideo, Chirang, Darrang, Dhemaji, Dhubri, Dibrugarh, Dima Hasao, Goalpara, Golaghat, Hailakandi, Hojai, Jorhat, Kamrup Metropolitan, Kamrup, Karbi Anghlong, Karimganj, Kokrajhar, Lakhimpur, Majuli, Morigaon, Nagaon, Nalbari, Sivsagar, Sonitpur, Soth Salmara Mankachar, Tamulpur, Tinsukia, Udalguri, West Karbi Anglong.

2.1.1 Geographic features

(1) General

In terms of topography, Assam the state has been classified into three main regions - the Brahmaputra River valley in the north, the Barak River valley (upper Surma River) in the south and the hill areas between Meghalaya (in the west) and Nagaland and Manipur (to the east) in the south-central parts of the state. It is believed all three broad regions, the valley formed by Brahmaputra River is the largest and according to Hindu scriptures, this sacred river is considered as the son of God Brahma. The river originated from a 'sacred pool' known as the Brahma Kund in the neighbouring state of Arunachal Pradesh. The mighty river enters Assam near Sadiya at the extreme northeast part of the state and flows westward for nearly 725 km before turning south to enter the plains of Bangladesh. Dotted with a number of isolated hills and ridges that rise suddenly from the plains, the valley is around 80 km wide and is surrounded on all sides except on the west by mountains.



Figure 2 - 1 Map of Assam State by district
Source: mapsofindia.com edited by the JICA Survey team

Only a small portion of the Barak River valley lies within Assam's borders, but it nevertheless forms an extensive lowland area which is vital for agriculture in the southern region of the state. The Brahmaputra and Barak valleys have formed ancient sediments consisting of clay, silt or gravel (deposited by rushing streams) over the centuries. These sediments themselves carry a number of deposits from the Neogene and Paleogene periods that are some 2.6-65 million years old. Some of early deposits are hard sandstone, soft and loose sand, conglomerates, coal seams, shales, sandy clays and limestone.

The North Cachar Hills which is now part of the Meghalaya plateau is an extension of a subcontinent called Gondwana, an ancient landmass in the southern hemisphere that once consisted of South America, Africa, Australia, and part of the Indian subcontinent as one geographical entity. The elevated part of the Meghalaya plateau displays a rugged topography as it is isolated from the main region by the embankments on the Kepili River. This upland generally has a northerly slope, with average elevations ranging from about 1,500 feet to about 3,300 feet.

Between the Brahmaputra valley and the south-central hill region are the northern ranges, which extend north-eastward from Dabaka (east of Dispur) to Bokakhat in east-central Assam. The Rengma Hills to the south of the ridge average about 3,000 feet and their most prominent peak is Chenghehishon (4,460 feet).

(2) Land resources and land utilisation

Assam boasts vast stretches of fertile plains, primarily formed by the Brahmaputra and Barak River systems. These plains are the agricultural heartland of the state, supporting the cultivation of a variety of crops such as rice, tea, jute, sugarcane, pulses, and fruits. The fertile soil, coupled with a favourable climate, makes Assam a significant contributor to India's agricultural output.

Covering approximately 35% of the state's geographical area, Assam's forests are a treasure trove of biodiversity. The state is home to various species of flora and fauna, including the iconic one-horned rhinoceros, Asian elephants, tigers, and several species of birds. These forests not only support wildlife but also provide valuable ecosystem services such as carbon sequestration, soil conservation, and water regulation.

Forest is not only providing invaluable ecological services to the nation, but also providing invaluable ecological services for the environment's security to the nation, forest also contribute significantly to economy specially that of rural and marginalised strata of the society. Forest and trees outside forests are rich sources of timber, small timber, firewood, bamboos, at the same time they provide the opportunity to establish forest base industry like sawmills, plywood and veneer industrial units, small scale industries like building materials unit, furniture houses, cane and Sital Pati enterprises on commercial basis where large numbers of youth is directly and indirectly engaged in these economic activities. Moreover, Govt has emphasised to plant Agar and Chandan sapling to encourage the common people for their economic development in the state.

(3) Water system

The State of Assam comprised of two valleys namely the Brahmaputra and Barak Valley and it is situated in between 90° to 96° North Latitude and 24° to 28° East Longitude. The geographical area of Assam is 78,438.00 km² out of which 56,194.00 km² and 22,244.00 km² fall under the Brahmaputra and Barak Valley including 2 (Two) hill districts respectively. The flood prone area of the state is 31,500.00 km² as assessed by the Rastriya Barh Ayog which is about 39.58 % of the total land area of Assam. This is about 9.40% of total flood prone area of the whole country. This signifies that the flood prone area of Assam is four times the national mark of the country. Records show that average annual area affected by flood is 9.31 Lakh Hectares. The flood protected area of the state is 16,500.00 km² till date.

The severity of flood problem of the state has been further aggravated by the acuteness of erosion on both banks of river Brahmaputra and its tributaries. Study reveals that an area of 4.27 Lakh Hectare of the state has been eroded by the rivers since 1950, which is 7.40 % of area of the state. The average annual rate of erosion is 8,000 Ha. The world's largest river island Majuli is also under the grip of erosion by river Brahmaputra and about 60 % of its original area has already been engulfed by the river.

(4) Brahmaputra river system

The Brahmaputra Valley has an average width of about 80 Km. The main river of the valley, Brahmaputra is one of the largest rivers in the world and rank fifth with respect to its average discharge. The river originates from the Kailash ranges of Himalayas at an elevation of 5,300 M. After flowing through Tibet it enters India through Arunachal Pradesh and flows through Assam and Bangladesh before it joins Bay of Bengal.

The catchments area of Brahmaputra in Tibet is 2, 93,000 km²; in India and Bhutan is 2,40,000 km² and in Bangladesh is 47,000 km². The Brahmaputra basin extends over an area of 5,80,000 km² up to its confluence within Bangladesh.

The average width of Brahmaputra River is 5.46 Km. The average annual discharge is about 20,000 cumec and average dry season discharge is 4,420 cumec.

The river slope is very steep till it enters India. A drop of about 4,800 M is achieved in a length at about 1,700 Km in China (Tibet). This average slope of about 2.82 m/Km gets reduced to about 0.1m/Km in Assam valley. Due to this sudden flattening of river slope, the river becomes braided in nature in the Assam valley. During its course in Assam valley from Kobo to Dhubri the river is joined by about 20 (twenty) important tributaries on its North bank and 13 (thirteen) on its South bank. Joining of these tributaries bringing high sediment load activates braiding.

Brahmaputra sub-basin extends over an area of 580,000 km² lying in Tibet (China), Bhutan, India and Bangladesh. The drainage area lying in India is 194,413 km² which is nearly 5.9% of the total geographical area of the country. It is bounded on the north by the Himalayas, on the east by the Patkari

range of hills running along the Assam-Burma border, on the south by the Assam range of hills and on the west by the Himalayas and the ridge. Separating it from Ganga sub-basin. The sub-basin lies in the States of Arunachal Pradesh, Assam, Nagaland, Meghalaya, West Bengal and Sikkim. Below table reflects the State-wise distribution of drainage area of the river.

Table 2 - 1 State-wise distribution of drainage area

State	Drainage Area (km ²)
Arunachal Pradesh	81,424
Assam	70,634
West Bengal	12,585
Meghalaya	11,667
Nagaland	10,803
Sikkim	7,300
Total	194,413

Source: Water Resources, Government of Assam

The most predominant soil type found in the sub-basin is the red loamy soil and alluvial soil. Other important soil types are sandy, loamy, clayey soils, their combinations and laterite soils. The culturable area of the sub-basin is about 12.15 M. ha which is 6.2% of the culturable area of the country.

(5) Barak river system

The Barak valley has a geographical area of 6,922.00 km² excluding 2(two) hill districts. The local rainfall run off of the valley along with that of adjacent hilly areas flows through river Barak and its various tributaries and is drained out to Bangladesh. The Katakhal, Jiri, Chiri, Modhura, Longai, Sonai, Rukni and Singla are the main tributaries of the valley. The tributaries are mainly rain fed and cause flood problems when precipitation occurs. The Barak sub-basin drains areas in India, Bangladesh and Burma. The drainage area of the suit lying in India is 41,723 km² which is nearly 1.38% of the total geographical area of the country. It is in the north of Barail range separating it from the Brahmaputra sub-basin, on the east by the Na Lushai hills and on the south and west by Bangladesh. The sub-basin lies in the States of Meghalaya, Manipur, Mizoram, Assam, Tripura and Nagaland. The State-wise distribution of drainage area is given below table.

Table 2 - 2 State-wise distribution of drainage Area

State	Drainage Area (km ² meter)
Meghalaya	10,650
Manipur	9,567
Mizoram	8,866
Assam	7,224
Tripura	4,688
Nagaland	728
Total	41,723

Source: Water Resources, Government of Assam

The Brahmaputra and Barak rivers, along with their tributaries, crisscross the state, providing abundant water resources for various activities such as irrigation, fishing, and transportation. Assam's waterways serve as vital arteries for trade and commerce, connecting the state to other parts of India and neighbouring countries like Bangladesh and Bhutan. The hilly terrain of Assam, particularly in the Karbi Anglong and Dima Hasao districts, offers immense potential for hydroelectric power generation. Several hydroelectric projects have been undertaken in these regions to harness the energy of flowing rivers, contributing to the state's electricity generation and fulfilling the growing energy demands.

(6) Climate and rainfall

The climate of Assam is tropical monsoon climate with warm humid summers and cool dry winters. Assam experiences moderate temperatures for most of the year, with slight variations across seasons and elevations. During the summer months (March to June), temperatures can soar, especially in the

plains, with highs reaching up to 35-40°C (95-104°F). However, the presence of forests and water bodies helps mitigate the heat to some extent. The winter months (December to February) are relatively mild, with temperatures ranging between 10-20°C (50-68°F).

The state is situated in high rainfall zone with annual average rainfall of 2,297.4 mm. The state normally receives 2 percent of the total rainfall in the winter season (January-February), 25 percent in the summer season (March-May), 65 percent in the monsoon season (June-September) and 7 percent in post-monsoon season (October-December). Assam is prone to floods and drought like situations. The state though has natural potentialities to drive the agriculture sector, erratic and unpredictable weather conditions and floods have been creating adverse impact making the farmers vulnerable to the situations.

Table 2 - 3 Season-wise Rainfall Pattern in Assam in mm

Season		2020	2021	2022
Winters (Jan-Feb)	Actual ¹	33.0	13.9	75.4
	Normal ²	47.8	48.5	47.7
	Deviation (%)	-31%	-71.34%	58.07%
Summer (March-May)	Actual	555.4	323.2	761.1
	Normal	578.6	543.6	539.8
	Deviation (%)	-4.01%	-40.54%	40.99%
Monsoon (June-September)	Actual	1,878.6	1,932.2	1,340.5
	Normal	1,584.6	2,402	1,474.1
	Deviation (%)	19%	-19.56%	-9.06%
Post Monsoon (October-December)	Actual	185.8	133.6	198.5
	Normal	165.7	157.3	154.9
	Deviation (%)	12%	-15.07%	28.15%
All season (January-December)	Actual	2,652.8	2,402.9	2,375.5
	Normal	2,376.6	3,151.4	2,216.5
	Deviation (%)	12%	-23.75%	7.17%

Source: Economic Survey, Assam, 2023-24

Above table shows that in all seasons (January to December) in the year 2022, the actual rainfall pattern is 2,375.5 mm as against 2,402.9 mm in 2021. And Normal rainfall pattern is 2,216.5 mm in 2022 as against 3,151.4 mm in the previous year. The deviation is 7.17% during 2022 as against -23.75% in 2021.

¹ “Actual” indicates observed values in particular period.

² “Normal” is defined as the average of a rainfall data computed over a long period

2.1.2 Administrative structure

The state is governed by a Chief Minister and a Council of Ministers, who are responsible for the administration of the state's affairs. The state's legislative branch is composed of a unicameral legislature, the members to be elected by the people of the state. Vidhan Sabha is the legislative assembly of the state of Assam in India. It is a unicameral legislature, the only house of the state parliament. The assembly has a total of 126 members who are elected for a term of 5 years through regular elections. The constituencies for the elections are demarcated based on the population density of the state. The Vidhan Sabha has the power to make laws and approve budgets for the state government, and also scrutinize and approve the policies and budgets proposed by the government. The members of the Vidhan Sabha can also ask questions and make suggestions to the government.

The elected head of government is called Chief Minister. The chief minister reports to the governor of Assam who is appointed by the central government of India in New Delhi. The elected head of the Assam is divided into three regions (1. The Brahmaputra River Valley. 2. The Barak Valley and. 3. The hilly Regions) each of which headed by a commissioner. Under each commissioner. There are several administrative units called Districts. Figure 2-3 reflects the administrative structure of the Assam State.

Assam is divided into five divisions for the administrative purposes. Below table reflects the details of these divisions. Assam comprises of five divisions namely Barak Vally, Central Assam, lower Assam, North Assam and upper Assam with the divisional office at Silchar, Nogaon, Guwahati, Tezpur and Jorhat respectively.

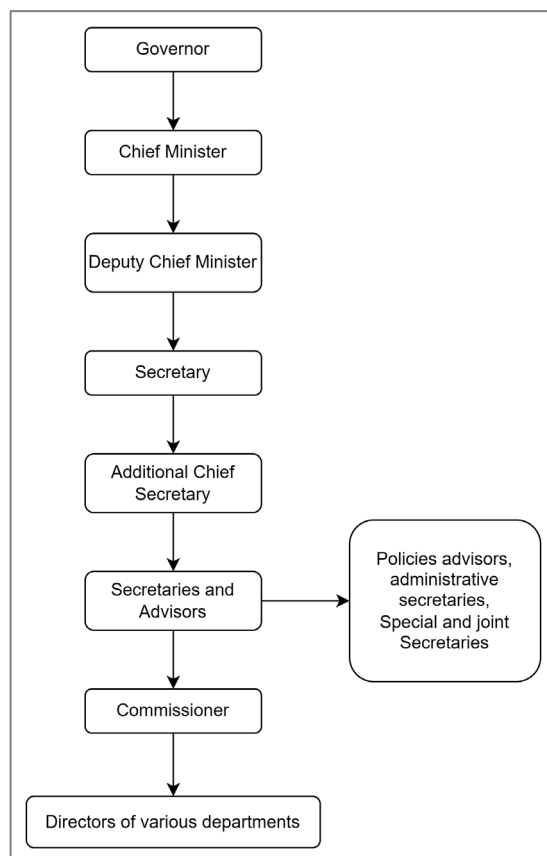


Figure 2 - 2 Administrative structure

Source: JICA Survey Team edited the chart in DPR, DoF

Table 2 - 4 Districts under divisions

Division Name	Division Office	Districts	
Barak Valley	Silchar	Cachar	Karimganj
		Hailakandi	
Central Assam	Nagaon	Dima Hasao	Morigaon
		East Karbi Anglong	Nagaon
		West Karbi Anglong	Hojai
Lower Assam	Guwahati	Baksa	Kamrup Metropolitan
		Barpeta	Kamrup Rural
		Bongaigaon	Kokrajhar
		Chirang	South Salmara-Mankachar
		Dhubri	Bajali
		Goalpara	Tamulpur
		Nalbari	
North Assam	Tezpur	Darrang	Udalguri
		Sonitpur	Biswanath
Upper Assam	Jorhat	Charaideo	Lakhimpur
		Dhemaji	Majuli
		Dibrugarh	Sivasagar
		Golaghat	Tinsukia
		Jorhat	

Source: Assam State Portal (<https://assam.gov.in/index.php/about-us/396>)

Each division consists of several districts. Each district composed of sub-divisions which are composed of tehsil or sub-tehsil. A tehsil is purely for revenue administration purposes. Each tehsil/ sub-tehsil consists of multiple community development blocks. A community development block is a rural subdivision and typically smaller than a tehsil. Community development block (CD block) or simply Block is a sub-division of Tehsil, administratively earmarked for planning and development. It is administered by a Block Development Officer (BDO), supported by several technical specialists and village-level workers. A community development block covers several Gaon panchayats (the local administrative units at the village level). Fisheries Development officers (FDOs) are the employees of the Fisheries extension of the government of Assam works to disseminate fisheries related technologies/ schemes/information to the fish farmers in the region. Fisheries extension officers are located in each district and sub-divisions. There are 35 districts, 80 sub-divisions 155 tehsils and 219 blocks, 214 total towns and 26,395 villages. The state is having 219 community development blocks and 2,200 Gaon panchayat.

Below table shows the overview of the administrative units of the Assam by districts.

Table 2 - 5 District-Wise Administrative Units of Assam

District	Sub-Division	Towns (Statutory + Census)	No. of Villages			Community Development Blocks	Gaon Panchayat
			Total	Inhabited	Uninhabited		
Kokrajhar	4	4	1,068	1,053	15	5	0
Dhubri	2	9	777	773	4	11	133
Goalpara	2	11	829	779	50	8	81
Barpeta	4	9	835	825	10	12	129
Morigaon	1	6	632	598	34	5	85
Nagaon	2	8	1,012	963	49	13	172
Sonitpur	2	6	1,044	1,008	36	7	102
Lakhimpur	3	4	1,184	1,145	39	9	81
Dhemaji	2	4	1,319	1,264	55	5	65
Tinsukia	3	13	1,168	1,136	32	7	85
Dibrugarh	3	9	1,348	1,318	30	7	93
Sivasagar	2	4	531	518	13	4	79
Jorhat	2	11	600	571	29	6	91
Golaghat	4	7	1,125	1,032	93	8	102
Karbi Anglong	3	5	2,353	2,165	188	7	0
Dima Hasao	3	4	695	676	19	5	0
Cachar	4	19	1,040	998	42	15	163
Karimganj	3	7	936	915	21	7	96
Hailakandi	1	3	331	330	1	5	62
Bongaigaon	2	5	563	535	28	5	65
Chirang	2	3	508	501	7	2	0
Kamrup	3	16	1,068	1,037	31	14	139
Kamrup Metro	6	12	216	204	12	3	21
Nalbari	4	11	456	455	1	7	65
Baksa	3	2	690	679	11	5	0
Darrang	1	3	561	552	9	5	75
Udalguri	2	3	800	791	9	6	0
Biswanath	2	2	832	790	42	7	56
Charaideo	1	3	344	344	0	5	39
Hojai	1	9	400	398	2	5	67
Majuli	1	0	248	192	56	2	19
South Salmara	1	0	314	280	34	3	35
West K. Anglong	1	2	568	547	21	4	0
Assam	80	214	26,395	25,372	1,023	219	2,200

Source: Statistical Handbook, Assam, 2022

2.1.3 Demographic feature

(1) Area and population

Assam is a state of heterogeneous population with socio-cultural and ethnic diversity. According to the Census of India, 2011 the population of Assam was 312.05 lakh of which 159.39 lakh were male and 152.66 lakh were female. The projected population (released by Census of India) of Assam in 2022 is found as 353.78 lakh of which 180.06 lakh are male and 173.71 lakh are female. The decadal growth rate of the state population during 2001-2011 was 17.07% against 17.68% growth for the country as a whole. Out of total population in the state, 86% population lived in rural areas and 14% population in urban areas. The percentage of rural population of the state was higher than all India average (69%). However, the urban population in the state had increased from 12.9% in 2001 to 14% in 2011. The density of population of Assam in 2011 was 398 persons per km². as compared to 340 persons in 2001. The sex ratio (number of females per thousand male) of Assam had increased to 958 in 2011 from 935 in 2001.

Table 2 - 6 District-wise Area population and Density of Assam

District	Area (in km ²)			Population			Density per km ² (2011 Census)*
	Total	Rural	Urban	2001 Census*	2011 Census	2024 (Projected)	
Kokrajhar	3,296	3,280	16	843,243	887,142	1,457,829	283
Dhubri	1,511	1,483	28	1,566,396	1,394,144	549,012	687
Goalpara	1,824	1,760	64	822,035	1,008,183	3,428,107	553
Barpeta	2,282	2,246	36	1,394,755	1,693,622	5,578,893	522
Morigaon	1,551	1,525	26	776,256	957,423	3,312,594	562
Nagaon	2,550	2,518	32	2,314,629	1,892,550	PD	738
Sonitpur	3,409	3,368	41	1,665,125	1,311,619	PD	362
Lakhimpur	2,277	2,241	36	889,010	1,042,137	3,032,788	457
Dhemaji	3,237	3,221	16	571,944	686,133	2,170,590	213
Tinsukia	3,790	3,728	62	1,150,062	1,327,929	3,640,200	347
Dibrugarh	3,381	3,336	45	1,185,072	1,326,335	3,162,754	393
Sivasagar	1,581	1,551	30	1,051,736	692,435	PD	431
Jorhat	1,758	1,666	92	999,221	924,952	884,407	383
Golaghat	3,502	3,466	36	946,279	1,066,888	2,634,805	302
Karbi Anglong	7,366	7,343	23	813,311	660,955	PD	93
Dima Hasao	4,888	4,866	22	188,079	214,102	552,401	44
Cachar	3,786	3,721	65	1,444,921	1,736,617	5,528,665	459
Karimganj	1,809	1,790	19	1,007,976	1,228,686	4,097,916	673
Hailakandi	1,327	1,316	11	542,872	659,296	2,172,808	497
Bongaigaon	1,093	1,061	32	612,665	738,804	2,378,611	425
Chirang	1,923	1,911	12	433,061	482,162	1,120,475	244
Kamrup	3,105	3,031	74	1,311,698	1,517,542	4,193,514	436
Kamrup Metro	955	693	262	1,059,578	1,253,938	3,780,618	2,010
Nalbari	1,052	997	55	689,053	771,639	1,845,257	763
Baksa	2,457	2,451	6	857,947	950,075	2,147,739	475
Darrang	1,585	1,573	12	759,858	928,500	3,120,846	491
Udalguri	2,012	2,002	10	758,746	831,668	1,779,654	497
Biswanath	1,796	1,778	18	NA	612,491	NA	NA
Charaideo	1,087	1,074	13	NA	458,615	NA	NA
Hojai	1,422	1,374	48	NA	931,218	NA	NA
Majuli	1,093	1,093	0	NA	167,304	NA	NA
South Salmara	665	661	4	NA	555,114	NA	NA
West K. Anglong	3,068	3,054	14	NA	295,358	NA	NA
Assam	78,438	77,178	1,260	26,655,528	3,1205,576	90,356,200	398

Source: Statistical Handbook, Assam, 2021, 2023

Note: NA: Not available

Note: The data excludes the statistical information for the newly formed districts namely Biswanath, Charaideo, Hojai, Majuli, South Salmara, West K. Anglong. The figures are provisionally estimated only for the rest of the districts as per census 2001 and 2011.

By looking at the population distribution of the rural and urban areas, 86% of the population lives in the rural setting and the rest of the 14% population lives in the urban setting of the state. In Kamrup metropolitan, 82.75 population lives in the urban area, making it the only district with highly urbanized population. In Majuli district 100% population lives under the rural area.

According to the Indian Census, the average sex ratio in Assam is 958 females per 1,000 males, while the national average is 943 which is somewhat higher than the national average. However, in every district, the female population is lower than the male population.

Table 2 - 7 District-wise Population and Sex ratio

District	Population					Females per '000 Males
	Total	Rural	Urban	Male	Female	
Kokrajhar	887,142	832,201	54,941	452,905	434,237	959
Dhubri	1,394,144	1,216,605	177,539	715,821	678,323	953
Goalpara	1,008,183	870,121	138,062	513,292	494,891	964
Barpeta	1,693,622	1,546,269	147,353	867,004	826,618	953
Morigaon	957,423	884,125	73,298	486,651	470,772	967
Nagaon	1,892,550	1,695,366	197,184	962,632	929,918	962
Sonitpur	1,311,619	1,169,142	142,477	672,670	638,949	956
Lakhimpur	1,042,137	950,804	91,333	529,674	512,463	968
Dhemaji	686,133	637,848	48,285	351,249	334,884	953
Tinsukia	1,327,929	1,063,186	264,743	680,231	647,698	952
Dibrugarh	1,326,335	1,082,605	243,730	676,434	649,901	961
Sivasagar	692,435	612,062	80,373	354,673	337,762	954
Jorhat	924,952	704,418	220,534	471,239	453,713	962
Golaghat	1,066,888	969,152	97,736	543,161	523,727	964
Karbi Anglong	660,955	565,852	95,103	338,980	321,975	951
Dima Hasao	214,102	151,613	62,489	110,802	103,300	932
Cachar	1,736,617	1,421,153	315,464	886,284	850,333	959
Karimganj	1,228,686	1,118,986	109,700	625,864	602,822	963
Hailakandi	659,296	611,156	48,140	337,890	321,406	951
Bongaigaon	738,804	628,994	109,810	375,818	362,986	966
Chirang	482,162	446,825	35,337	244,860	237,302	969
Kamrup	1,517,542	1,375,148	142,394	778,461	739,081	949
Kamrup Metro	1,253,938	216,927	1,037,011	647,585	606,353	936
Nalbari	771,639	688,909	82,730	396,006	375,633	949
Baksa	950,075	937,833	12,242	481,330	468,745	974
Darrang	928,500	873,006	55,494	475,273	453,227	954
Udalguri	831,668	794,094	37,574	421,617	410,051	973
Biswanath	612,491	581,123	31,368	311,234	301,257	NA
Charaideo	458,615	428,892	29,723	234,543	224,072	NA
Hojai	931,218	758,868	172,350	476,480	454,738	NA
Majuli	167,304	167,304	0	85,566	81,738	NA
South Salmara	555,114	528,952	26,162	282,027	273,087	NA
West K. Anglong	295,358	277,495	17,863	151,187	144,171	NA
Assam	31,205,576	26,807,034	4,398,542	15,939,443	15,266,133	958

Note: NA:Not available

Note: The data excludes the statistical information for the newly formed districts namely Biswanath, Charaideo, Hojai, Majuli, South Salmara, West K. Anglong. The figures are provisionally estimated. only for the rest of the districts as per census 2001 and 2011.

Source: Census 2011

Statistical Handbook, Assam, 2023

The caste system in India is a social hierarchy that categorizes people into distinct groups based on birth, occupation, and social status. It has ancient roots, with its origins dating back thousands of years, and has profoundly influenced Indian society and culture. Scheduled Castes (SC) are communities in

India that have been historically disadvantaged and marginalized due to the caste system. They are designated as such by the government to receive special support and assistance to help uplift them socio-economically. Similarly, Scheduled Tribes (ST) are indigenous communities in India who have their own distinct cultures and ways of life. They have been recognized by the government as needing special protections and assistance because of historical marginalization, often living in remote and underdeveloped areas. The socio-economic conditions of scheduled castes and scheduled tribe vary from one district to another district due to various socio-economic and political regions. Below table shows the districts and gender-wise population of these categories. Assam has 35 districts out of these 35 districts some are developed, and some are deprived of basic infrastructure. Out of the total population of Assam, 2,231,321 belongs to the SC and 3,884,371 belong to the ST category. It covers 7% (SC population) and 12.4% (ST population) share of the Total population of the district. In case of Schedule caste, Cachar district has the largest percent share of the scheduled caste population (15.2%) and in case of scheduled tribe, West K. Anglong (65.5%) has the largest share of the total population of the district.

Table 2 - 8 Population of Schedule Caste and Schedule Tribe

District	Population					
	Scheduled Caste			Scheduled Tribe		
	Total	Male	Female	Total	Male	Female
Kokrajhar	29,570	15,386	14,184	278,665	139,579	139,086
Dhubri	62,628	32,362	30,266	2,300	1,144	1,156
Goalpara	45,094	22,999	22,095	231,570	116,013	115,557
Barpeta	95,320	49,165	46,155	27,344	13,530	13,814
Morigaon	117,841	60,194	57,647	136,777	68,382	68,395
Nagaon	156,913	79,655	77,258	86,422	43,119	43,303
Sonitpur	65,367	33,474	31,893	139,033	70,335	68,698
Lakhimpur	81,840	41,689	40,151	249,426	126,716	122,710
Dhemaji	44,225	23,006	21,219	325,560	165,449	160,111
Tinsukia	37,688	19,443	18,245	82,066	41,769	40,297
Dibrugarh	58,876	30,517	28,359	102,871	51,835	51,036
Sivasagar	34,847	17,753	17,094	37,334	19,099	18,235
Jorhat	64,787	32,931	31,856	62,368	31,467	30,901
Golaghat	62,298	31,807	30,491	111,765	56,420	55,345
Karbi Anglong	33,523	17,502	16,021	345,220	174,557	170,663
Dima Hasao	4,337	2,340	1,997	151,843	76,520	75,323
Cachar	264,897	136,051	128,846	17,569	8,736	8,833
Karimganj	157,890	81,384	76,506	1,940	994	946
Hailakandi	70,659	36,369	34,290	691	354	337
Bongaigaon	82,784	42,513	40,271	18,835	9,377	9,458
Chirang	35,135	18,105	17,030	178,688	89,273	89,415
Kamrup	107,827	55,237	52,590	182,038	92,094	89,944
Kamrup Metro	101,789	52,106	49,683	75,121	37,902	37,219
Nalbari	60,216	30,654	29,562	23,364	11,692	11,672
Baksa	73,083	37,534	35,549	331,007	165,634	165,373
Darrang	40,260	20,566	19,694	8,419	4,300	4,119
Udalguri	37,844	19,402	18,442	267,372	133,550	133,822
Biswanath	43,763	22,343	21,420	93,174	47,350	45,824
Charaideo	7,500	3,815	3,685	11,705	5,890	5,815
Hojai	109,437	56,818	52,619	28,731	14,640	14,091
Majuli	23,878	12,263	11,615	77,603	39,328	38,275
South Salmara	7,767	3,997	3,770	4,032	2,054	1,978
West K. Anglong	11,438	5,934	5,504	193,518	97,903	95,615
Assam	2,231,321	1,145,314	1,086,007	3,884,371	1,957,005	1,927,366

Note: NA:Not available

Source: Census 2011

Statistical Handbook, Assam, 2023

(2) Working population

The worker population ratio is one of the major estimates of the employed persons. Worker Population Ratio (WPR) is the percentage of persons employed among the persons in the population. In other words, it is the ratio of total number of workers to the total population in a country and expressed in terms of percentage. Worker population Ratio reflects the proportion of the population engaged in the production process which also tells us about the employment situation in an economy. Higher WPR usually reflects a higher proportion of the population engaged in production activities and vice-versa. It is important to have a high WPR which will boost the economy in the process of growth and in further cases development. Below table shows the WPR for both Rural and Urban areas from 2020-21 to 2022-23.

Table 2 - 9 Worker Population Ratio (rural + urban) in Assam from 2017-18 to 2020-21

Category	2020-2021		2021-2022		2022-2024	
	Male	Female	Male	Female	Male	Female
Assam	76.6	22.9	76.8	26.8	88.9	19.6
India	73.5	31.4	73.4	31.7	76	35.9

Source: Economic Survey, Assam, 2023-2024

Note: according to usual status (PS+SS) since 2020-21 to 2022-23. (age group 15yr. and above)

In comparison to overall Indian parameters of WPR, that of Assam is poorer in female participation ratio. In 2020-21, the female WPR of Assam was 22.9% compared to the national percentage of 31.4%. It is also observed that the female WPR vis-à-vis male WPR, the difference is wider in the case of Assam (53.7%) in comparison to overall India (42.1%) in 2020-21 which are 69.3% (Assam) and 40.1% (India) respectively in 2022-23.

Table 2 - 10 Fishers' population in India and Assam (2020-2021)

Category	Male	Female	Total
Assam*	1,624,059	900,047	2,524,106
India	13,013,978	10,103,842	23,117,820

Table 2 - 11 Category wise fishers' population engaged in inland fisheries activities (2020-2021)

Category	India		Assam	
	Male	Female	Male	Female
Full time	1,351,316	494,969	65,693	60,628
Part time	1,249,414	599,289	281,107	259,530
Occasional	606,245	210,531	15,357	13,979
Total	3,206,975	1,304,789	362,157	334,137

Source:

Handbook of Fisheries Statistics, GOI, 2022

[Handbook Fisheries Statistics 19.01.2023 \(Final File\).cdr \(DoF.gov.in\)](#)

2.2 State of economy

(1) Economic development policy

The state of Assam located in the northern-east India has rich biodiversity and natural resources, which contribute to the development of agriculture production and other various industries. The population of Assam has increased year by year, and the ratio of rural population (86%) is higher than the average of India (69%) according to the Population Census 2011. This situation could indicate that the industrial development in rural areas such as agriculture is crucial for economic growth in Assam.

The Government of Assam has developed a policy document "Assam 2030 Our Dream, Our Commitment" prepared in July 2016, in alignment with Sustainable Development Goals (SDGs)³. This vision has been prepared as an operational document including interventions and the processes toward the economic development of Assam considering sustainability and inclusivity. In this document, three components are presented as strategic factors for the interventional processes: i) implementing SDGs as a single synergized initiative through people, partnership, and project approach,

³ Government of Assam (2016) "Assam 2030 - Our Dream, Our Commitment"

ii) technology, innovation, knowledge management through tools of effective and efficient delivery mechanisms, and iii) mobilization and utilization of resources for project implementation.

Component i) is highlighting the importance of the project implementation through a market-driven approach, inviting various stakeholders, with effective structure, resources and capacity development. Along with component i), the acquired knowledge and information are expected to be stored and utilized transparently and efficiently through the technologies/ systems/ platforms developed under component ii). For component i) and ii), the allocation of resources including nature, human and finance needs to be planned and implemented by component iii). Under the 2030 Agenda for achieving SDGs, these components are expected as key directions to accelerate the development of the economy of Assam for the livelihood improvement of the citizens living in Assam.

(2) Major industry

The state economy of Assam indicates a growth constantly from FY 2016/17 to FY 2022/23, while the temporary decline happened in FY 2020/21 under the pandemic of Covid-19. During the period from FY 2016/17 to FY 2022/23, the growth rate of the Gross State Domestic Product (GSDP) had increased from 11.6% to 19.9 %, which is larger than the Gross Domestic Product (GDP) of all India. The sectoral contribution of an economic indicator, the Gross State Value Added (GSVA) shows a steady growth in recent years, and each composition that is 22.10% of agriculture and allied sector (crops, livestock, forestry and fisheries), 30.75% of industry sector (mining and quarrying, manufacturing, electricity, gas, water supply and other utilities), and 42.25% of service sector (trade, hotels and restaurants, transport, storage and communication, financial services, real estate, public administration, railway and other services). Even the least ratio of growth contribution of the primary sector, agriculture and allied sector, the breakdown of sectors indicates that the sector of agriculture, forestry and fishing has the largest share of sectoral compositions in Assam, 22.1%, which is larger than the percentage of all India, 18.4% as shown in below table.

Table 2 - 12 Sectorial composition of GVA of All India and GSVA of Assam at Current Prices (FY 2022-23)

No	Sector/ Sub-sector	Assam ¹⁾		All India ²⁾	
		GSVA (INR in crore)	Share %	GVA (INR in crore)	Share %
1	Agriculture, forestry and fishing	98,629	22.1	45,57,599	18.4
2	Mining & quarrying	56,118	12.6	5,83,535	2.4
3	Manufacturing	51,937	11.6	36,36,171	14.7
4	Electricity, gas, water supply & other utility services	9,478	2.1	7,41,540	3.0
5	Construction	28,206	6.3	20,27,545	8.2
6	Trade, hotels, transport, communication, and services related to broadcasting	86,071	19.3	44,48,156	18.0
7	Financial, real estate& professional Services	38,812	8.7	53,00,147	21.4
8	Public administration, defense and other services	77,072	17.3	34,48,178	13.9
	Total	4,46,324	100	2,47,42,871	100

Source: Economic Survey, 2023-24 of Government of Assam

Note: 1) quick estimates and 2) provisional estimates from Directorate of Economics and Statistics, Assam and Govt. of India

(3) Establishments

According to the 6th economic census⁴, an agricultural establishment is defined as one indicator engaged in economic activities related to agriculture including livestock production, agricultural services, hunting, trapping and game propagation, forestry and logging, fishing and aquaculture. The below table shows the number of establishments and the employed persons of the agriculture and allied sectors. In Assam, 206,216 units (93%) of total number of establishments are located in rural areas and employs 352,783 persons. While a livestock unit is dominant in both rural and urban areas in Assam, the next larger unit is fishing and aquaculture in both rural and urban areas.

⁴ Directorate of Economics and Statistics, Assam (2013) "Sixth Economic Census, 2013 Assam"

Table 2 - 13 Number of Establishments and Persons Employed in the Rural and Urban Areas of Assam

Activity	Rural		Urban		Total	
	No. of Establishment	No. of Persons Employed	No. of Establishment	No. of Persons Employed	No. of Establishment	No. of Persons Employed
Agriculture	28,625	67,704	1,235	2,014	29,860	69,718
Livestock	115,675	197,197	11,504	20,150	127,179	217,347
Forestry and logging	13,098	17,304	778	1,404	13,876	18,708
Fishing and aquaculture	48,818	70,578	2,187	3,000	51,005	73,578
Total	206,216	352,783	15,704	26,568	221,920	379,351

Source: 6th Economic Census, Assam, https://des.assam.gov.in/sites/default/files/swf_utility_folder/departments/-nfrastr_medhassu_in_oid_3/menu/document/cc_2013_0.pdf

The ownerships of establishments of agriculture and allied sectors are varied in six types as government; private (proprietary); private (partnership); private (company); private (self-help group); private (non-profit institution); private (others). Out of the total employments, 93.73% are engaged under the private-proprietary ownership. It is observed that out of 221,920 of all agricultural establishments in Assam, 98.8% is operated under the private-proprietary ownership and the rest 1.2% is operated under other ownerships. The number of establishments under proprietary ownership is the highest in livestock (57.1%), followed by fishing and aquaculture (23.17%) and agriculture and forestry (13.45%).

The district-wise distribution of sector-wise establishments is given in the below table. The large establishments of fishing and aquaculture are located in Barpeta, Nagaon, Dhubri, Kamrup and Cachar districts, in which areas are mostly situated along Brahmaputra River except Cachar where is one of the most southern districts in Assam.

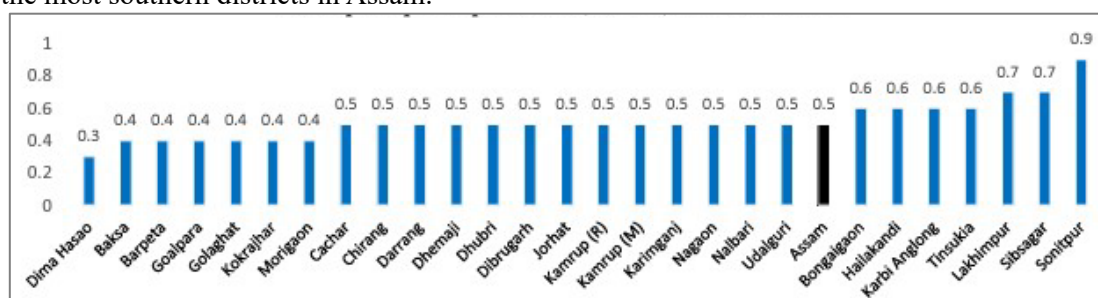


Figure 2 - 3 Rural inequality of district wise in Assam

Source: Economic Survey Assam - 2017-18, https://transdev.assam.gov.in/sites/default/files/swf_utility_folder/departments/pnodd_medhassu_in_oid_2/portlet/level_2/economic_survey_assam_2017-18_sdg_chapter.pdf

Note: The index scores are measured by GINI coefficients of monthly rural per capita expenditures.

Table 2 - 14 District-wise Number of Sector-wise Establishments

No.	Districts	Sector-wise No of establishments				
		Agriculture	Livestock	Forestry and logging	Fishing and aquaculture	Total
1	Kokrajhar	300	3,612	778	1,679	6,369
2	Dhubri	274	1,933	383	3,893	6,483
3	Goalpara	239	1,048	392	2,025	3,704
4	Barpeta	1,610	35,709	126	10,017	47,462
5	Morigaon	181	2,359	451	2,094	5,085
6	Nagaon	768	19,441	1,367	5,877	27,453
7	Sonitpur	1,415	5,277	332	2,013	9,037
8	Lakhimpur	2,984	2,044	493	2,089	7,610
9	Dhemaji	265	1,388	191	777	2,621
10	Tinsukia	8,938	2,174	164	1,349	12,625
11	Dibrugarh	570	3,243	262	1,273	5,348
12	Sivasagar	304	5,621	385	729	7,039
13	Jorhat	930	7,076	300	943	9,249
14	Golaghat	1,794	3,146	216	1,032	6,188
15	Karbi Anglong	1,876	5,914	2,093	524	10,407
16	Dima Hasao	122	304	594	92	1,112
17	Cachar	2,522	2,683	682	2,244	8,131
18	Karimganj	2,559	1,682	2,999	1,822	9,062
19	Hailakandi	199	730	267	509	1,705
20	Bongaigaon	171	1,105	141	1,455	2,872
21	Chirang	27	1,655	52	201	1,935
22	Kamrup	632	6,576	313	3,071	10,592
23	Kamrup Metropolitan	118	3,376	165	684	4,343
24	Nalbari	469	987	204	1,651	3,311
25	Baksa	250	5,104	259	1,106	6,719
26	Darrang	269	1,740	89	1,387	3,485
27	Udalguri	74	1,252	178	469	1,973
	Total	29,860	127,179	13,876	51,005	221,920

Source: Report on 6th Economic Census-2013, Directorate of Economics and Statistics, Assam, https://des.assam.gov.in/sites/default/files/swf_utility_folder/departments/-nfratr_medhassu_in_oid_3/menu/document/ec_2013_0.pdf

Note: The number of districts is as of 2013 when 6th Economic Census prepared.

(4) Rural Economy

Income

The per capita income in Assam has grown at the annual rate of 15.74% from FY 2021/22 to FY 2022/23 and reached INR 120,336 per capita⁵.

The comparative table of monthly per capita consumption expenditure (MPCE), an indicator of household wealth and living standards is given below with these categories covering spatial and social features. Additionally, the index score of MPCE is calculated as shown in Figure 2-4, which indicates that Sonitpur has the highest inequality while Dima Hasao the least in Assam.

(5) Wage Employment

According to the data collected by the Directorate of Economics and Statistics, the average daily wage rates of agricultural (field) labors shows in Assam are INR 357 and INR 301 per day respectively, which are lower by 5 to 15% than All India average in both male and female labours in 2021-22. Similar tendencies appear in terms of other agricultural labour wages in 2021-22 as well. Daily wages of different works in agriculture are also published by state wise and district wise.

⁵ 6th Economic Census-2013, Assam, https://des.assam.gov.in/sites/default/files/swf_utility_folder/departments/ecostat_medhassu_in_oid_3/menu/document/ec_2013_0.pdf

(6) Poverty

As per reports of international donors like the World Bank⁶ and the Asian Development Bank⁷, while poverty levels in Assam declined rapidly between 1994 and 2005, the progress of Assam has been quite behind compared to other states in reducing poverty. The poverty rate in Assam remains higher than all India average, which is 27.3% as opposed to the national average of 20.7% in 2015-2016⁸. The poverty headcount rate of Assam got worse (37.0%) compared to the all-India average (21.9%) in 2017⁹. Moreover, after the pandemic of Covid-19, the poverty headcount rate increased from about 40% up to 50% in Assam.

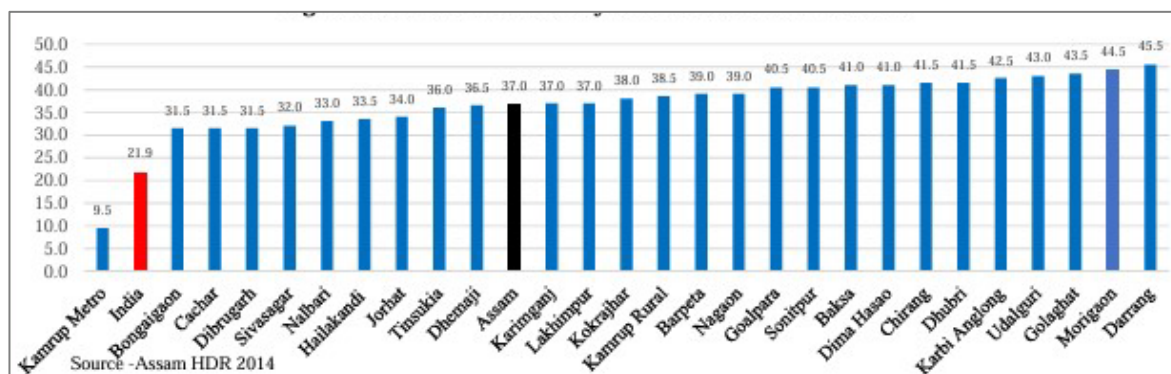


Figure 2 - 4 Poverty levels of District Wise in Assam

Source: Economic Survey Assam - 2017-18,
https://transdev.assam.gov.in/sites/default/files/swf_utility_folder/departments/pnnd_medhassu_in_oid_2/portlet/level_2/economic_survey_assam_2017-18_sdg_chapter_.pdf

According to the above data in 2017, most districts in Assam fare much worse than the all-India average except Kamrup Metro. The five major districts in very poor position are Darrang (45.5%), Morigaon (44.5%), Golaghat (43.5%), Udalguri (43.0%) and Karbi Anglong (42.5%).

(7) Migration

Northeast states in India used to be the frontier regions for migrants from other regions and countries due to a low density of the population. However, this has changed in the recent decade along with urbanization. According to Census 2011, the migration status of inflow and outflow of Assam shows diversified features in each state, which would be associated to geographic, industrial, educational and other life reasons such as marriage.

The summary of migration data of Assam and other Northeast states is compiled as below. In Assam, the migration ratio of outflow to inflow within Northeast India is comparatively higher than other northeast states, for reasons such as work and marriage potential.

⁶ World Bank (2017) "Assam Poverty, Growth & Inequality"

<https://documents1.worldbank.org/curated/en/545361504000062662/pdf/119141-BRI-P157572-Assam-Poverty.pdf>

⁷ Asian Development Bank (2020) "Initial Poverty and Social Analysis" <https://www.adb.org/sites/default/files/project-documents/53277/53277-002-ipsa-en.pdf>

⁸ Asian Development Bank (2020) "Initial Poverty and Social Analysis" <https://www.adb.org/sites/default/files/project-documents/53277/53277-002-ipsa-en.pdf>

⁹ Transformation and Development, Govt. of Assam (2017) "Economic Survey Assam – 2017-18"

https://transdev.assam.gov.in/sites/default/files/swf_utility_folder/departments/pnnd_medhassu_in_oid_2/portlet/level_2/economic_survey_assam_2017-18_sdg_chapter_.pdf

Table 2 - 15 Summary of Migration Data of Assam and Other Northeast States

Indicators	Items	Assam	Other NE states average	India
Migration intensity	Place of birth	33.3%	31.49%	36.9%
	Place of last residence	34.1%	32.79%	37.6%
Distribution of migration	Interdistrict	74.2%	63.8%	60.9%
	Interdistrict	20.1%	19.4%	25.9%
	Interstate (within NE or India)	4.6%	12.9%	11.9%
	Immigrants	1.0%	4.2%	1.2%
Reasons for interstate outflows from NE states	Work	27.6%	17.2%	24.7%
	Education	2.3%	7.0%	3.9%
	Marriage	25.4%	20.8%	24.4%
	Moved after birth	1.9%	1.6%	1.8%
	Move with household	27.1%	29.3%	27.9%
	Others	15.6%	24.1%	17.4%
Outflows and inflows for NE states	Outflow to inflow ratio within NE	1.82	1.10	-
	Outflow to inflow ratio in rest of India	1.14	0.90	-

Source: Compiled from Census of India 2011, <https://censusindia.gov.in/census.website/>, and Lusome R. and Bhagat R. B. (2020) "Migration in Northeast India: Inflows, Outflows and Reverse Flows during Pandemic" Indian J Labour Economics, 3(4): 1125-1141, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7585351/>

In addition, floods and river erosions could be one of the factors for migration in recent decades since these can wipe out villages, houses and farms drastically affecting people's lives. Due to river erosions of the River Brahmaputra and the tributaries until 201, about 7.4% (more than 4,000 km²) of total area of the riverbank was lost and affected the displacement of 500,000 people in 2,500 villages¹⁰. According to the assessment on the vulnerability to climate and environmental impacts in India¹¹, Assam is indicated as the most vulnerable state out of all states, and especially, a vulnerable index, "flood" meaning the impact of flood shows "very high" in many districts in Assam. Of the districts in Assam, Marigaon, Dhemaji and Nalbari are the most vulnerable districts affected by flood mainly (refer to the below table).

Table 2 - 16 Environmental Vulnerability with Ranking the Districts in Assam

Rank	Districts	Index	Rank	Districts	Index
1	Marigaon	0.638	15	Dhubri	0.365
2	Dhemaji	0.555	16	Golaghat	0.309
3	Nalbari	0.526	17	Sonitpur	0.307
4	Sibsagar	0.512	18	Baksa	0.304
5	Karbi Anglong	0.506	19	Tinsukia	0.291
6	Nagaon	0.501	20	Karimganj	0.288
7	Hailakandi	0.475	21	Udalguri	0.287
8	Goalpara	0.433	22	Darrang	0.246
9	Cachar	0.412	23	Dibrugarh	0.236
10	Lakhimpur	0.410	24	Kamrup M	0.230
11	Bongaigaon	0.402	25	Kokrajhar	0.091
12	Jorhat	0.399	26	Barpeta	0.063
13	Chirang	0.392	27	Dima Hasao	0.046
14	Kamrup	0.376			

Source: Assam Human Development Report 2014

Note: The index is calculated from environmental indicators of agri. Land affected by flood; agri.land affected by sand; agri.land affected by erosion; agri.land affected by industrial pollutions; forest loss; problem in water; facing air pollution.

¹⁰ State Innovation & Transformation Aayog, Government of Assam (2014) "Assam Human Development Report 2014", <https://transdev.assam.gov.in/portlets/assam-human-development-report>

¹¹ Council on Energy, Environment and Water (CEEW) (2021) "Mapping India's Climate Vulnerability (A District Level Assessment)" <https://www.ceew.in/sites/default/files/ceew-study-on-climate-change-vulnerability-index-and-district-level-risk-assessment.pdf>

2.3 Utilization of the water bodies

2.3.1 Category of water bodies for fish production

Surface water resources of Assam used for fisheries activities are summarized as shown in below table. Utilization of public water bodies such as beel (or wetland in general), river and reservoirs is governed by responsible government departments. On the other hand, at present there are no comprehensive rules and regulations for operation of aquaculture in private properties except for the Assam Fish Seed Act (2005) and Assam Fish Seed Rule (2010), which will be explained later in Chapter 3.4.4 (2).

Table 2 - 17 Surface Water Resources for fisheries and aquaculture in Assam

	Resource type	Number	Water area (ha)
1	Ponds & Tanks (Aquaculture)	501,800	85,067.51
2	Beel fisheries (wetlands)- registered	1,904	69,719.23
3	Derelict water bodies/ swamps/ low-lying areas	4,434	83,639.25
4	Reservoirs fisheries	4	3,096
5	Forest fisheries	493	5,001.8
6	River fisheries	Main rivers-2	10,607.29 km
		Tributaries-53	

Source: Annual Report 2021-22, Department of Fisheries, Govt. of Assam

2.3.2 Relevant policies, laws and regulations

Government of India issues guidelines for state governments and union territories to formulate/ up-date/ amend the relevant state acts & rules based on specific local situations. Some of these guidelines are:

1. Indian Fisheries Act, 1897
2. National Water Policy - 2002
3. Wetlands (Conservation & Management) Rules, 2017
4. Biodiversity Action Guide- The Nature Conservancy
5. Guidelines for the States for Framing a Bill on Inland Fisheries and Aquaculture, GoI, 2010.

Based on these guidelines, Govt. of Assam has formulated (i) Assam State Water Policy, (ii) Assam Fishery Rules, 1953.

(1) Assam State Water Policy, 2007

1) Policy frame

Assam state water policy is prescribed in accordance with the guidelines and general directions in the National Water Policy - 2002, keeping in view the specific necessity for the State of Assam. In view of the inter-State water disputes, the State Water Policy has specific importance. The Policy envisages a long-term water resource management programme designed to develop a critical mass of indigenous productivity with the requisite technical, economic and sociocultural means for sustainable development.

It adopts integrated water resource - infrastructure as a core strategy, based on the principles of water as a finite resource, need to use a participatory approach, the crucial role of men and women, ensuring clean water for human health and looking at water both as an economic and social good. The priority in the strategy would be to develop a systematic knowledge base to examine the current understanding of integrated freshwater management quantitatively and qualitatively.

In the planning and operation of the systems, water allocation priorities would be broadly as follows:

- Drinking and domestic use
- Sustaining livelihoods - aquaculture, cottage industries
- Sustaining environment, maintaining river systems, wetland systems and aquatic life
- Irrigation and hydropower
- Agri-based and rural industries
- Thermal power and industries
- Recreation and religious uses, and
- Navigation and other uses.

2) Important policy stipulated for Fisheries Development and Aquaculture

Culture based fisheries in closed wetlands and wetlands with a very brief period of connection with river, would be encouraged with community participation through strategic stocking and recapture. Capturing fisheries to manage natural fish stock would be encouraged through community participation in wetlands with riverine connection for a reasonably long time by allowing recruitment by conserving and protecting the brooders and juveniles (refer to Box below). The growth over-fishing would be prevented by taking appropriate measures in gear selection and strictly observing the closed season to protect the brooders. Fisheries would be part of an integrated water resources management system including navigation and recreation, bird sanctuary, aquaculture and open water fisheries as a part of holistic development which would benefit the local people and help retaining the biodiversity of the water system and the environment.

Box Characteristics of wetlands or beels in Assam

In Assam, the wetlands, often called as beel, are either closed or open in terms of connection to natural river. The closed ones have lost riverine connections (link channel) due to siltation and urbanization etc., so they are proposed to be managed by stocking of juveniles by community. On the other hand, open type is called “live beel” having riverine connection through permanently or seasonally occurring canals, which allow entry of wild fishes. These link channels shall be kept functional by the efforts of community participation.

(2) Assam Fishery Rules, 1953

Assam Fishery Rules, 1953 was originally framed with the objective to generate Government revenue by leasing out the registered fisheries under rivers and beel fishery resources. These water bodies are grouped into 60% and 40% category. More specifically, 60% of total number of fisheries in a sub-division (Rule 13 (a)) are leased out to fishermen cooperative societies formed of 100% members from scheduled caste and Maimal Community¹² of Barak Valley. Again, out of total numbers of fisheries in a sub-division, remaining 40% fisheries are leased out to individuals from any community (Rule 13 (b)). For leasing out the fisheries, tenders are floated by District Fisheries Development Officer (DFDO¹³) with due approval of the Deputy Commissioner (DC) as per Govt. Notification No AR.122/2018/27 dated 1st November, 2018 which was previously done by Revenue & Disaster Management Department through DC, in the month of January/ February generally and leased out to approved tenderer/ lessee for a period of seven (7) years at a time, with provision of depositing lease amount approved on annual basis.

There are in total 51 rules. The important rules covering the main aspects are (i) Procedure for sale (settlement) of Fisheries (Rule No. 3), Condition of Sale (Rule No. 5), Settlement of Fisheries with Co-operative Societies (Rule No. 13), Restriction on fishing during breeding season on catching and selling of under sized fish (Rule No. 23-A), Declaration of Sanctuaries (Rule No.30), and Penalties on breach of rules (Rule No.41).

Government has decided to amend the age-old rules to suit the present-day requirements. The draft amendment proposal is under active consideration of Government.

Government notifies the essential provisions of the Assam Fishery Rules, 1953 every year before the onset of fish breeding season in the capture fisheries to allow fish to breed and have sustainable fish stock in the capture fisheries. Some of the provisions which are generally notified are:

¹² Indigenous Bengal Muslim community of inland fishermen. Also called as “Mahimal”.

¹³ DFDO is a sub-division of the Government of Assam (DoF), an administrative body established in each district to implement measures in line with DoF policies at the district level.

Table 2 - 18 Essential Rules for Fish conservation in Capture Fisheries of Assam

Regulation (Assam Fishery Rules, 1953)	Period	Content
Rule 23-A (1)	May 1 st -July 15 th	Fishing of mature Rohu, Catla (Bahu) , Mrigal, Mali (Calbasu), Chital (Kharia), Pithia, Mahasol, Gharia and Kuri (Gonius) are prohibited.
Rule 23 (1)	April 1 st -July 15 th	The use of fishing nets with a mesh size of 7 cm/14 cm or less (Berjal/Mahajal: seine nets or Fasijal nets) are prohibited.
Rule 23-A (2)	August 1 st -October 31 st	Fishing of Rohu, Catla (Bahu), Mrigal, Chital (Kharia) and Pithia (Mahasol), Gharia under 23 cm in length and Mali (Calbasu) Gonius (Kurhi)/Bhagan under 10 cm in length are prohibited.
Rule 23 (2)	Year-round	The use of fishing nets with a mesh size of less than 1 cm/2 cm are prohibited.

Note: 'Berjal= encircling net, 'Mahajal= drag net

(3) Relevant conservation policies & plans about fisheries resources

At present conservation and wise use of wetlands are being ensured through following legal instruments:

- 1) Legislation: Indian Forest Act, 1927; Forest (Conservation) Act, 1980; Wildlife (Protection) Act, 1972; Air (Prevention and Control of Pollution) Act, 1974; Water (Prevention and Control of Pollution) Act, 1974; Water Cess Act, 1977; Environment (Protection) Act, 1986; Biological Diversity Act, 2002; Coastal Regulation Zone Notification, 1991; and their respective amendments.
- 2) Policies: National Environment Policy, 2006; National Conservation Strategy and Policy Statement on Environment and Development, 1992; National Forest Policy, 1988.
- 3) Plans: National Biodiversity Action Plan, 2008.

Government of India has been implementing the National Wetlands Conservation Programme (NWCP) in close collaboration with the State/UT Governments since the year 1985-86. Under this programme, 115 wetlands have been identified by the Ministry which requires urgent conservation and management interventions. Out of these, wetlands of North Eastern India are Deepar Beel, Urpada Beel and Sone Beel of Assam; Loktak lake of Manipur; Umiam lake of Meghalaya, Tamdi and Palak of Mizoram; and Rudrasagar and Gumti reservoir of Tripura. The aim of the programme is to prevent further degradation and ensure wise use of the wetland for the benefit of local communities and overall conservation of biodiversity.

Several states have reoriented fisheries management policies to increase involvement of fishing communities by designing appropriate property rights structures. In Chhattisgarh, freshwater aquaculture (common village ponds and irrigation tanks) is managed under co-operative governance structure through three tier panchayat organizational setup (Village panchayat, Janpad (group of villages) panchayat and District panchayat). Fishing right or lease duration for ponds/irrigation tanks is generally for five years and the lease amount varies according to types of water bodies (seasonal or perennial). The administrative and functional jurisdiction of the panchayat bodies is restricted according to water spread area of ponds/tanks. In West Bengal, a similar management structure is available, and additionally, an officer of Fishery Department of the rank of district officer in each district supervises the management of the cooperative societies as member of the panchayat bodies.

(4) Legal reviews in beel fisheries Management by ARIASP

Assam Rural Infrastructure and Agricultural Services Project (ARIASP), a World Bank aided project was implemented from 1995-96 to 2003-04 under which beel fishery development was one of the major components under Fishery Sector. Initially, after approval and sanction of beel specific project for development, NIQ (Notice Inviting Quotation) was floated and subsequently work for development of the beel was awarded to approved tendered individual(s). During later part of implementation of ARIASP, one major shift in the approach of the project came in the form of community participation in development of beel fisheries as these being the common property resources, can generate sustainable source of livelihood to the community. It was also felt that (i) there was need to understand the legal framework governing this sector, which is characterized by

multiplicity in the management and (ii) the framework itself needs a review keeping in mind the fishermen's interest.

Accordingly, a Study for "Legal Review and Literacy in Beel Fisheries" was undertaken by the ARIASP Society¹⁴ to identify the laws and policies regarding fishery sector and specially Beel Fisheries and to identify the areas of cumbersome or obsolete provision under different rules which are hindering the sector's satisfactory performance and more specifically equitable sharing of profit amongst Beel users of the common property resources. The main activities under the project were (i) development of legal module (ii) conducting field level meetings and workshops on the existing laws with the objective to suggest appropriate modifications in the laws and policies on the basis of feedback received.

The ARIASP Society accordingly engaged two legal consultants who put forward 41 recommendations. The Government subsequently notified (dated, 6th April, 2004) constitution of a committee of 6 members with the Project Director, ARIASP Society as the Chairman. The Committee accepted 31 recommendations. However, the main issues of (i) management of the beel fisheries by the neighboring beel users and (ii) equitable sharing of profit amongst the beel users and (iii) settlement of Beel fisheries to surrounding beel user communities were still not finalized. The report submitted by the subsequent Consultant was not accepted by the Government as it suggested major changes in the existing fishery rules. Subsequently, the Directorate of Fisheries prepared the draft amendments to the Assam Fishery Rules, 1953 with incorporation of major recommendations including the main issues of community empowerment of common property resources for sustainable management. The draft is under Government consideration at present.

2.3.3 Roles of concerned government departments and agencies

(1) Department of Fisheries

Management of riverine fisheries like beel fisheries is presently vested with Fishery Department as per recent Government notification No. AR.122/2018/27 Dated 1st November, 2018 which was earlier with the Department of Revenue and Disaster Management. The jurisdiction of Fishery Department is only the leasing out of the resource and management of the fish stock. The management of the rivers in relation to its erosion and flood control is in the hand of Water Resource Department while navigation in the rivers is under Inland Water Transport Department. The two major rivers, Brahmaputra and Barak are leased out either to fishermen co-operative societies or individuals' part by part for convenience of management, as per The Assam Fishery Rule, 1953. The *mahaldars* or lease holders, generally well versed about the fish stock in their respective areas but are reluctant to share the supposed information with others.

(2) Assam Fisheries Development Corporation Ltd. (AFDC)

AFDC Ltd., was registered in March 1977 with registration No. 1682, Dated 01/03/1977 under the India's Company Act 1872. The Corporation was incorporated by the Government of Assam with an authorized share capital of Rs. 50.00 lakhs.

The main objective of the Corporation is to develop the natural fisheries of the state and to improve the socio-economic condition of the actual fisherman of the Scheduled Caste Community of the State and Maimal Community of Barak Valley through various fish and fishery related allied income generating activity such as (i) cage farming of fish, (ii) seed raising in nursery & rearing ponds in beel periphery, (iii) fish marketing.

At present a total of 25 employees are in position against 108 sanctioned posts.

AFDC controls a total of 189 beels out of which 3 are either totally unproductive or lost control over it. Those beels are scattered in 19 districts of Assam and the district wise no. of AFDC beels along with its total area of 12,424 ha. These beels are leased out to fisher groups by AFDC as per provisions of Assam Fishery Rules, 1953.

¹⁴ This Society changed the name later as Assam Rural Infrastructure and Agricultural Service Society (ARIASS) and coordinate multisector externally aided projects in the state of Assam such as ARIASP, AACP and APART so far since 1995-96 till 2024.

AFDC leases beels based on the Assam Fishery Rules, 1953. Those beels are relatively large in area. The P&RD Deptt leases smaller beels as per Assam Panchayat Act, 2002 in which case the revenue generated is for management and developmental work of Panchayat level works in rural areas. DRDM (Department of Revenue and Disaster Management) is basically the owner of beels which does not lease out the beel fisheries. Practically, there is no overlapping of activities but for administrative convenience.

Revenue generation, expenditure incurred by AFDC during the period of 2017-2021 is indicated in below table.

Table 2 - 19 Revenue generation by AFDC Ltd.

Year	Income (Rs in lakhs)	Expenditure (Rs in lakhs)	Profit (Rs in lakhs)
2017-18	1,101.18	767.82	333.36
2018-19	1,178.01	665.18	512.83
2019-20	1,262.69	1,012.27	250.42
2020-21	1,356.53	1,747.73	(-)391.20

Source: AFDC (2022)

(3) Revenue and Disaster Management Department (DRDM)

DRDM is basically the owner of all natural water bodies like beel/ wetlands, rivers etc.- both registered and unregistered. As such, the DRDM is the leasing authority which is administered by district administration headed by the Deputy Commissioner. Recent Government notification No. AR.122/2018/27 empowered the Department of Fisheries for leasing out of these registered water bodies with due approval of Deputy Commissioner of the districts. The notification is in the process of being affected.

(4) Panchayat and Rural Development Department (P & RD Deptt.)

The Department of Panchayat and Rural Development is the leasing authority of registered water bodies under their jurisdiction on the basis of guidelines of Assam Panchayat Act, 1994, normally for a period of one (1) year. Important provisions under the Act are:

- 1) Act No. 90. Functions & Powers of Zilla Parishad- (11) Fisheries- (i) fish seed production and distribution; (ii) development of Fisheries in private and community tanks; (iii) development of island fisheries; (iv) fish curing and drying; (v) assistance to traditional fishing; (vi) organizing fish marketing co-operatives; (vii) welfare schemes for the uplift and development of fishermen.
- 2) Act No. 109. Settlement of Fisheries and distribution of proceed thereof-
 - (i) Save as otherwise provided in this Act or rules frame there under, all fisheries of an Anchalik Panchayat shall be settled by the Anchalik Panchayat in the manner prescribed for a period coinciding with or not exceeding one Panchayat financial year by inviting tender at the office of the Anchalik Panchayat by its President.
 - (ii) All sale proceeds of public fisheries shall be deposited in the Anchalik Panchayat fund and shall be distributed in the manner hereinafter provided. (a) 20 percent of the total sale proceeds of the Anchalik Panchayat fisheries shall be made over to the Zilla Parishad fund. (b) 40 percent of the total sale proceeds of the Anchalik Panchayat fisheries shall be retained with the Anchalik Panchayat Fund. (c) 40 percent of the total sale proceeds of Anchalik Panchayat fisheries shall be distributed equally among the Gaon Panchayats falling within the jurisdiction of the Anchalik Panchayat.

Box Various Panchayats

‘Gram Panchayat’- A Gram Panchayat is a management body of elected members by the villagers who manage the general issues in respect of rural development activities and small issues in respect of general administration.

‘Anchalik Panchayat’- An ‘Anchalik Panchayat’ is a conglomeration of Gram Panchayats with elected members drawn from 7-10 Gram Panchayats of the district. It has specific jurisdiction within a district.

‘Zila Parishad’- Zila Parishad is a conglomeration of Anchalik Panchayats with elected members drawn from 7-10 Anchalik Panchayats of the district. It has specific jurisdiction within a district.

These bodies are formed with the objective of de-centralization of power to rural people mainly for need based selection and implementation of development schemes in their respective jurisdictions.

- (iii) The Hats (rural small markets), Ferries (river crossing floating facility) and Fisheries falling under any Anchalik Panchayat within the jurisdiction of Zilla Parishad, the yearly sale value of which is more than rupees 1 lakh and less than 3 lakhs shall be settled by the Zilla Parishad concerned for a period coinciding with and not exceeding one Panchayat Financial year as under Sections 105, 106 and 109 in the manner prescribed. The powers of examination and final acceptance of such tenders shall be vested in the Standing Committee as under Section 81 (1) (a).

(5) Forest & Environment Department

The Forest and Environment Department leases the water body under its control for fishing only for a period of 1 month at the end of each financial year. These resources are meant for conservation only.

(6) Department of Water Resources

The 4 reservoirs in Assam shown in below table are managed by the Department of Water Resources in collaboration with National Hydro-electric Power Corporation. Occasional stocking of fish seed is done in the reservoirs by the Department of Fisheries and ICAR-CIFRI¹⁵.

Table 2 - 20 Reservoir fisheries in Assam

	District	Name of Reservoir	Area (Ha)	Production (MT) (2022-23)	Productivity (kg/ha/yr)	Remarks
1	West Karbi Anglong	Karbi Longpi Amtereng	10	0.47	47	
2	Dima Hasao	Khandang	1,336	-		Production not recorded
3		Umrangsu	1,600	-		Production not recorded
4	Chirang	Jaoti	150	4.05	27	
	Total		3,096	4.52		

Source: Annual Report 2021-22, Department of Fisheries, Govt. of Assam

¹⁵ Indian Council of Agricultural Research (ICAR), Central Inland Fisheries Research Institute (CIFRI). <http://www.cifri.res.in/>

CIFRI is a national research institution specifically for inland fisheries, basically not including aquaculture. Its headquarters is located at Barrakpor, West Bengal. It has 4 Regional Research Centers (RRC) and 2 centers nationwide and one of RRC is located in Guwahati.

Chapter 3 Present Condition and Problem Analysis of Inland Fisheries & Aquaculture Sector in Assam

3.1 The importance of the fisheries sector in Assam

The fishery sector has been emerging as one of the most potential sectors in the state with immense natural resources in the form of ponds, derelict water bodies and beels/ flood plain wetlands etc. covering 2.59 lakhs hectares. Besides this, the two major river systems i.e. the Brahmaputra; Barak and its tributaries which spread up to 11,304 KM as a riverine fishery. Thus, the entire water spread areas have immense opportunities to boost up the fish production and provide ample employment opportunities as well as livelihood to the society and nutrition to the individual's health.

Considering the socio-economic importance of the sector and untapped natural fishery resources of the State, both the Central and State Governments have given special thrust on this sector to make the state self-sufficient in fish production as well as to make the State, a hub of fish export to the neighbouring states and to the countries.

Accordingly, State Fisheries Department has been implementing a number of development schemes and programmes for sustainable development of the sector playing an important role in solving various issues of the fish farmer and fishery entrepreneur contributing technical backstopping as well as facilitating financial and material helps to them and thereby creating ample scope of employment opportunities. (Economic survey, Assam 2023-24)

The following are some of the characteristics and strengths of the fisheries industry in Assam that are worth mentioning.

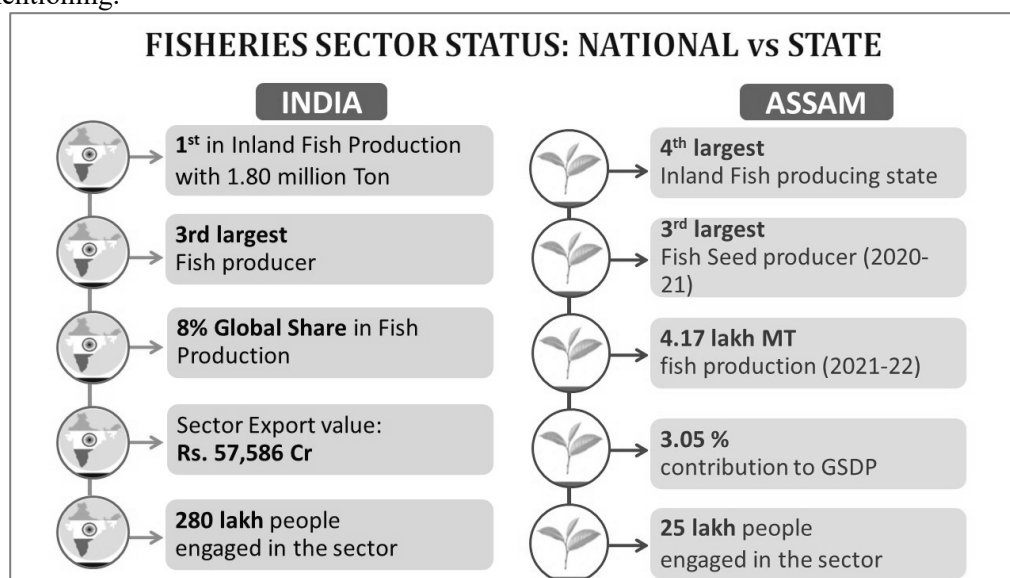


Figure 3- 1 Assam's fisheries sector status (National vs Assam State)

Source: DoF Presentation during the JICA survey

- Creating job and employment

The fisheries sector creates job for 2,524,106 people in Assam (PPR P.17, 2019-20).

- Contribution to the State's GSDP

The contribution of Fishery and Aquaculture sector to the State's GSDP at current price was Rs. 1,989,719 lakhs for the year 2022-23 (QE), accounted for 3.05% of GSDP, with a growth rate of 16.38% over the previous year. Again, the contribution of the sector to the State's GSDP at constant price (2011-12 prices) was Rs. 728,033 lakhs for the year 2022-23 (QE) with a growth rate of 2.60% over the previous year.

- Fish production at national level

Assam State is the 4th largest states in inland fish producing (4.17 Lakhs MT) state at National level (2021-22) following by Andhra Pradesh (42.19Lakhs MT), West Bengal (16.52Lakhs MT), Odisha (7.89Laks MT)¹⁶.

3.2 Administrative structure

(1) Department of Fishery

The State of Assam is richly endowed with abundant natural resources including aquatic resources. Considering the immense potential for development of fishery sector in these aquatic resources, the then State Government in power had thought it appropriate to at least have a cell in the Government to coordinate the various activities of fisheries in the State, more so in the matter of settlement of fisheries even if it was for the limited purpose of earning revenue for the Government. The department of fisheries came into existence in the year 1968.

The vision of the department is to maximize sustainable production, nutritional and food security, livelihood and employment generation, welfare of fishermen, development of skills and professional human resource & economic prosperity and thereby making the State self-sufficient in fish production.

To meet the nutritional demand of fish in the State, make fish available to common people at affordable price and to provide fish for nutritional supplement at over 15 kg per capita per annum and produce surplus fish and cater to the need of other states including Northeast states and neighboring countries are short term, mid-term and long-term goals of the department.

Department of Fisheries (DoF), Government of Assam, which is executing agency of the Project, is constitutes of two organizations namely Directorate of Fisheries and Assam Fisheries Development Corporation Limited(AFDC). Figure 3-3, and 3-5 shows their organizational set up.

Major functions of the Department for overall development of the fishery sector includes;

- increase in fish and quality fish seed production in the state with optimum utilization of resources,
- implementation of fishery related schemes of the Government of Assam and Government of India,
- identification and promotion of research and studies on fisheries and fisheries related areas so that benefit can be disseminated to the grass root level users,
- collection, compilation, and analysis to make available adequate/relevant statistical and other information for proper planning to promote fish farming and related industries/activities,
- preparation/support in reports and proposals related to Fisheries and fishery related industries, and
- providing extension services to Fish farmers/fishermen and fishery entrepreneurs.

In present scenario, Fish production in the state has reached a level of 4.43 lakhs MT during the year 2022-23 against the estimated nutritional demand of 4.49 lakhs MT considering per capita consumption of 13.06 Kg/yr. The Department has taken some fish production enhancing strategy such as horizontal expansion of fish culture area through creation of New Pond construction, New Rearing Tank construction, Reclamation and Renovation of existing areas for pisciculture and converting low lying area to Community Tank.

Further, emphasis has been given on adoption of advanced technologies such as Recirculatory Aquaculture System (RAS), Biofloc, and Recreational Fishery etc. along-with diversification of culture technique. River ranching programme and fingerling stocking at wetland are also introduced as special activity under Pradhan Mantri Matsya Sampada Yojana (PMMSY) for augmenting and enhancing the natural productivity of river and beel through release of quality fish seed. Simultaneously, the pen and cage culture activities are implemented under Chief Ministers' Samagra Grammya Unnayan Yojana (CMSGUY) scheme in some beel and wet land. The revenue fisheries, i.e. rivers and beels are at present are under the control of Assam Fisheries Development Corporation Ltd; Fisheries Administrative Departments, Government of Assam; Deputy Commissioners and Sub-Divisional Officers (Civil) and Panchayats through leasing out to individual /Co-operative societies.

¹⁶ Source: Handbook on Fisheries Statistics 2022, Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India, November, 2022.

Moreover, few farms and low-lying areas are managing by Fish Marketing & Processing Federation Ltd. (FISHFED) by itself or through leasing.

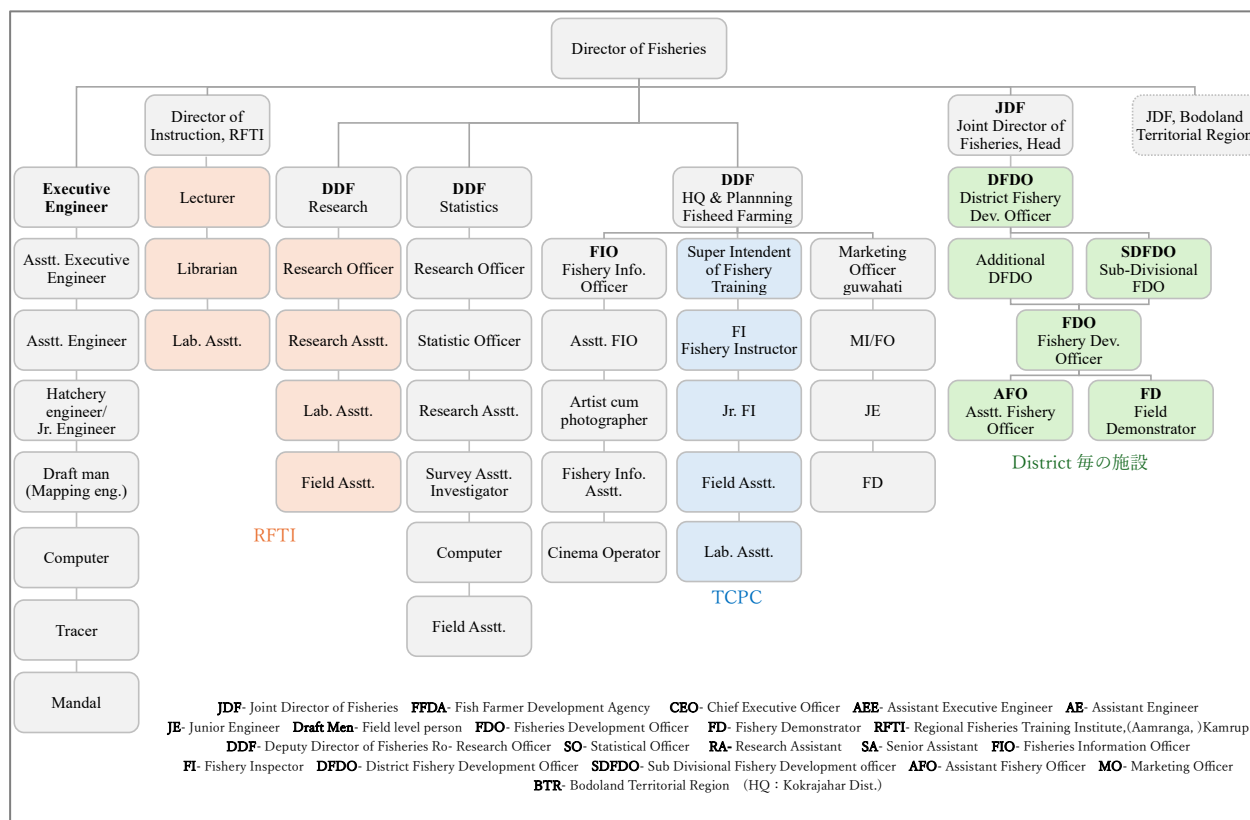


Figure 3- 2 Organizational Chart Directorate of Fisheries

Source: DPR, DoF

Category	Total No. of sanctioned post	Main in position	Number of vacancies
Class-I	270	198	72
Class-II	31	4	27
Class-III	713	546	167
Class-IV	312	217	95
Total	1326	965	361

Note: “Category” is classified corresponding to the positions in Figure 3-2 as follows

Class-I: FDO and above positions.

Class-II: SDFDO

Class-III: Block demonstration officer, Clerk, Driver, etc.

Class-IV: Helper, janitor, etc.

Figure 3- 3 Staffing at DoF (as of 2022)

Source: Directorate of Fisheries

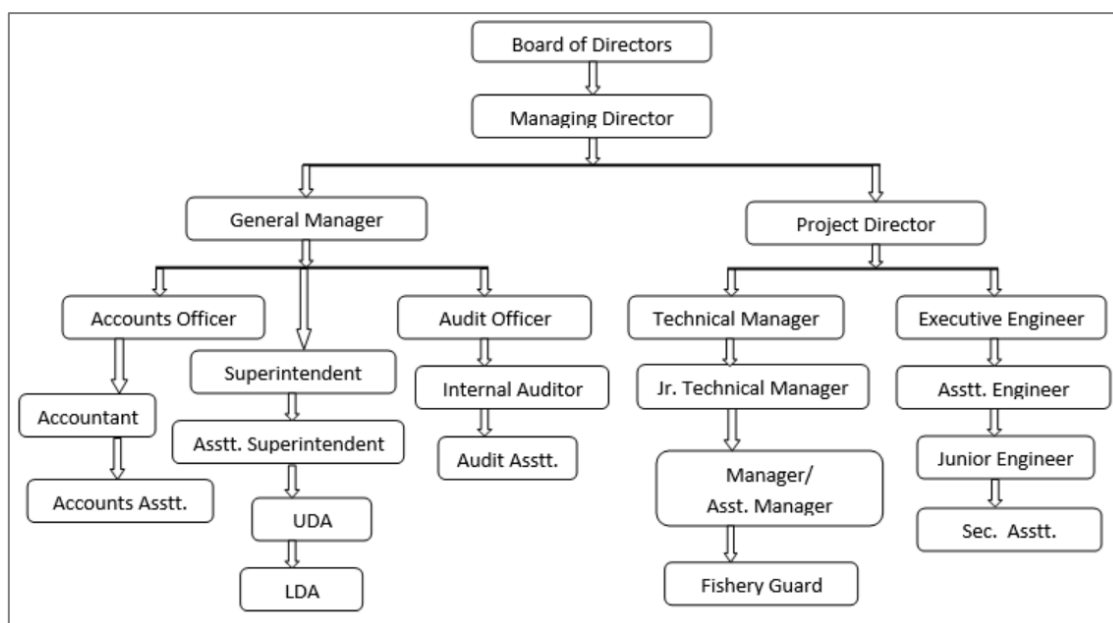


Figure 3- 4 Organizational structure of National Fisheries Development Cooperation Limited.

Source: National Fisheries Development Cooperation Limited. (Organisational Chart | Assam Fisheries Development Corporation Ltd | Government of Assam, India)

3.3 Fisheries Development Policy

(1) Development plan at national level

In India, the fisheries sector (fisheries and aquaculture) has an important position in food, nutrition, employment and income. The sector accounts for 1.24% of the gross domestic product (GDP) and 7.28% of the agricultural sector GDP, providing the population with the livelihoods and animal proteins of about 16 million fishers and aquaculture farmers. The sector showed growth at an annual rate of 10.88% in production from 2014-15 to 2018-19. However, considering the current state of undeveloped waters as fishing or aquaculture ground, there is still a lot of capacity to develop furthermore (Assam Fisheries Development and Livelihood Projects Final Report). Responding to this situation, the Government of India has launched Blue Revolution Initiative from 2014 to enhance sustainable and environmentally friendly development. The target and purposes of the initiative are as follows.

Table 3 - 1 Summary of Blue Revolution Initiative

Target	Considering sustainability, biosecurity, and environmental issues, it will dramatically improve the income situation of fisheries and aquaculture producers and create an environment for the maximum and integrated development of domestic fisheries possibilities.
Purpose	Increase production by 3 times by 2020 in both inland and marine fisheries. - Transformation of the fisheries sector into a professional, modern, and world-class industry with a particular focus on new technologies and processes - Increase productivity, improve post-harvest infrastructure, including e-commerce and other technologies, improve marketing, and double income on fishery and aquaculture with emphasis on world-class innovation - Achieve comprehensive participation of fishery and aquaculture producers in income-raising activities - Increase export income by three times by 2020, in emphasizing the flow of profits to fisheries and aquaculture producers, including the institutional arrangement of fishers' associations (FA), enterprises, and other organizations - Enhancing national food and nutrition security

The Government of India has launched a variety of development schemes and development plans to realize the Blue Revolution. The most significant scheme is the “Pradhan Mantri Matsya Sampda Yojana (PMMSY¹⁷)”, which is a huge development scheme approved with an estimated investment of Rs. 200.5 billion (about 360 billion Yen) for 5 years from FY2020-21 to FY2024-25.

¹⁷ Refer to 3.9 and table 3-58 in this report

(2) Development plan at state level

Assam 2030

The ‘Assam 2030’ policy document, formally known as ‘Assam 2030: Our Dream, Our Commitment’, focuses on aligning the state’s development goals with the United Nations Sustainable Development Goals (SDGs). While the document encompasses a wide range of goals across various sectors. The main focus of Assam 2030 is on sustainable development, which aims to balance environmental, social and economic dimensions to ensure progress in critical areas such as poverty alleviation, health, education, gender equality, clean energy, economic growth and innovation.

The document underlines Assam’s vision to transform itself into a sustainably developed state by 2030, using the latest technologies and management techniques to fully utilise its natural and human resources. It emphasises inclusiveness and sustainable growth and aims to develop the state comprehensively through goals such as decent work and economic growth, industry, innovation and infrastructure, reduced inequalities, sustainable cities and communities, and partnerships to achieve these goals. In the Assam Budget 2021, the SDGs are given top priority and 16 of the 17 goals (apart from Goal 14 ‘Life below water’) have been allocated a budget allocation per goal. A budget of Rs 6,145 crore has been allocated for Goal 9 ‘Industry, Innovation and Infrastructure’ and Goal 1 ‘Life without Poverty’. The Assam State Government prepared the “Assam 2030 Our Dream, Our Commitment” in 2016. It has formulated sustainable development goals and strategies respectively in this document.

Table 3 - 2 Fisheries sector targets in the Assam State Government

Goal	Target	Strategy (fisheries sector)
No.1 No Poverty	Alleviation of poverty ratio From 27.3% in 2015 to 0% in 2030	- Action for enhancing productivity and creating infrastructure for processing & supply chains - Development for creating jobs and employment, facilitate activities for value addition and sustainable production - Setting up effective administrative structures for ensuring equality of opportunity & access for gainful employment
No. 2 Zero Hunger	- End hunger by 2030 and malnutrition by 2025 - Double the productivity and incomes of small-scale food producers	
No. 3 Good Health	By 2030, reduction of: - maternal mortality ratio to less than 70 per 100,000 live births - neo-natal mortality to at least as low as 12 per 1,000 live births - under 5 years mortality to at least as low as 25 per 1,000 live births	Improving agricultural practices by encouraging organic cultivation
No. 5 Gender Equality	- Full participation and equal opportunities in political, economic and public life - End discrimination against women and girls - Elimination of all forms of violence and harmful practices against women and girls	- Undertake all possible measures to ensure gender equality in all spheres of life- education, employment, health, ownership over properties and natural resources etc. - Involving women in all policy and decision making levels in social, economic and political arena
No.8 Decent Work and Economic Growth	7% growth in GDP per annum	- Diversification, technological up-gradation and innovation with focus on high value added - Promotion of policies that support entrepreneurship, growth of small and medium size enterprises, innovation, sustainable tourism
No.12 Responsible Production and Consumption	By 2030, Efficient use of natural resources, reduction of food waste along production, supply chains and post-harvest losses at least by 50%	- Efficient use of natural resources, waste reduction, recycling and reuse through environmentally sound industrial processes - Put in place policy frameworks/statutory provisions for integrating compliance of sustainability principles by companies/ industrial houses

Source: Assam 2030 Our Dream, Our Commitment

Assam Fisheries and Aquaculture Policy (in progress)

Department of Fisheries, Assam is yet to notify the State Fisheries and Aquaculture Policy. However, the Department has engaged one National Consultancy Firm to draft the 'Assam Aquaculture and Fisheries Policy'. The Firm has submitted the draft report and the same is under scrutiny of the Department. Presently, Department has been functioning with the 'Vision' and 'Mission' as formulated and stated below (as reported in the Annual Report, 2021-22: Department of Fisheries).

Vision of the Department of Fisheries, Government Assam is 'Maximize sustainable production from fisheries sector for nutritional security and economic prosperity'.

Mission states 'facilitating long-term overall development through increased production and productivity of fish and other aquaculture commodities, integrated approach for infrastructure development, extension services and market linkages; creating opportunities for employment generation, adoption and promotion of innovative and frontline technologies; conservation and judicious exploration of fish and fishery resources, preservation of genetic resource base and development activities with eco-friendly approaches.

In this Policy main functions of the Department are stipulated as follows:

- a) Increase fish and quality fish seed production in the state with optimum utilization of resources,
- b) Implement fishery related schemes of the Government of Assam and Government of India,
- c) Identify and promote research and studies on fishery and fishery related areas so that benefit can be disseminated to the grass root level users,
- d) Collect, compile and analyse and make available adequate/ relevant statistical and other information for proper planning to promote fish farming and related industries/ activities,
- e) Prepare/ support in preparation/ vet project reports and proposals related to fisheries and fisheries related industries,
- f) Provide extension services to fish farmers/ fishermen and fishery entrepreneurs.

3.4 Inland fishery and aquaculture

3.4.1 Brief history of recent development

Adoption of improved aquaculture practices in culture fisheries and sustainable management practices in capture fisheries are the solutions to ensure higher productivity, reduce waste and pollution, and increase income of farmers and fishers. The state of Assam is advancing fast from previous farming systems to modern practices in recent times. This has resulted in considerable increase in market landings of locally produced fish and thereby gradually reducing inflow of fish from other states. The changes in the management practices noticeable in Assam fisheries sector are described below:

(1) Practices adopted prior to the year 2004 in Assam

Government sponsored fishery development programmes taken up till 2003-04 supported only the individual fish farmers for production enhancement in pond fisheries. These beneficiary farmers were also provided with 1-3 days training on farming technologies. In case of beel fisheries, development works such as strengthening of embankment and canals connecting to the river were taken up by engaging contractors to develop beels which were leased out by AFDC Ltd. Management of resources adopted from the year 2004-05.

Assam has witnessed a major shift in aquaculture practices and management of common property resources. AACP (World Bank supported multi-sector Project) has shown the door to the famers/ fishers of the benefits of community-based management practices.

Community Group formation: In case of individual ponds, CIG (Common Interest Groups) with 14-20 farmers each having pond water area of 0.10-0.40ha were formed while in case of village community tanks of water area ranging from 0.40-1.00 ha, 20-40 members of grouped together to form CTG (Community Tank Group). Beneficiaries were selected through PRA (Participatory Rural Appraisal) conducted jointly by selected NGOs and local fishery technical staff at block level. In case of beel fisheries with water area of 7.0-60 ha, BDCs (Beel Development Committee) were formed with one member from each of the families living in the beel peripheral villages. President, Secretary and Treasurer of all such groups were provided with 3 days training on production technologies, record keeping, marketing of produce, procurement of inputs, benefit sharing procedures, conduct of

meetings etc. The Fishery sector has formed 1,879 CIGs with 27,181 farmers (3,064 ha), 629 CTGs with 19,182 farmers (761 ha) and 103 BDCs with 22,184 fishers (1,760 ha) under AACP. In case of individual pond, productivity increased from 1,200 to 3,102 kg/ha/yr, in community tank, it was from 875 to 2,666 kg/ha/yr and in case of beel fisheries, increase was from 480 to over 893 kg/ha/yr.

Technology application: Farmers were trained on semi-intensive composite culture practices developed by ICAR, benefits of stocking carried over seeds and the need for application of fish feed and manures for production enhancement. They were also trained on single-stocking single-harvesting, single-stocking multiple harvesting and multiple-stocking multiple harvesting practices in case of pond and tank fisheries. In case of beel fisheries, practices adopted were mostly cleaning of undesirable water weeds, stocking of fish seed (single stocking) of IMC (Indian Major Carp) species, creation of nursery ponds covering 2% of beel water area in the beel periphery for seed raising and subsequent stocking into the beel. Training to the President, Secretary and Treasurer of each BDC including exposure visits to West Bengal beel fisheries were imparted.

(2) Intensive aquaculture practices adopted from the year 2020-21

The state has introduced Recirculatory Aquaculture System (RAS) and Bioflocks with financial support to potential fish farmers under Pradhan Mantri Matshya Sampada Yojana (PMMSY). Farmers are provided short duration training including exposure visits to outside state. 9 RAS farmers and 173 Biofloc farmers have set up so far. Production is under stabilization stage now. However, during 2022-23, production from these systems were as minimum as 323.03 tons only.

Some pond fishery farmers in some locations in the main production clusters have been achieving pond productivity in the range of 7-8 ton to about 14 ton/ ha/yr. They use to stock fish seed of 100-400 mm size, follow stocking of different doze and different species combination, apply mustard oil cake and formulated pelleted floating feed @3-4% of body weight of fish stock.

(3) Value chain support activities taken up by the state so far:

The state has supported the community groups/ farmers/fishers by (i) setting up fish seed hatcheries under Rastriya Krishi Vikas Yojana (RKVY) and PMMSY, (ii) construction of wholesale and retail fish markets under National Fisheries Development Board (NFDB)/ PMMSY, (iii) setting up fish feed mills under RKVY and PMMSY, construction of fish landing centres under AACP, (v) setting up ice plants under PMMSY, (vi) setting up cold storage under PMMSY, (vii) development of roads from community groups' production cluster to nearest fish markets under AACP, etc., to reduce marketing costs, increase income of producers, produce higher quality fish seed and other products, etc., to ensure access to new markets and increased income to producers and relevant stakeholders and overall fish production in the state.

3.4.2 Fisheries and Aquaculture Production

(1) Overview

Total fish production in the state during the year 2022-23 was 443,250 tonnes, out of which capture fisheries contributed 143,870 tonnes while culture fisheries contributed 299,380 tonnes. Species/ group wise break up of production both in capture and culture fisheries and its percentage contribution are indicated in the table 3-3.

Table 3 - 3 Outline of fishery and aquaculture production in the Assam State

Fish species	Capture fishery	Aquaculture	Total	Ratio by source (%)		
				Capture Fisheries	Aquaculture	Total
IMCs (Rohu, Catla, Mrigal)	16,587	1,99,172	2,15,759	11.5%	66.5%	48.7%
Minor carps	18,760	40,928	59,688	13.0%	13.7%	13.5%
Exotic carp (Common, Grass, Silver)	4,397	30,369	34,766	3.1%	10.1%	7.8%
Snake heads	27,556	4,082	31,638	19.2%	1.4%	7.1%
Catfishes	25,134	5,375	30,509	17.5%	1.8%	6.9%
Other freshwater spp.	51,372	19,454	70,826	35.7%	6.5%	16.0%
Hilsa spp.	64	0	64	0.0%	0.0%	0.0%
Total	143,870	299,380	443,250	100.0%	100.0%	100.0%
	32.5%	67.5%	100.0%			

Source: DoF

- 1) Assam produced 443,250 tons of fish in 2022-23. Breakdown shows that 32.5% came from capture fishery and 67.5% from aquaculture. The latter plays a central role in production.
- 2) In the capture fishery, various carp species, snakehead, catfish and many other small fish species are caught. The proportion of “other freshwater fish” is the largest at 35.7%.
- 3) In aquaculture, the ratio of 3 Indian major carp species is the highest, accounting for 66.5%. When minor carp and exotic carp are combined, carps account for 90.3% of the total in aquaculture.

(2) Major fish production areas

According to the latest fisheries statistics, district wise fisheries and aquaculture production is reviewed as shown in Table 3-4. Based on this table, current level of fish production in the major production districts were examined for beel fisheries and aquaculture in Figures 3-6 respectively.

Table 3 - 4 Fish production of Assam State by district by production category (2022-23)

	District	Beel Fisheries	Ponds and Tanks	Derelict Water Bodies/ Swamps	Reservoir Fisheries	Forest Fisheries	River Fisheries	Advance technology (Bio Flock, RAS)	Paddy cum fish culture	Others (captured from Paddy field/canals/ Jan/ Kur etc.)	Total Production
1	Bajali		2,710	69			32	1	5	89	2,905
2	Baksa	381	9,265	17			10	0	4	2	9,678
3	Barpeta	1,927	12,410	1,263			98		635	1,613	17,946
4	Biswanath	615	2,463	110		27	59		812	1,516	5,603
5	Bongaigaon	1,847	7,476	475			156	18	36	79	10,085
6	Cachar	4,887	25,141	4,601		830	116	6	0	2,042	37,622
7	Charaideo	88	1,459	65		29	55	1	0	7,051	8,748
8	Chirang	44	1,087	51	4	13	50		0	25	1,273
9	Darrang	1,622	13,410	18			124	8	0	60	15,242
10	Dhemaji	280	2,784	655			212	21	6	4,577	8,535
11	Dhubri	1,710	6,890	1,045			50	0	96	2,379	12,169
12	Dibrugarh	3,430	8,776	381		170	182	6	457	1,670	15,073
13	Dima-Hasao	0	485	9	0	0	41		10	2	545
14	Goalpara	717	6,193	210			194	0	171	1,983	9,469
15	Golaghat	1,225	3,822	68		670	315		0	0	6,100
16	Hailakandi	1,418	17,812	412			48		5	0	19,694
17	Hojai	556	10,243	868		375	79		5	2,315	14,441
18	Jorhat	661	5,254	2,989			102		0	746	9,752
19	Kamrup (M)	3,527	2,086	104			28	98	64	247	6,155
20	Kamrup (R)	3,120	12,641	672		188	185	57	392	948	18,203
21	Karbi-Anglong	15	5,799	5		13	14		1	0	5,847
22	Karimganj	2,502	11,655	2,402			55	2	0	912	17,529
23	Kokrajhar	980	6,761	36		81	36		0	29	7,924
24	Lakhimpur	262	16,652	216		3	81	2	95	0	17,311
25	Majuli	621	2,243	872			73		0	178	3,987
26	Morigaon	6,126	12,174	287		196	52	24	2	2,682	21,544
27	Nagaon	3,676	26,475	12,688		905	125	0	7,089	1,379	52,338
28	Nalbari	404	10,198	802			25	1	242	470	12,141
29	Sivasagar	1,152	4,144	2,731			119		0	17,505	25,651
30	Sonitpur	1,770	6,391	515			310		1,828	6,886	17,702
31	South Salmara	775	5,094	269			17		905	235	7,294
32	Tinsukia	1,325	13,405	966		32	122	3	18	338	16,208
33	Udalguri	0	7,033	178			45	75	78	244	7,653
34	West. K.A	23	838	8	0	1	12		0	0	883
	TOTAL	47,688	281,271	36,053	5	3,534	3,220	323	12,956	58,201	443,250
		10.8%	63.5%	8.1%	0.0%	0.8%	0.7%	0.1%	2.9%	13.1%	100.0%

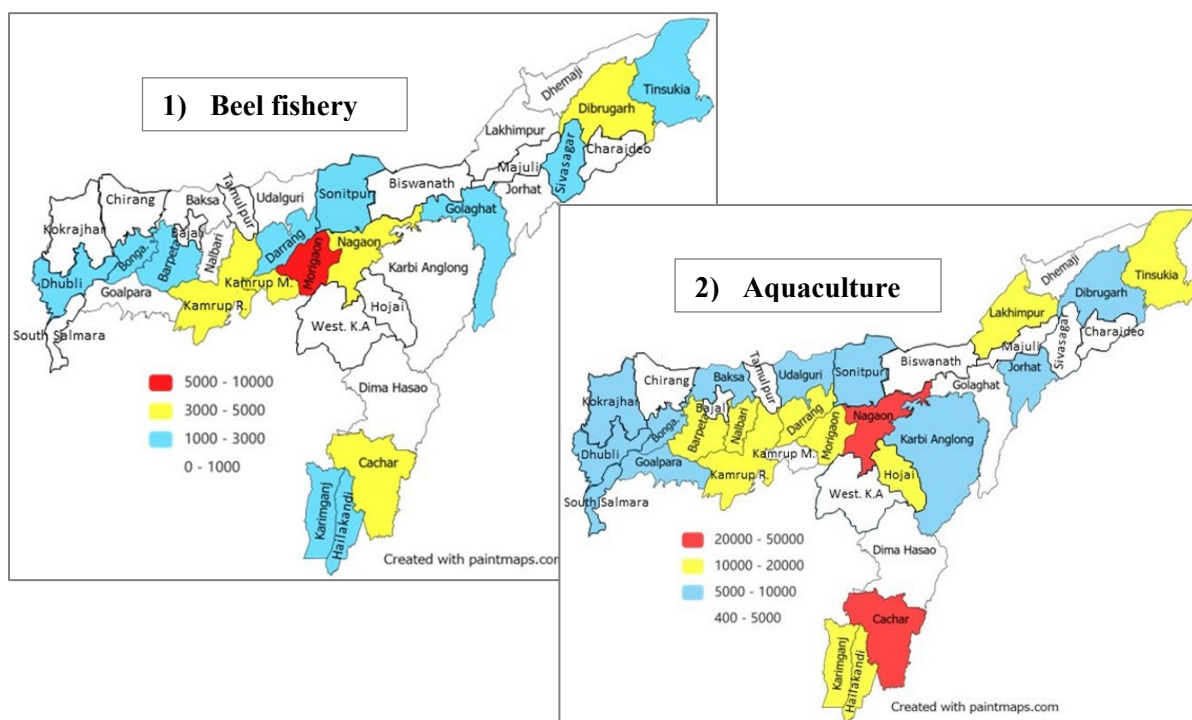


Figure 3- 5 Fish production in major production districts

Source: prepared based on the data of Table 3-4

As for beel fisheries, Morigaon achieved the largest production as 6,126 tons followed by the neighbouring districts such as Nagaon (3,676 tons), Kamrup metro (3,527 tons) and Kamrup (3,120 tons). This area is lowland along the Brahmaputra River and forms a center of beel fishery. The other centres of beel fishery are found in the north-east of the state around Dibrugarh district (3,430 tons) and in the south of the state around Cachar (4,887 tons). The former is along the upper Brahmaputra river, while the latter is lowland along the Barak river.

As for aquaculture, largest production center of the state is found in Nagaon producing 26,475 tons and the associated western districts such as Morigaon, Darrang, Kamrup, Nalbari and Barpeta with production of more than 10,000 tons each in 2022-23. Production of Hojai district located in the southern vicinity of Nagaon district also reached at 10,000 tons. The 2nd center of aquaculture production can be pointed out in the south of the state. Cachar district produced 25,141 tons and neighboring Hailakandi and Karimganj district showed production as high as more than 10,000 tons each. In the north-east region of the state, significant aquaculture production is achieved in the districts of Lakhimpur (16,652 tons) and Tinsukia (13,405 tons).

Based on the above examinations, current fish production centers or clusters of districts in Assam state can be consolidated as shown in Table 3-5.

Table 3 - 5 Fisheries and aquaculture clusters in Assam

Cluster	Geographical location	Main Districts
1. Central-Western Assam	● Brahmaputra river basin (midstream in the state)	Nagaon, Hajai, Morigaon, Darrang, Kamrup metro, Kamrup, Nalbari and Barpeta
2. Northeastern Assam	● Brahmaputra river basin (upstream in the state)	Lakhimpur, Dibrugarh, Tinsukia,
3. Southern Assam	● Barak river basin	Cachar, Hailakandi, Karimganj

3.4.3 Examination on the per capita fish consumption/production

(1) Per capita fish consumption of India and Assam State

Trend of per capita fish consumption of India is shown in Figure 3-7, which is based on the FAO statistics. It has been increased from approximately 2 kg in 1961 to 8 kg in 2020, in short four folds in last 60 years.

When comparing this among neighboring countries it is far less than Myanmar (45.9kg) and Bangladesh (26.3kg), and nearly equal to the inland country, Bhutan (7.3kg) (Table 3-6).

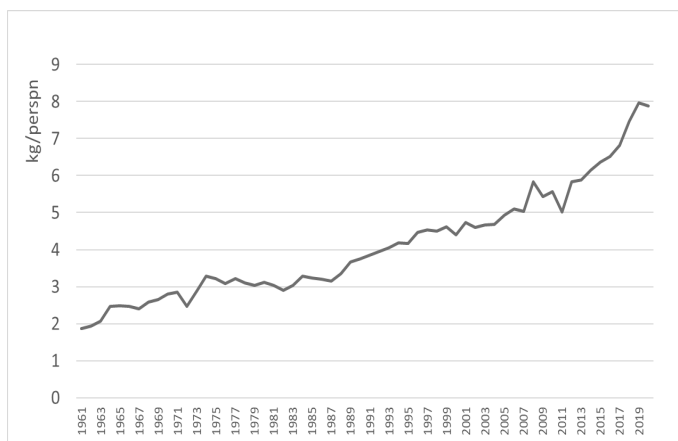


Figure 3- 6 Per capita fish consumption in India
Source: FAO statistics (2020)

Table 3 - 6 Per capita fish consumption of India, neighboring countries and Japan

Countries	kg/person
India	7.9
Myanmar	45.9
Bangladesh	26.3
Bhutan	7.3
Japan	46.7

Source: FAO statistics (2020)

According to the Fisheries Statistics of India in 2022, per capita fish consumption is calculated as 6.31 kg (Table 3-7). Per capita fish consumption of Assam State is 11.89kg and ranked 10th among of the 36 States.

Table 3 - 7 Per capita fish consumption in India

Rank	States	kg/person	Rank	States	kg/person
1	Lakshadweep	125.00	20	Nagaland	6.06
2	Goa	78.00	21	Jammu & Kashmir	6.00
3	A and N Islands	77.84	22	Madhya Pradesh	4.87
4	Tripura	25.53	23	Maharashtra	4.72
5	Chhattisgarh	19.70	24	Arunachal Pradesh	3.65
6	Puducherry	18.88	25	Mizoram	3.38
7	Manipur	18.25	26	Himachal Pradesh	2.22
8	Kerala	17.93	27	Daman and Diu, D & Nagar Haveli	1.20
9	Odisha	16.34	28	Sikkim	1.16
10	Assam	11.89	29	Uttarakhand	0.81
11	Uttar Pradesh	11.09	30	Punjab	0.40
12	Jharkhand	10.61	31	Haryana	0.30
13	Karnataka	10.55	32	Delhi	0.25
14	Bihar	9.60	33	Ladakh	0.05
15	Tamil Nadu	9.30	34	Rajasthan	0.01
16	Meghalaya	9.00	35	West Bengal	NR
17	Andhra Pradesh	8.91	36	Chandigarh	NR
18	Telangana	8.70			
19	Gujarat	7.44		ALL INDIA	6.31
Source: Handbook on Fisheries Statistics, India (2022)					

In the North-Eastern Region, Tripura State shows the highest fish consumption at 25.5kg per person and followed by Manipur State 18.3 kg and Assam State as 11.9kg. It is plausible that people in Tripura State are more familiar to fish consumption as their protein source because of its geographic nature connecting to Bangladesh.

(2) Comparative analysis of per capita fish production

In order to grasp the characteristics of current fish production against population, comparative analysis between Assam State and neighboring 4 inland Divisions of Bangladesh is carried out as shown in Table 3-8. The land area of Assam State is bigger than the total of those 4 Divisions of Bangladesh, but the population density is lower. Due to these characteristics coupled with relatively low aquaculture production of Assam at present, per capita fish production of Assam appears as low as 12.0 kg comparing to the 4 Divisions of Bangladesh, which is totally 26.4 kg/person in average or 2.2 times of Assam State.

Considering large quantity of inflow of salani fish¹⁸ in Assam, per capita fish consumption must be higher than the above examined per capita fish production. Although we need more examinations about those gaps, it is sure that Assam state has large demands and potential for increasing fish production to cope with domestic fish demand.

Table 3 - 8 Comparison of per capita fish production

	Area (km2)	Population	Population density (person/km2)	Fisheries Production (ton)		Total (ton)	Per capita fish production (kg/person)
				Capture Fishery	Aquaculture		
Assam State	78,438	31,169,272	397	152,779	220,375	373,154	12.0
Neiboring Divisions of Bangladesh							
Rangpur	16,185	17,610,956	1,088	75,965	201,905	277,870	15.8
Rajshahi	18,174	18,484,858	1,017	141,208	368,923	510,131	27.6
Mymensingh	10,485	12,225,498	1,166	97,146	401,834	498,980	40.8
Sylhet	12,298	11,034,863	897	209,802	72,084	281,886	25.5
Total	57,143	59,356,175	1,039	524,121	1,044,746	1,568,867	26.4

Sources: 1) Fishery statistical hand book Assam 2019-20. 2) Yearbook of Fisheries Staistics of Bangladesh 2020-21. DoF, MoFL, Bangladesh.

Remarks: Populations were cited from Wikipedia. For Assam State and Rajshahi Division, based on the census of 2011, other Divisions, census of 2022.



Figure 3- 7 Location of the Divisions of Bangladesh used in the examination

¹⁸ Salani fish are imported fish from the other states and countries than Assam State

3.4.4 Recent aquaculture activities

(1) Target species

The fish species cultured in Assam are listed in Table 3-9. It is observed that there are some variations in the selection of fish species for aquaculture by farmers in different localities. This variation is driven by market demand of fish species in the respective regions.

3 IMCs and common carp are overwhelmingly accepted and largely cultured in all production clusters. Other 3 Chinese carps such as Silver Carp, Grass Carp, and Big Head are well accepted in Central-Western Assam and North-Eastern Assam, but only partially cultured in the Southern Assam. Species diversification is found to be more in case of Central-Western Assam.

Table 3 - 9 Target species for aquaculture in Assam

Local/colloquial name		English name	Scientific name
IMC			
	Rui	Rohu	<i>Labeo rohita</i>
	Catla/Bhakua	Catla	<i>Catla catla</i>
	Mrigal	Mrigal	<i>Cirrhinus mrigala</i>
Chinese carps			
	Grass carp	Grass carp	<i>Ctenopharyngodon Idella</i>
	Silver carp	Silver carp	<i>Hypophthalmichthys molitrix</i>
	Bighead carp	Bighead carp	<i>Hypophthalmichthys nobilis</i>
	Common carp	Common carp	<i>Cyprinus carpio</i>
Exogenous species			
	Rupchanda	Pacu/Pirapitinga	<i>Piaractus brachypomus</i>
	Pangus	Striped catfish	<i>Pangasianodon hypophthalmus</i>
	Tilapia	Nile tilapia	<i>Oreochromis niloticus</i>
Other indigenous species			
	Bhangan	Labeo	<i>Labeo bata</i>
	Calbasu	Labeo	<i>Labeo calbasu</i>
	Chital	Knife fish	<i>Notopterus chitala</i>
	Mola	Carplet	<i>Amblypharyngodon mola</i>
	Puthi	Barb/minnow	<i>Puntius spp.</i>
	Magur	Magur (cat fish)	<i>Clarias batrachus</i>
	Singi	Stinging catfish	<i>Heteropneustes fossilis</i>
	Koi / Kawai	Climbing perch	<i>Anabas testudineus</i>

Source: JICA survey team

(2) Seed production

1) Domestic seed production in Assam

The most important program that the Department of Fisheries implemented since the '60s was 'Fish seed farming' (production) in the Departmental Seed Farms and its distribution to private fish farmers. The primary source of fish seed for fish farmers throughout the state till 1985 was 141 Departmental Fish Seed farms scattered in all the districts. With gradual take up of the seed production technology through induced breeding and setting up of hatcheries by private farmers, the importance of Departmental Farms gradually declined.

Box Dawn era of seed production in Assam:

Till the year 1981, seeds produced through 'hapa' breeding in Nilambazar Centre, Karimganj district, were distributed by seed retailers by train all over the state of Assam. They used big aluminium pots (locally called 'hundi') for transportation. The seed retailers got down from train at certain railway stations to change water of the hundies. First 2 hatcheries were constructed in 1983-84 by 2 seed producers in Nilbagan village of Nagaon district. One of the pioneers is no more now.

2) Assam Fish Seed Act, 2005 and Assam Fish Seed Rules, 2010

There exists no rule or act notified in Assam to govern grow-out fish culture practices except controlling seed production systems. To deal with negative impact of destructive activities in the production process of fish seed, Government of Assam notified Assam Fish Seed Act, 2005 and Assam Fish Seed Rules, 2010.

The fish seed act and rules introduced in Assam was the first of this kind in the country. Under these Act and Rules, the fish seed hatcheries are to conform certain criteria such as size of brood fish for breeding, replacement of 30% brood stock annually etc. to ensure production of quality fish seed and accordingly, licenses are issued to the hatcheries by the DFDOs and without license, the hatcheries are barred from production and selling of fish seed. Accordingly, licenses are issued to the hatcheries. In addition to that, for marketing of fish seed by conforming certain conditions, licenses are also issued to the traders by the DFDO.

Table 3-10 indicates district wise variation of seed production compared to number of hatcheries operating in the respective district.

Table 3 - 10 District wise hatcheries (no) and Fish seed production in 2021-22

Sl.	District	Hatchery (no)	Seed (Fry/fingerling) Production (million)	Production % against state's total	Production/ hatchery (million)
1	Nagaon & Hojai (113+15)	128	89,233	49.0	697
2	Barpeta	75	51,145	28.1	682
3	Karimganj	27	25,106	13.8	930
4	Baksa	13	6,740	3.7	518
5	Lakhimpur	17	2,609	1.4	153
6	Dhubri	6	1,784	1.0	297
7	Nalbari	12	1,082	0.6	90
8	Darrang	15	777	0.4	52
9	Goalpara	10	550	0.3	55
10	Kamrup I	35	546	0.3	16
11	Cachar	17	492	0.3	29
12	Kokrajhar	0	450	0.3	0
13	Udalguri	6	250	0.1	42
14	Dibrugarh	9	215	0.1	24
15	Kamrup (M)	5	194	0.1	39
16	Bongaigaon	10	160	0.1	16
17	Tinsukia	5	141	0.1	28
18	Golaghat	6	129	0.1	22
19	Jorhat	3	117	0.1	39
20	Sonitpur & Biswanath (4+7)	4	101	0.1	25
21	Sivasagar	7	90	0.1	13
22	Chirang	1	75	0.0	75
23	Majuli	2	65	0.0	32
24	Dhemaji	6	38	0.0	6
25	Hailakandi	3	32	0.0	11
26	Karbi-Anglong	1	27	0.0	27
27	W.KarbiAnglong	1	26	0.0	26
28	Morigaon	39	15	0.0	0
29	Dima-Hasao	0	0	0.0	0
30	Charaideo	0	0	0.0	0
31	Mancachar/ South Salmara	7	0	0.0	0
Total		470	182,187	100	Average 388

Source: Directorate of Fisheries, Assam: March 2024 (in respect of data at Col. 3 & 4)

Currently the private sector is developing and actively leading in seed production in Assam. In fact, almost all districts have hatcheries and seed production systems being developed. On the other hand, the production volume is biased by district. Nagaon and Barpeta districts in the Central-Western cluster, and Karimganj district in the Southern cluster are overwhelming the North-Eastern cluster of the state, and the production volume of these 3 districts accounts for 90.8% of the state's total production. Seed production volume in the North-Eastern cluster is small at present.

The huge variation of seed production among districts may be due to factors such as (i) use of poor-quality brood fish, (ii) poor brood stock management, (iii) less number of nursery/ rearing areas, (iv) poor technology application, (v) use of poor quality water during breeding and hatching, (vi) selling of considerable quantity of spawn to neighbouring districts by the hatchery operators, (vi) wide variations in the numbers of hapa breeders in the districts of high production volume etc.

The sources of water for hatchery operations are bore well (70%), river (18%), pond (6%) and tank (6%) and about 90% of seed producers sell directly to the markets without agents (Ref: APART-Improving Fish Value Chain Study, 2021).

However, important point here is that there are huge numbers of seed growers in the state scattered in almost all districts. They procure spawn from hatchery operators, grow this spawn to fry/fingerling and sell in the markets or grow-out fish farmers by door-to-door visit. The per hatchery seed production figures as shown in the above table 3-10 is therefore not indicative of the performance level of hatcheries between the districts. The gross seed production (fry/fingerling) in a district is the sum total of seed produced by hatcheries and the seed growers.

In the field survey, the actual condition of hatchery operating in the state was investigated. However, to assess the actual performance of hatcheries and scope for future capacity enhancement, further investigation of the hatcheries as well as interaction with hatchery operators as well hapa breeders and seed growers is desired through capacity building of DoF officers at district level and block level.

3) Size categories of fish seeds

In general, fish seed means 'fry' & 'fingerling' size as per Government of India and Government of Assam, and probably of all the state Governments of India. But for production purpose in grow-out ponds, large-size seeds called 'yearling' or "carry over seed" or "Gitti" in local name are also popularly utilized. Table 3-11 reviewed characteristics of various size of seeds.

Table 3 - 11 Characteristics of various size of IMC seeds and their production regime

Particulars	Spawn	Fry (Early)	Fry (Adv.)	Fingerling (small)	Fingerling (large)	Yearling
Standard size (IMC)	6.95-7.3 mm (72 hrs after hatching)	7.3-25 mm	25-50 mm	50-100 mm (5-10g)	100-150 g	150-500 g
Pond water area for culture (ha)	0.10-0.15	0.15-0.25		0.25-0.30		0.30-0.50
Culture period (to next stage) -Days	15	15-30		30-60		150-180
Stocking density (million/ha/crop)	05 to 10	0.20-0.30		0.07-0.10		0.008-0.02
Survival rate (%) in culture period	50-70	60-80		80-90		100
Market price (INR)	6,000-1,500/ litre	1,500-600/kg	600-400/ kg	400-300/ kg	300-250/ kg	250-225/kg

Remarks:

- Earlier the size of Nursery Pond (NP) for raising spawn to fry stage was in the range of 200-500 m². Now-a-days progressive farmers are having bigger NPs.
- Similarly Rearing Ponds (RP) for raising fry to fingerling were having smaller size such as 500-2,000 m², and Stocking Ponds (ST i.e. grow-out ponds) for growing table size fish from fingerling were up to 2 ha.
- Earlier (in 1990-2000, the period when the activities of seed production had started) stocking density of spawn was 5 million/ha which is now 10 million or more.
- Survival rate was earlier 30-40% in NP, 40-50% in RP & 50-60% in SP; now it is much more as indicated in the Table. Market price is very high in early season (February-April), gradually reduces till July. In August again, it slightly increases.

4) Salani seed

Seed from outside the state is mainly distributed from Kolkata in neighboring West Bengal (mostly Naihati, a town 40 km from Kolkata) to Rangia in Kamrup, where it is known as Salani seed. The distribution period is from late February to May each year, with 8-10 seed trucks per day (800-1,000 kg seed per day) entering the state; an estimated inflow of 100 tons of seed per season; Salani seed is sold to a specialized seed company in Rangia, which sells through local traders. This salani seed goes to central, eastern, and few western districts in Assam. In general, it is not distributed to southern districts (Karimganj, Cachar & Hailakandi districts) where all seeds are produced domestically.

Regarding the price of Salani seedlings, it is different from Rs. 300/kg in Rangia to Rs. 500/kg in Sivsagar in the north due to the transportation cost being Rs. 2,000/unit. Regarding price fluctuations in the year, for example, in IMC, the price fluctuates from Rs. 300-400/kg in late February to Rs. 200-250/kg from the end of March to the end of April, and then falls to Rs. 100/kg in May, the last month of the season.

As for locally produced seed, the distribution period is later than for Salani seed and extends from the end of February to July. Prices for IMC, for example, fall from Rs. 200-250/kg in April to Rs. 70/kg in July. In addition, the remainder of the previous year's seed, called Gitti, is also sold throughout the season.

In Assam, it is believed that Salani seed is better in quality than local seed, and in fact Salani seed can be used to start rearing up to 2 months earlier than local seed and grow bigger before the winter season. However, most of fish farmers are more likely to purchase seed from nearby seed sellers to reduce costs.

(3) Fish feed and feed production

1) Overview of current feeding method

IMC and other carp species are basically planktonic, herbivorous or benthic feeders so they can be grown-out by only fertilization in large ponds or with supplemental feeding if the stocking density is controlled low. In fact, there are still many traditional ponds where this type of low input aquaculture practice is employed.

On the other hand, as the sector developed over the years, regular feeding of farm-made feed, particularly mustard oil cake (MOC) gained prominence. Moreover, in the last decade, with the advent of commercial aquaculture in ponds and tanks, farmers have realized that fish farming has much better return on investment than traditional agriculture activities like paddy farming. Then, formulated pellet feed, which is produced by national brand large-scale manufacturers in other states of India such as Andhra Pradesh and West Bengal, became also common among progressive fish farmers particularly in the districts of production clusters.

Now thereof, there are various types of feeding methods carried out in the state. Most popular one is feeding of MOC and de-oiled MOC called DMOC¹⁹ using jute bags. MOC is stuffed in the bags and kept floating in the water to enable fish to nibble through the pores of the bags. According to the examination of APART (2021), around 53% of fish farmers utilize MOC and 44% of them use DMOC. Other farm byproducts such as rice bran, wheat bran etc. are also given as supplemental feeds as per availability. Those feeding ingredients can be procured from local retailers and mustard oil millers with high levels of price variation between seasons.

Due to recent development of local feed millers in Assam, mash feed (mixture of dry ingredients and not formulated as pellets) has also become popular. Local feed millers' grain different proportions of low materials such as MOC, DMOC, rice bran, de-oiled rice bran (DORB), broken rice, groundnut oil cake, lentil husk dust, maize, wheat bran, wheat refuse (consisting of sticks, straw, damaged and other grains and obtained after initial cleaning of wheat grain in flour mills) and broken wheat. In order to improve the protein contents for carnivorous fish species such as catfish, fish meal, blood meal and bone meal, which are imported from other state, are also utilized in some millers.

¹⁹ Selling price of DMOC is higher than the one of MOC by approx.10 %.

2) Fish feed production in Assam

At present there are a total of 41 feed mills in Assam (Table 3-12). All of them are small units of production capacity of less than 1 ton/day. Till the year 2018-19, the Department of Fisheries had promoted 13 small-scale private feed mills across Assam, primarily with an average capacity of 0.5 tons/hr. They use a combination of materials of not more than 4-5 kinds of the above-mentioned ingredients to prepare fish feed. A commonly used formulation is around 30% DMOC, 30% maize powder, 20% rice polish or DORB and remaining part with grounded wheat refuse. Those feeds are often sold directly to fish farmers in the vicinity of the mill.

Table 3 - 12 District wise list of Fish Feed Mill (August, 2023)

Sl	District	Feed Mill (no)	Sl	District	Feed Mill (no)
1	Jorhat	1	18	Hailakandi	1
2	Majuli	0	19	Udalguri	0
3	Goalpara	9	20	Cachar	4
4	Karimganj	2	21	Bongaigaon	2
5	Lakhimpur	0	22	Darrang	0
6	Kamrup Metro	3	23	Dhubri	1
7	Kamrup Rural	1	24	Mankachar	1
8	Kokrajhar	1	25	Nagaon	2
9	Dima-Hasao	0	26	Hojai	0
10	Sivasagar	0	27	Morigaon	1
11	Charaideo	0	28	Sonitpur	2
12	Golaghat	2	29	Biswanath	1
13	Barpeta	0	30	Dhemaji	1
14	Bajali	0	31	Karbi Anglong	0
15	Baksa	1	32	W.Karbi Anglong	0
16	Nalbari	1	33	Chirang	0
17	Dibrugarh	1	34	Tinsukia	2
Total					41

Source: DoF

Apart from those small-scale fish feed mills, it is known that there are at least 4 large-scale feed manufacturing units primarily cater to livestock feed. They use a part of their production capacity for producing fish feed. 3 of them are located around Guwahati city (Chaygaon, Amingaon and Khetri) and 1 in Sonitpur district near Tezpur. Those mills produce mainly poultry feed, partly cattle feed and small quantity (5-10%) of sinking pelleted fish feed. These plants have a processing capacity of 12 to 16 tons per hour. The millers have their own brand and reportedly have their own wholesalers/distributors and retailer network for distribution across Assam.

As for public mill, Assam Livestock and Poultry Development Corporation Ltd. manages a plant of 2 ton/hr capacity near Guwahati (Sonapur) on lease system. The Department of Fisheries has sponsored 1 more large feed mill recently with 40% financial support under PMMSY at South Salmara district (near Dhubri) with production capacity of 50 tonnes/day (about 15,000 t/yr) which was recently commissioned and initial production started.

The latest supposed formation said that 5 mills recently set up under RIDF (Rural Infrastructure Development Fund)²⁰ will be producing sinking pelleted.

3) Marketing of national brand fish feed

It is said that Indian aquaculture feed mills have the capacity of 2.88 million metric tons (APART-Improving Fish Value Chains in Assam-2021). Such commercial brands are common in Assam and nationwide as Kalyani, CP, Godrej, ABIS, Anmol, Ganga-Caveri, Cargil, NOVA. They are producing various types of pelletized feed for fish either floating or sinking depending on the market needs and development stages of target species such as carp spawn feed, carp fry feed, carp grow-out feed, carp brood feed as well as feeds for tilapia, catfish, seabass, etc. Those national level brands of fish feed have their own distributor and retailer network across Assam in most potential production districts.

²⁰ In RIDF program, NABARD provided funding for transportation vehicles, feed milling facilities, etc. For more details, refer to Section 4.9.

The retailers are generally multi branded sale points housing multiple brands of fish feed along with other inputs like fish medicines, vitamins, lime, MOC etc. The margins available for the retailers are around 20-25% on the minimum retail price (MRP). However, the retailers seldom sell feed at MRP and provide discounts to the range of around 10% leaving their margins at 10-15%. National brands generally have individual storage bag size of 10 to 35 kgs. However, local brands and manufacturers of feed were found to have 40 kgs to 50 Kg bag. Local manufacturers of fish feed also sell to farmers through retailers.

4) Estimation of the demand gap for fish feed

We examined current requirement of fish feed in Assam as shown in Table 3-13 based on the estimation of pond & tank water areas and approximate feeding amounts such as 5 tons/ha/yr for intensive culture pond, 2 tons/ha/yr for semi-intensive pond and no feeding for extensive and traditional ponds. As a result, it is assumed that a total of 142,000 tons of fish feed are required in Assam annually.

Table 3 - 13 Requirement of Fish feed in Assam in 2023

Present farming practices	Estimated water area coverage (ha)	Fish feed application by Farmers (tonne/ha/yr)	Total feed demand (tonne/yr)
Total area under Ponds & Tanks-94,693 ha (Directorate of Fisheries, Assam-2024)			
Intensive (10%)	9,469	5	47,347
Semi-intensive (50%)	47,347	2	94,693
Extensive (30%)	28,408	0	0
Traditional (10%)	9,469	0	0
Sub-Total	94,693		142,040

Source: JIA study team

As for domestic feed production, it is roughly calculated that the 41 small-scale feed mills in the State produced 9,840 tons annually (300 tons capacity/year/mill x 80% operation x 41 mills) and 4 large-scale mills in the State produced 6,720 tons annually (10 ton/hr x 8hr/day = 80tons/mill/day, Supposing, 7% of which is for fish feed and 300 days/yr, it is calculated as 80 tons/mill/day 4 mills x 7% x 300 days/yr). Therefore, currently total feed production for aquaculture is estimated at 16,560 ton/yr.

In conclusion, Assam faces a large annual demand gap of 125,440 tons (142,000 - 16,560 tons), which preferably must be filled by a simple feeding of MOC/DMOC and floating pellets of national brands.

(4) Aquaculture calendar

Seasonal aquaculture practice adopted in Assam State is overviewed in Figure 3-9 and more detail is given in Table 3-13 based on the site survey. Target species of aquaculture are mainly IMC, Chinese major carps and to some extent other carp species, and Rupchanda. Their polyculture is carried out broadly in earthen ponds using artificially bred juveniles.

Breeding season of IMC and many other culture species starts from March and lasts till August. Broodstock of 1-3 kg/individual (IMC) are introduced in circular concrete tank in breeding pool/ breeding pool cum hatchery for induced spawning by means of injecting hormone. Brood fish spawn in the tank and the eggs are transferred to the so-called Chinese-style circular hatching tanks having gentle water flow-through system for hatching until yolk sac absorption on the 3rd day of hatching.

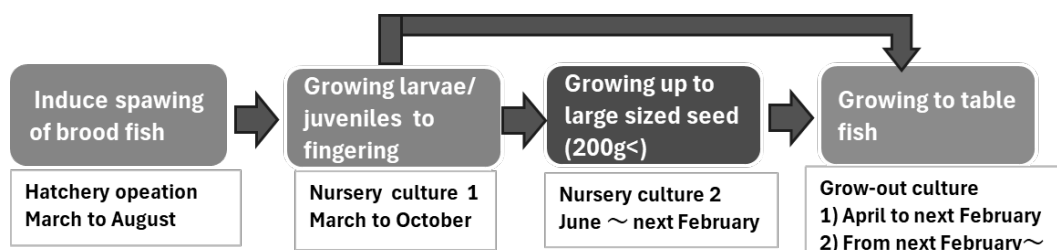
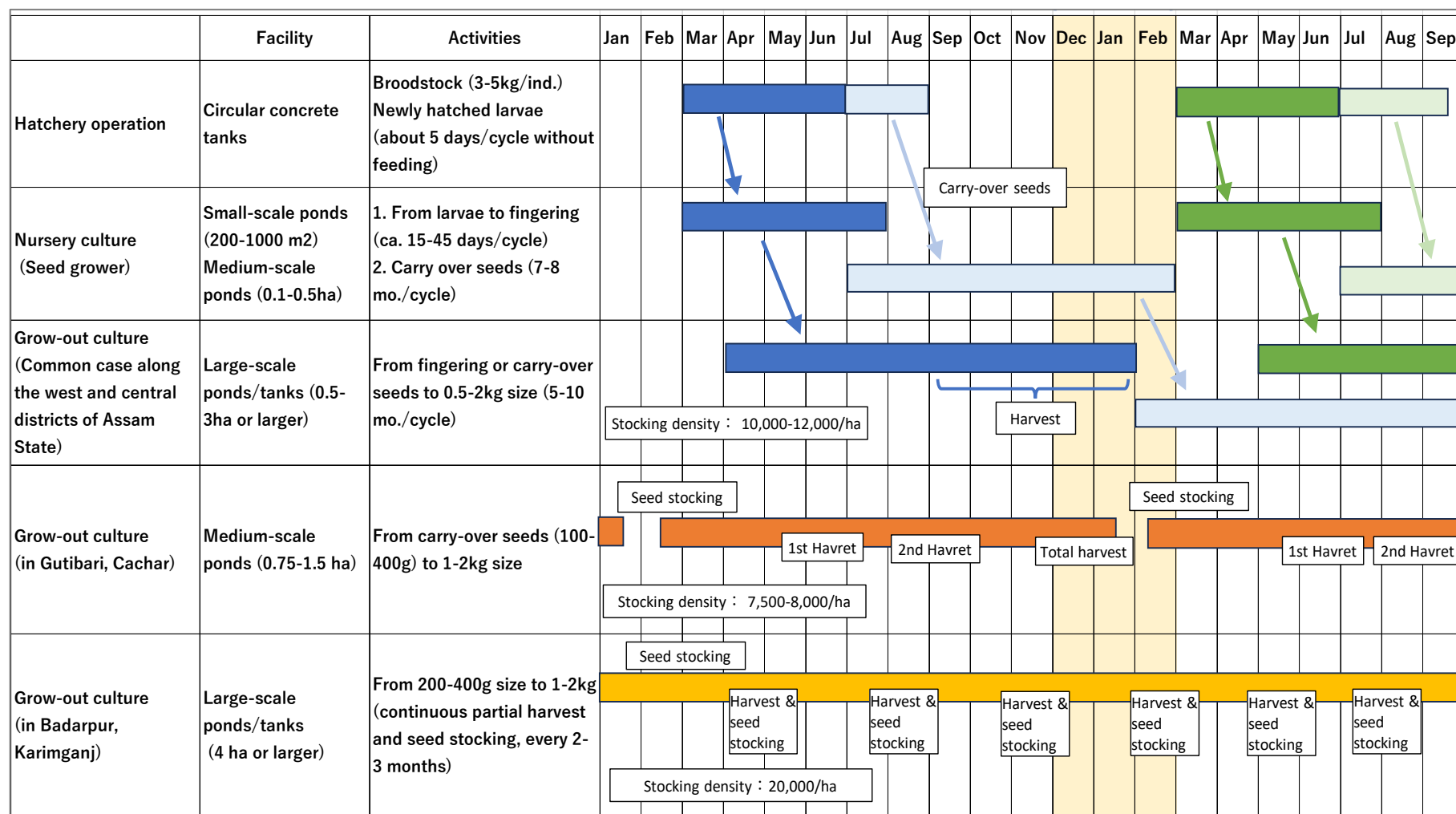


Figure 3- 8 General aquaculture production flow for IMC and other target species in Assam State

Source: JICA survey team

Table 3 - 14 Seasonal aquaculture practices in Assam State



Source: JICA survey team

Those larvae are transferred to small- (200-1,000m²) to medium-scale (1,000-5,000 m²) earthen ponds for initial feeding of zooplankton, and they are reared in such nursery ponds for 15 days followed by shifting to rearing ponds for another 30 days or so, with supplemental feeding in both types of ponds. Fries in the rearing ponds are nourished until fingerling size to be current year seeds sometimes. On the other hand, larvae collected in late spawning season are often used for producing carry-over seeds. Production of carry-over seeds is a common practice in Assam State. Here, the fries are stocked in ponds at very high density (more than 10 times as usual) and reared without additional feeding or with very scant feeding so that their growth rate is controlled minimum. They are harvested next February for grow-out to large-size seed (100-400g) and then table fish production (1-2kg). Carry-over seeds are known to be robust and grow faster after they start feeding in new pond environment comparing to current year seeds.

Table-size fish production is carried out as soon as fingerling-size juveniles are available after winter season. It will be February for carry-over seeds and April for current year seeds at the earliest. Based on our field observation in west and central districts of Assam State, majority of target species are IMC and Chinese major carps and stocking density of current year fingerlings is around 10,000-12,000/ha. They are grown to minimum marketing size of 500g in 4-5 months thereafter partial harvesting is done according to the demands. They are totally harvested in January and the ponds are prepared for next seed stocking. When carry-over seeds are used, aquaculture can be started earlier, and better growth of fish can be expected.

In the southern districts of Assam, namely Cachar and Karimganj, progressive or systematic operation of grow-out culture could be seen. In Gutibari (village of Garerbond Part-I fishery cluster) Fish Farmer FIG, Cachar, which is composed of 25 members and registered as a member of Borkhola Aquaculture Farmers Producer Company Ltd., 80% of member fish farmers are said to operate medium-scale ponds (0.75-1.5ha) using large-size carry-over seeds (100-400g) at lower stocking density of 7,000-8,000/ha. They are stocked in February and 15% of fish is harvested in June and thereafter partial harvests are continued until January when total harvest is carried out. Since they are using large-size seeds, survival rate is considered at almost 100%. Supposing average harvest size is 1kg/fish, productivity of pond is calculated to be 7-8tons/ha. Fish from Garerbond Part-I and Garerbond Part-II cluster are sold in the local Srinagar Wholesale Fish Market and also marketed in the states of Mizoram and Meghalaya.

In Anair Haor, Ghoramara Fish Cluster, Badarpur Block, Karimganj district, there are about 50 individual large-scale fish farmers operating more than 4ha pond each. The largest pond owner interviewed possesses a total of 6 ponds with a total water area of 35 ha. Their culture style is intermittent/repeated partial harvests followed by stocking of large-size seeds (200-300g) with high stocking density (20,000 fish/ha). Major species they culture is Rupchanda (50%) because of its high growth rate, and followed by IMC (30%), Chinese carps (10%), *Pangasius catfish* (5%) and *Tilapia* (5%). Mono-sex male tilapia seeds are imported from Bangladesh. Feed comprising floating 60%, sinking 30% and MOC 10% is applied daily at 4% body weight. Normally, MOC is soaked in water in a boat and spread over pond surface. However, 4 days prior to each harvest, MOC is powdered and spread over pond surface in dust form. They said that 20-30% of fish in ponds are harvested every 2-3 months and thereafter the same numbers of large-size seeds which they grow in their rearing tanks are added into the ponds. Total harvest and drying the bottom are carried out only once in 3-4 years. Supposing average harvest size is 0.7kg and 100% of fish is harvested in 1 year, productivity is calculated as 0.7kg x 20,000 fish = 14 tons/ha.

(5) Women participation in fish farming

Women participation in fisheries activities in the state is not very encouraging. This is due to lack of technical knowledge, social taboos etc. They are mostly involved in pond cleaning and feeding of fish in aquaculture systems. They are also found involved in fishing in wetlands with small fishing nets, traps and other small gears in tribal areas of the state.

The study on 'Improving Fish Value Chains in Assam, 2021' under APART indicated that 57% households with commercial aquaculture acknowledge the role of women in pond cleaning and pond preparation. Another 48% households have reported that women engagement in feed application is

regular and responsibilities of applying feed in respective ponds and tanks rest on women. The challenges ascribed to this are:

- Trade timings are ill suited for women due to security issues and domestic responsibilities during the same time.
- Women are often not considered suitable for heavy labor like lifting bulk packs of inputs like lime or feed.
- Socio-cultural barriers due to large scale engagement of specific communities in fishery activities, especially debar women from freely undertaking fish sales and marketing functions.
- Current status of market infrastructure with unhygienic operations, over-crowded sale counters and lack of basic amenities like clean toilets, etc. is also not designed to promote women participation.

3.4.5 Capture fisheries activities

Assam is a land locked state. Hence main stay of fisheries in the state is capture fisheries in the form of wetlands (beels) and river fisheries with its tributaries under ownership of Government in addition to traditional small-scale fisheries in derelict water bodies/swamps, paddy fields, wetland in the forestry etc.

(1) Beel fisheries

1) Nature of beels

Beels are known as a type of wetlands, either flat natural shallow water bodies, or the ox-bow lakes/ dead river courses originally having connecting channels with mother rivers. There are 2 types of beel: ①Live Beels: formed by riverine activities, similar to lakes, large, shallow, irregularly shaped, connected to rivers, and with inflow of water. Most of them are connected to the Brahmaputra and Barak rivers or their tributaries. ②Dead Beels: often formed by isolated meandering rivers due to topographic changes, and are basically deep. Both types of beels are used as important fishing ground in Assam State.

Large extent of these resources is yet to be brought under scientific management practices. Beel fisheries and derelict water bodies/ low-lying areas are the main target area for development interventions taken up by the Government under different programmes so far.

Some of the important wetlands under this category are Deepar Beel, a Ramsar site in Kamrup district, Dhir Beel in Dhubri district, Tamaranga Beel and Dalani Beel in Bongaigaon district, Chatla haor in Cachar district and Sone beel in Karimganj district. Other important large water bodies are Gaurisagar Pukhuri, Sibsagar Pukhuri and Joysagar Pukhuri in Sibsagar district. Besides providing water to the people of the nearby areas, these Sibsagar tanks can also be used for rearing fishes and raising plantation crops like coconut, areca nut, cashew nut etc. along the sides of the tanks. Ornamental gardens can also be developed on the banks of the tanks.

2) Beel management system

In Assam, the Revenue Department and AFDC manage Beel for national interest and lease on a 7-year basis. The lessee employs fishermen to operate the fishery. The lessee is usually the head of the fishing cooperative, which is often non-functional. Fishermen are either employed at very low wages or receive approximately 50% of the harvest as income. The marketing of the fishery in Beel is therefore almost entirely controlled by renters. Fishermen employed by renters are not allowed to sell fish to the market and have to sell to renters at a lower price. The water in beel is often pumped out in order to increase the catch.

3) Beel production and productivity

According to the latest statistics of the Department of Fisheries (2022-23), beel fisheries produced 47,688 tons or 10.8% of state's total production with total water spread of 71,844 ha annually. The average productivity is calculated to be 0.664 tons/ha/yr. When focusing on the number and area of beels, the districts having large potential for future development are: Cachar (198 beels, 7,945ha), Dhubri (153 beels, 3,637ha), Dibrugarh (87beels, 5,289ha), Golaghat (120 beels, 1,494ha), Kamrup (M) (55 beels, 5,211ha), KamrupI (140 beels, 4,434ha), Karimganj (143 beels, 3,851ha), Nagaon (110 beels, 6,882ha), and Sivasagar (147 beels, 1,356ha). Those areas would have larger potential for future development of beel fisheries as well as aquaculture.

Table 3 - 15 District wise data on fish production in beel and derelict water bodies/swamp in 2022-23

District		Beel Fisheries				Derelict Water Bodies/ Swamps			
		No.	Area	Production	Productivity	No.	Area	Production	Productivity
1	Bajali					42	146	69	0.474
2	Baksa	6	340	381	1.120	51	447	17	0.038
3	Barpeta	77	2,540	1,927	0.759	78	1,367	1,263	0.924
4	Biswanath	51	722	615	0.853	64	444	110	0.249
5	Bongaigaon	41	2,619	1,847	0.705	193	3,332	475	0.143
6	Cachar	198	7,945	4,887	0.615	284	5,738	4,601	0.802
7	Charaideo	26	135	88	0.654	405	145	65	0.445
8	Chirang	11	122	44	0.363	77	150	51	0.337
9	Darrang	19	4,020	1,622	0.403	71	610	18	0.030
10	Dhemaji	42	425	280	0.660	145	706	655	0.927
11	Dhubri	153	3,637	1,710	0.470	241	4,178	1,045	0.250
12	Dibrugarh	87	5,289	3,430	0.648	80	406	381	0.937
13	Dima-Hasao	0	0	0	0.000	112	35	9	0.249
14	Goalpara	76	2,106	717	0.340	90	483	210	0.435
15	Golaghat	120	1,494	1,225	0.820	102	57	68	1.193
16	Hailakandi	42	4,378	1,418	0.324	25	1,628	412	0.253
17	Hojai	24	1,118	556	0.497	371	1,805	868	0.481
18	Jorhat	43	720	661	0.919	83	6,069	2,989	0.492
19	Kamrup (M)	55	5,211	3,527	0.677	26	165	104	0.628
20	Kamrup (R)	140	4,434	3,120	0.704	204	1,159	672	0.580
21	Karbi-Anglong	16	121	15	0.124	85	267	5	0.020
22	Karimganj	143	3,851	2,502	0.650	211	11,480	2,402	0.209
23	Kokrajhar	76	2,067	980	0.474	96	572	36	0.062
24	Lakhimpur	41	1,560	262	0.168	68	4,273	216	0.050
25	Majuli	92	1,381	621	0.450	295	2,388	872	0.365
26	Morigaon	94	2,487	6,126	2.463	310	424	287	0.676
27	Nagaon	110	6,882	3,676	0.534	572	22,338	12,688	0.568
28	Nalbari	25	792	404	0.510	515	3,645	802	0.220
29	Sivasagar	147	1,356	1,152	0.850	98	6,058	2,731	0.451
30	Sonitpur	70	1,380	1,770	1.283	305	679	515	0.759
31	South Salmara	23	405	775	1.912	38	258	269	1.042
32	Tinsukia	18	2,221	1,325	0.597	160	1,864	966	0.518
33	Udalguri		0	0	0.000	504	242	178	0.737
34	West. K.A	6	88	23	0.256	21	74	8	0.102
TOTAL		2072	71,844	47,688	0.664	6022	83,633	36,053	0.431

Source: Directorate of Fisheries, Assam (March 2024)

(2) Derelict waters/Swamps

So-called derelict waters/swamps are not utilized for agricultural purposes and lying fallow for generations. Most of these lands are shallow and infested with different types of weeds providing a favorable natural environment not only for fishes but also for birds, reptiles and many other land-based animals.

On the other hand, they are also important as traditional fishing grounds. A total of 6,022 derelict water bodies/swamps with 83,633 ha produce 36,053 tonnes of fish, or 8.1% of the total of Assam during the year 2022-23. The average productivity is calculated at slightly lower than beel as 0.431 tons/ha/yr.

Although detailed analysis has yet to be done, such districts would have higher development potential from the view of area are: Nagaon (22,338 ha), Karimganji (11,480 ha), Jorhaat (6,069 ha), Silvasagar (6,058 ha), Cachar (5,738 ha), Lakhimpur (4,273 ha) and Dhubri (4,178 ha).

Department of Fisheries have taken up initiatives to develop these potential resources for production enhancement and engagement of rural youths for self-employment. However, progress in this sector is not worth mentioning.

(3) River fisheries

River fisheries comprise of 2 main river systems, the Brahmaputra and Barak with network of 53 tributaries spread throughout the length and breadth of the state. River fisheries have almost no scope for fisheries development except taking up some measures of fish biodiversity conservation to maintain sustainable stock through application effective acts and rules.

The main rivers are leased out by Government by imaginary partitions for a period of 7 years at a time. However, fish catches from river fisheries are only 3,220 tons in 2022-23 contributing to 0.73% only comparing to the state's total fish production.

The National Institute of Agricultural Marketing (NIAM) mentioned that productivity in the river fisheries Assam is between 10-50 kg/ha/yr. Catch statistics showed dominance of carnivorous fishes with lesser percentage of IMC. The Market Study of Fishery (2009) of NIAM under AACF also indicated gradual decline of fish catch in most of the rivers in the state. Gears mostly used in the rivers are gill net, drag net, cast net. Wooden country crafts (boats) are used and there is no mechanized fishing. Selling rate of fishes depends on demand, season, catch size and volume of the catch. It has been estimated 77% of fish catch from rivers are sold during peak season (September-March) while 33% are sold during lean season (April-August).

3.5 Fisheries value chains/industrial policy

3.5.1 Fisheries value chains

In Assam, traditionally dependent on fishing in the rich rivers and Beel, local wild fish has declined, mainly due to population growth, creating shortages for the local population. The influx of people from other states, who do not particularly prefer only local fish, has led to a division between 'local' high quality products and 'salani' for the mass, price-sensitive market. Aquaculture used to be mainly for household use and was not considered a commercial venture, but over the last 2 decades, the growth of aquaculture in Andhra Pradesh has ensured a steady supply to meet the demand in Assam and has created a network of marketers and service providers in the state. Local aquaculture has taken off in Assam in the last decade and has become a lucrative income-generating activity for rural farmers, with much better financial returns than traditional agriculture, mainly paddy. The encouragement from the state government as well as private suppliers of inputs such as fish seed, feed and services made it easier for farmers to take up commercial aquaculture. Farmers with more entrepreneurial zeal were found to be more involved in commercial aquaculture.

Growth in fish seed and fish production over the last 5 years is shown in the table 3-16.

Table 3 - 16 Fish seed and Fish production in Assam in the last 5 years

Year	Fish seed production (mil nos.)	Fish production (lakh ton)
2018	9,893	
2019	9,519	20.0
2020	9,886	21.2
2021	18,219	25.0
2022	20,843	28.1

Source: DoF

The table indicates that in Assam, fish seed production has significantly increased over the last 5 years, from 9,893 million in 2018 to 20,843 million in 2022. Fish production has also risen steadily from 3.31 lakhs tons to 4.43 lakhs tons during the same period. This suggests an improvement in aquaculture practices and efficiency, leading to the growth of the fisheries sector in the state.

The interstate trade has also remained as follows.

Table 3 - 17 Import and Export and consumption in the last 5 years

Year	Import (ton)	Export (ton)	Consumption (kg/Capita)
2018	12,641	8,308	10.43
2019	20,073	9,731	11.72
2020	12,829	11,694	11.83
2021	22,731	27,399	12.18
2022	26,430	20,077	13.06

Source: DoF

There is no statistical data on the source of fish imports into Assam from outside the country, but according to interviews with market traders in the VC survey, Assam imports from Bangladesh and Myanmar. However, these supplies are routed through West Bengal and Andhra Pradesh. This makes it difficult to obtain data on imports of foreign fish sold in Assam. As far as exports are concerned, according to the same VC survey interviews, most of these exports are to Bhutan.

In order to contribute to the Japanese government's Free and Open Indo-Pacific (FOIP) initiative, the establishment of a value chain between Northeast India (NER) and Bangladesh is being considered. However, in the current context, the following challenges exist:

Export imbalance: NER imports fish from Bangladesh, but there are few fish exports from NER to Bangladesh.

Lack of competitiveness: It is possible to farm shrimp in the NER, but there is a lack of competitiveness with farmers in West Bengal and Orissa.

High cost: The biggest cost in fish production is feed, which in the NER has to be sourced from other regions due to the difficulty of local feed production, resulting in high costs.

Solutions could include;

Improve the transport of live fish: The geographical proximity of the NER to Bangladesh makes it suitable for the transport of live fish. Improve live fish transport technology and establish a system to transport live fish quickly while maintaining freshness.

Introduce technology: Introduce modern aquaculture technology to increase productivity. This includes the introduction of efficient feed management systems and water quality management techniques.

Local feed production: Establish a project for local production of fish feed in the NER to reduce transport costs. Local agricultural resources will be used to reduce the cost of feed.

Infrastructure development: Logistics infrastructure: Development of the infrastructure needed to transport fish (e.g., roads, refrigeration facilities, transport vehicles) to reduce transport costs and time.

These activities are expected to strengthen the value chain between NER and Bangladesh and contribute to the development of the regional economy.

The data in the table show that imports generally increased from 12,641 tonnes in 2018 to 26,430 tonnes in 2022. Exports increased from 8,308 tonnes in 2018 to 27,399 tonnes in 2021, before decreasing to 20,077 tonnes in 2022. Per capita fish consumption increased steadily each year, from 10.43 kg in 2018 to 13.06 kg in 2022. These trends suggest that despite the increase in production in the state, imports are still increasing, indicating growing demand for fish in the region, with export levels fluctuating but generally increasing.

The below pie chart presents the major fish-importing districts in Assam for the fiscal year 2022-23. Kamrup is the leading fish-importing district, accounting for nearly 10 per cent of the total fish imports. This indicates a significant demand for fish in the district, potentially due to its large population or commercial activities. Tinsukia district, contributes to 8.8 per cent of the total fish imports. The strategic location of district as a commercial hub may contribute to its high import figures. The 'Others' category represents a significant portion of the total imports, encompassing various smaller districts or regions with combined import volumes, highlighting the widespread demand for fish across the state. Understanding these import patterns is crucial for stakeholders in the fisheries and supply chain sectors to optimize distribution and meet consumer demand effectively.

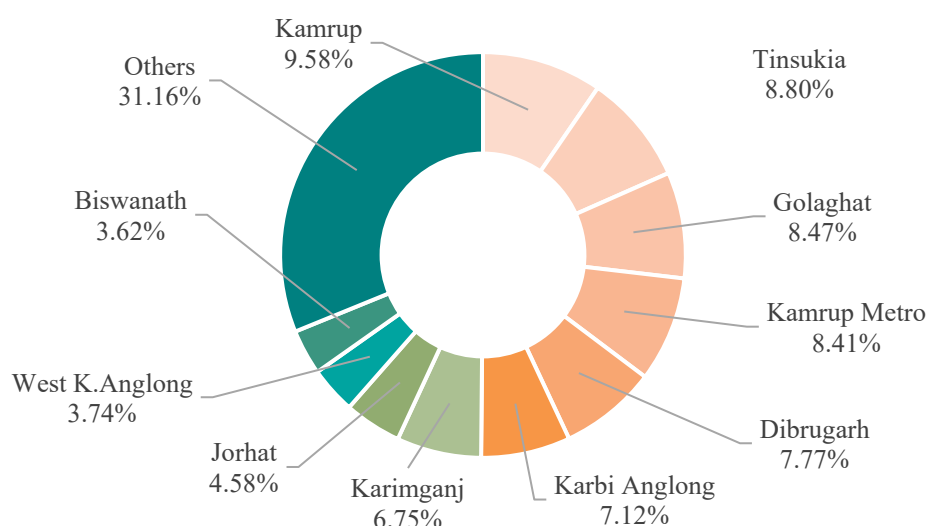


Figure 3- 9 Major fish-importing districts in Assam (2022-23)

Source: Directorate of Fisheries, Govt. of Assam

Note: Major fish species imported to Assam include Indian Major Carps (Catla, Rohu, Mrigal), Pangasius catfish, Hilsa and Tilapia.

Assam's local fish is mainly sourced from aquaculture farms and beels, with very small amounts coming from rivers and other water bodies. The aquaculture farms, which account for more than 80% of the total local fish supply, are largely confined to IMC, other carps and Bata/Bhangan.

There is a consumer preference for purchasing live fish, which accounts for about 20-30% of the local aquaculture supply. Live fish are transported to markets in special temporary tanks mounted on vans or small vehicles, each holding about 150-200 kilograms of fish. Live fish sell for 20-30% more than the same size of dead fish, so local aquaculture practices have shifted to producing live fish through semi-intensive farming and frequent stocking and harvesting. Fish farmers find that they can meet their income targets by growing small fish over 2-3 growing cycles. However, fish farming knowledge and practices vary widely across Assam, largely influenced by the markets they serve and their livelihood structures. For example, farmers within 100-150 km of Guwahati, such as those in Nagaon, Barpeta, Nalbari and Darrang, have become skilled in trading live fish to meet the specific demands of Guwahati and other towns.

In Assam, fish distribution channels are typically multi-tiered, involving a number of intermediaries from the point of production to the consumer. Here's a general overview of the fish distribution channels:

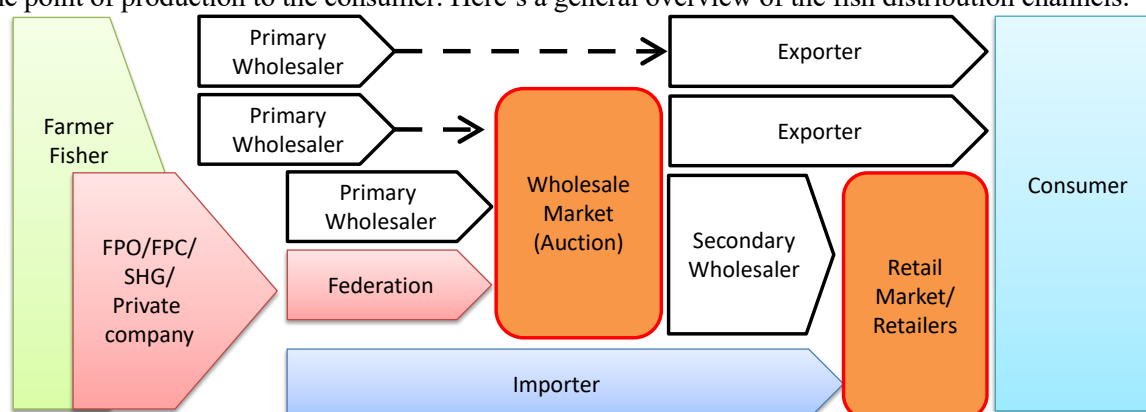


Figure 3- 10 The fish distribution channels

Source: JICA survey team consulted by DoF

Producers: These include fish farmers and fisher who harvest fish from rivers, ponds and aquaculture facilities.

Primary wholesalers: They buy fish directly from producers in bulk, often at landing centres or farm gates.

Secondary wholesalers: These wholesalers buy from primary wholesalers and then sell to smaller wholesalers or large retailers, sometimes operating in district level markets.

Retail market and Retailers: This group consists of market stall owners, shop owners and street vendors who sell fish directly to consumers.

Live fish markets: Due to the preference for fresh, live fish in Assam, live fish traders use special containers to transport live fish to markets.

Agents and brokers: These intermediaries facilitate transactions between different levels of the supply chain, particularly in remote or rural areas where direct market access is limited.

Online platforms: Although not as widespread, there is a growing trend to use online platforms and apps to deliver fish directly to consumers or restaurants.

Processing units: In some distribution channels there are facilities that process fish into various products such as fillets, frozen fish or fishmeal before it reaches retailers or exporters.

Exporters: some companies specialise in exporting seafood to international markets, but this channel has developed only for certain types of seafood and regions.

FPO and self-help groups (SHG): These organisations often assist small-scale producers by facilitating access to markets and ensuring fair prices.

The actors in the individual value chain stages are described in 3.7 and A list of wholesale markets in Assam is given below.

Table 3 - 18 District wise list of fish wholesale market of assam

SL.	Disriect	Name of Market
1	Kamrup (Metro)	1. Paltanbazar 2. Uzanbazarghat 3. Maligaon 4. Goneshguri 5. Bhetapara 6. Notbama 7. Lokhara 8. Chandrapur 9. Sonapur
2	Kamrup (Rural)	1. Azara 2. Palashbari 3. Sualkuchi 4. Hajo 5. Rangia 6. Chaigaon 7. Dhupdhara
3	Nalbari	1. Nalbari Municipal Market 2. Tihu 3. Ghograpar 4. Bijuli Ghat 5. Mukawlmua
4	Baska	1. Mashalpur 2. Barama 3. Tamulpur 4. Nagrijuli 5. Goreswar 6. Jalah
5	Barpeta	1. Daulashal 2. Sarthaibari 3. Barpeta Municipal Market 4. Barpeta Road 5. Sorbhog 6. Howly 7. Pathsala 8. Kalgashia
6	Darrang	1. Khairabari 2. Sipajhar 3. Tangla 4. Mangaldai Municipal Market 5. Kalaigaon 6. Kharupetia 7. Dalgaon
7	Udalguri	1. Udalguri Municipal Market 2. Mazbat
8	Sonitpur	1. Tezpur Municipal Market 2. Gahpur 3. Rangapara 4. Biswa Nath. Chariali 5. Dhekiajuli.
9	Lakhimpur	1. North Lakhimpur Municipal Market 2. Narayanpur 3. Chilapathar.
10	Dhemaji	1. Dhemaji Municipal Market 2. Jonai 3. Dhakuakhana
11	Sivasagar	1. Sivasagar Municipal Market 2. Sonari 3. Nazira.
12	Jorhat	1. Jorhat Municipal Market. 2. Majuli
13	Dibrugarh	1. Dibrugarh Municipal Market 2. Moranhat 3. Chaikhowaghat
14	Golaghat	1. Golaghat Municipal Market. 2. Bokakhat 3. Sarupathar 4. Dergaon.
15	Nagaon	1. Nogaon Municipal Market 2. Haiborgaon 3. Hojai 4. Lamding 5. Silghat 6. Raha 7. Laharighat 8. Lanka 9. Jamunamukh 10. Kampur 11. Jakhlabandha
16	Morigaon	1. Morigaon Municipal Market. 2. Jagiroad.
17	Dhubri	1. Dhubri Municipal Market. 2. Gauripur 3. Golokgonja 4. Agamani 5. Bilashipara 6. Chapar 7. Mankachar 8. Hatshingimari.
18	Goalpara	1. Goalpara Municipal Market 2. Lakhipur 3. Dudhnai 4. Joleswer.
19	Bongaigaon	1. Bongaigaon Municipal Market 2. Bijni 3. Abhayapuri 4. Dangtol
20	Chirang	
21	Kokrajhar	1. Kokrajhar Municipal Market 2. Kokrajhar Station Market 3. Gossaigaon 4. Basugaon 5. Dotma 6. Fakirgram 7. Kashipara
22	Cachar	1. Cachar Municipal Market 2. Lakhipur
23	Hailakandi	1. Hailakandi Municipal Market 2. Pachgram

SL.	Disrict	Name of Market
24	Karimganj	1. Karimganj Municipal Market 2. Badarpur 3. Nilambazar 4. Kalain
25	Tinsukia	1. Tinsukia Municipal Market 2. Domdoma 3. Naharkatia 4. Namrup
26	Karbi-Anglong	1. Diphu 2. Hamreng 3. Boithalangsu
27	N.C. Hills -	1. Hoflong 2. Maibong
Total		120 Nos

Source: DoF

The list of retail fish market of Assam is given below.

Table 3 - 19 The list of retail fish market of Assam

SL.	Disrict	Name of Market
1	Kamrup	1. Machkhowa 2. Chandmari 3. Bamunimaidan (Railway Colony) 4. Noonmati 5. Beltola 6. Lalgenesh 7. Basistha Chariali 8. Lokhara. 9.Fatasil-Ambari 10. Silpukhuri 11.Narengi 12.Khetri 13.North-Guwahati 14. Azara 15. Palashbari 16. Mirza 17. Bijoynagar 18.Kukurmara 19.Boko 20.Nagerbera 21.Soualkuchi 22. Hajo 23. Baihata chariali 24. Goreswar 25.Puthimari
2	Nalbari	1. Barama 2. Tamulpur 3.Nagriji 4.Dhamdhama 5.Machalpur 6.Chamata 7.Belsor 8. Daulashal 9. Kamarkuchi
3	Barpeta	1.Bhabanipur 2.Patacharkuchi 3. Jalah 4.Nityananda 5.Baghmara 6.Sarthaibari 7.Chenga 8.Bahari 9. Tarabari 10.Baghar
4	Darrang	1.Dumunichaki 2.Patharighat 3.Kaupati 4.Rowta 5.Orrang 6.Paneri 7.Harisinga 8. Udalguri 9.Bhergaon 10.Mazbat 11.Deomorno 12.Bhairabkunda 13.Aulachouka.
5	Sonitpur	1.Niz-Mishamari 2.Balipara 3.Chayduar 4.Jamugrui 5. Chatia 6.Bihali 7.Helem 8.Mishan.cr
6	Lakhimpur	1. Dhalpur 2.Bihpuria 3.Niz-Laluk 4.Gogamukha 5.Badatighat 6.Gathia 7.Ghilamara
7	Dhemaji	1.Chilapathar 2.Bardalan 3.Murkangchelek
8	Sivasagar	1.Amguri 2.Jaji 3.Dimow 4.Simaluguri 5.Geledi.
9	Jorhat	1.Titabar 2.Mariani 3.Tiyak
10	Dibrugarh	1.Lahowal 2.Chabuwa 3.Duliajan 4.Naharkatia 5.Namrup 6.Khowang 7.Dikam
11	Golaghat	1.Numaligarh 2.Kamargaon 3.Barhola 4.Merapani 5.Farkating.
12	Nagaon	1. Murajhar 2.Dabaka 3.Kathiatali 4. Kaliabar 5.Misa 6.Chamaguri 7.Puranigudam 8.Rupahihat 9.Mairabari 10.Dhing 11.Jajari 12.Juria 13.Mikirbheta 14.Raha 15.Bebejia 16.Lalung 17.Binakandi 18. Natunbazar (Nagaon) 19.Kadamani 20.Barapujia 21.Bardowa 22.Chaparmukha
13	Morigaon	1.Dharamtul 2. Mayang
14	Dhubri	1.Chowkbazar 2.Boubazar 3.Bagaribari 4..Salkocha 5.Tamarhat 6. Fakirganja 7.Chapatgram 8.South Salmara
15	Goalpara	1. Newmarket 2.Kharmuja 3.Agia 4.Krishnai 5.Darangiri 6.Rangjuli 7.Matia 8.Marnai 9.Dolgoma 10.Simalitola 11.Damara
16	Bongaigaon	1.Dhaligaon 2. North Salmara 3.Jogighopa
17	Kokrajhar	1. Chidli 2.SriRampur
18	Cachar	1. Katigora 2.Udarband 3.Barkhola
19	Hailakandi	1. Katlichera 2.Lalbazar 3. Lalaghat 4.Badarpur
20	Karimganj	1. Patharkandi 2.Ratabari
21	Tinsukia	1. Lidu 2. Margherita 3. Makum 4. Disoi 5.Digboai 6.Lekhapani
22	Karbi-Anglong	1. Howraghat 2. Bokajan.
23	Dima Hasao	1.Jatinga 2.Mahur 3. Garampani
Total		163 Nos

Source: DoF

The major production pockets do not have much trade in table fish among themselves and have developed independently as separate clusters, catering to the major consumption pockets surrounding each cluster. The consumption pattern of fish across the state is also more skewed towards urban centres like Guwahati, Silchar, Jorhat, Tezpur etc.

Table 3 - 20 Major fish production site and market in Assam State

Production Zones	West(green)	Central(Purple & Yellow)	East(pink)	South(orange)
Major production	Dhubri, Bongaingaon, Goalpara, NalbariBarpeta, Kamrup	Darrang, Morigaon, Nagaon, Sonitpur, Golaghat,	Jorhat, Lakhimpur	Cachar, Karimganj
Number of major local Markets	112	74	56	21
Destination consumption markets(Locations are shown on below figure as “★”)	Guwahati, Bongaingaon, Kokrajhar	Guwahati, Karbi Anglong, BiswanathChariali, Arunachal Pradesh	Nagaland, Jorhat, Numaligarh	Silchar
Population Spread	36%	30%	21%	12%

Source: Improving Fish Value Chains in Assam (APART 2021)

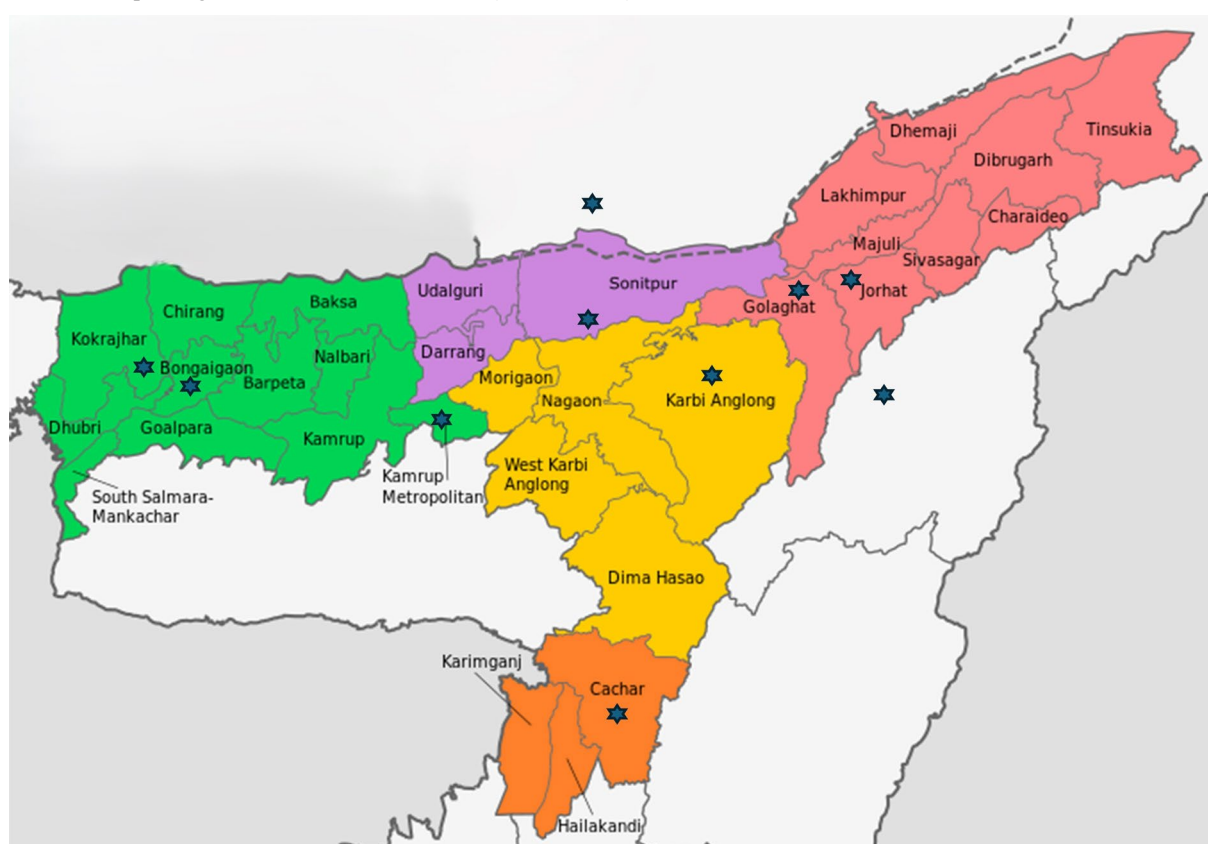


Figure 3- 11 Major production zones

Source: JICA Survey Team

Key challenges of the fisheries value-chain in Assam

The fisheries sector in Assam holds significant promise for driving positive socioeconomic change. Nevertheless, despite technological progress and production growth, the fish value chain encounters various hurdles in the region. Consequently, it is crucial to discern and comprehend the influence of these factors on the advancement and expansion of Assam's fisheries sector.

In order to optimise the fish value chain for sustainability, efficiency and equitable growth, the main challenges identified are divided into the following sections:

S. N.	Particulars	Key challenges
1	Fish Seed/ Hatcheries	a. Except in one or two districts, in the remaining districts, there is lack of sufficient infrastructure for fish seed production. b. In Districts such as Morigaon, a large quantity of fish seed is being imported from West Bengal, Odisha (Bhubaneswar) and even from Bangladesh. c. There is scope for improving quality of infrastructure in the existing hatcheries (scientifically designed, layout of hatchery for efficient production). d. Lack of qualified manpower to run hatcheries in a scientific manner. e. Absence of laboratory and veterinary services for disease identification and quality control of fish seed. f. Poor quality of transportation facilities for transportation of seed from hatcheries to farm.
2	Fish Feed	a. Majority of farmers are using mix of locally manufactured and branded fish feed. b. Farmers are not getting training on the requirement of fish feed at different stages, currently they are using the feed quantities as per their experience. c. There is a lack of standardisation of feed, hampering the quality of available feed in the market. d. The high cost of branded seed is making cost of production very high.
3	Fish Rearing	a. Farmers have adopted fish rearing practices, based on their learnings from their own past experiences. Extension and training support is not adequate for the fish farmers. b. The most common source of information and knowledge about fish farming practices is from marketing teams of various companies and input retailers. Most of the marketing executives/field team of different companies are not technically qualified to recommend technical advisory. Their recommendations are mainly influenced by the marketing of their own products. c. Most of the farmers do not adopt to practices of pond preparation in scientific manner. d. Although farmers have not much highlighted incidences of disease or any other infections such as fungus. However, in general farmers do not have sufficient fish medicine support and services. e. In many areas, farmers are facing problems of sufficient water quantity and water quality (in case of use of ground water). f. Overall, farmers are not aware of standard Packages of Practices for rearing of various species of fishes.
4	Transportation & Logistics	a. Lack of standard protocol for transportation of fish (given that the preference in the market is for live fish, many times there is chances of mortality due to poor aeration/circulation of water or over loading of fish in vehicles.) b. Lack of hygiene conditions of vehicles.
5	Marketing	a. Most of the fish farmers sell their pond harvest to local aggregators / middlemen, who intern take the produce to the market. The dependence of farmers on these intermediaries is significant. b. In Assam, most of the fish wholesale markets hardly have any infrastructure for fish handling (e.g. shade, fishponds, running water, waste disposal facility, weighing scales etc.) c. Markets are very unhygienic and poorly maintained. (in some cases, markets are running in make-shift arrangements at road sides). d. Markets are overcrowded during business hrs and have no space for movement and parking of vehicles. e. Although, fishes are marketed through auctioning system, there is hardly any data recorded by state agencies, which can help in creating authentic long-term data for decision making.

3.5.2 Industrial policy

Assam's approach to industrial policy is focusing on enhancing the state's transport infrastructure and bolstering the growth of small and medium enterprises (SMEs), particularly in the rural economy. The policy underscores the importance of improving transport connectivity, including roads, railways, waterways, and air transport, to facilitate the free mobility of goods and inputs, link production units to

markets, and provide access to basic facilities. Despite significant improvements in road length since 2001, challenges remain, such as covering all habitations with all-weather roads. The policy also recognizes the potential of the rural economy, emphasizing the development of small and medium scale agro-processing units, sericulture, horticulture, floriculture, handlooms, and textiles. The goal is to fully leverage the capabilities of small, tiny, micro, and medium enterprises (MSMEs) to drive industrialization in Assam. However, there is a noted gap in assessing the current status of small enterprises and establishing quantifiable targets or indicators to measure progress in both MSMEs and the transport system. To address these gaps and ensure a more comprehensive approach to poverty eradication and industrial development, the policy might benefit from incorporating indicators suggested by the United Nations Inter-Agency Expert Group (UN-IAEG).

Biotechnology_policy-assam_22-27²¹: The Assam Biotechnology Policy emphasizes fostering a dynamic biotech sector through research, innovation, and company establishment. Key strategies include:

- Academic-Industry Linkage: Strengthening the connection between academia and industry to enhance biotech education, skills, and research with financial and technical support.
- Process Simplification for Industry: Streamlining procedures to improve the business environment for biotech ventures, complemented by ease of doing business reforms.
- Infrastructure Development: Setting up state-of-the-art facilities such as biotech parks and incubation centres to aid in biotech product development and commercialization.
- Entrepreneurship Support: Promoting biotech entrepreneurship through technology transfer, business management training, capacity building, and financial incentives to spur company growth.
- These initiatives aim to create a skilled workforce, simplify industry processes, provide necessary infrastructure, and encourage entrepreneurship in the biotech sector.

3.5.3 Value chain survey on fishery

(1) Introduction

The Value Chain Survey for the fisheries sector in Assam is essential to address several critical challenges that hinder its development and sustainability. Despite its rich biodiversity and abundant water bodies, Assam has not fully capitalized on its potential within the fisheries sector. The state ranks 7th among Indian states in inland fishery production, suffering from underutilized production capabilities, low producer income, and inadequate management of resources and infrastructure.

These challenges necessitate a comprehensive analysis to enhance productivity, improve income levels for producers, and ensure efficient resource management. The survey aims to map out the entire supply chain, from production to market, identifying key inefficiencies and opportunities for value addition. By understanding the dynamics of the supply chain, including the roles and profit sharing among different actors and the integration of technologies such as cold chains and mobile fish transport units, stakeholders can implement targeted interventions.

(2) Objective of value chain survey

The objective of the value chain survey in Assam is to thoroughly analyze the fishery supply chain, identifying key actors and profit-sharing mechanisms, assessing value addition at various stages, understanding the needs of the goods market, and proposing intervention for enhancement to meet market demands.

(3) Outline of value chain survey

1) Outline

The survey, planned from February to May 2024, covers all districts in Assam and major consumption area/ states including high end market, and neighboring countries (Bangladesh, Bhutan, etc.), focusing on multiple aspects including stakeholder analysis, supply chain segments, and training needs for quality improvement. The survey targets various fish types, with a particular focus on Borali (catfish) and Catla among others, aiming to evaluate the integration of cold chain facilities, dryer units, and other elements essential for optimizing the supply chain.

²¹ https://www.guwahatibiotechpark.com/wp-content/uploads/2022/07/biotechnology_policy-assam_22-27.pdf

2) Target fish

Natural fish: Borali (catfish)

Aquaculture Production fish: Catla

Small Indigenous Species (SIS): Not restricted to any particular species.

Processed fish: Dried fish

3) Activities

Stakeholder analysis

The stakeholders involved at each stage of the supply chain (producers, aggregators, processors, storage operators, wholesalers, retailers, and consumers) were identified.

Interview survey and focus group discussions.

The following interviews and focus group discussions were conducted.

Stages of Supply Chain	Target Actors and the Number	Supporting Actors
Production	• Fisher: more than 20 per species • Fish farmer: more than 20 per species • Hatchery (fingering producer): 5 per species	Two to three interviews will be conducted with each stakeholder group, including financial institutions and private financial institutions), agri-tech and seafood suppliers, cold chain companies, NGOs, fishery associations, and commerce and industry associations.
Transportation/ brokerage/ wholesale/ storage/ processing (including large and small local suppliers)	• 5 from transportation companies, etc.	
Markets (consumption) Rural financial institutions	• 5 companies from major supermarket chains, food companies, food service industry (restaurants, etc.), hotels, export companies, etc.	
Aqua-tech companies, entrepreneurs	• About 5 companies from village financial institutions (NABARD, private financial institutions, Agri-tech companies, etc.).	

Survey items

The above interviews and focus group discussions will cover the following items.

Stages of Supply Chain	Survey Item	Survey Method
Production	Fishery household: ➤ Finances/economics: financial situation, access to finance ➤ Infrastructure: fishing and aquaculture area, storage facilities and management status, etc. ➤ Institutional: market information, extension services, utilization of government related programs ➤ Technology: production volume, costs and revenues, post-harvest handling, certification, knowledge of GAP, etc. ➤ Economics: destination and price ➤ Farmers' intention: willingness to switch to profitable fisheries/aquaculture, membership in FC (Fisher Cooperative), etc. ➤ Gender: ownership of fishpond, working time of women for agriculture, the worker in each activity of agriculture/marketing, decision-makers involved in agriculture/marketing, who has access to services/information, whether women belong to women's groups (SHGs, FCs, Cooperatives, etc.) or not, whether there is any change in workload (especially of women) in case of conversion to profitable crops, change in income	Individual interviews using questionnaires and group discussions will be conducted.

Stages of Supply Chain	Survey Item	Survey Method
	FC (Fish farmer Cooperative): ➤ Financial: financial situation, access to and use of financial services ➤ Technology: services to fishers and fish farmers, access to extension services and market information ➤ Infrastructure: ownership, maintenance and management status and needs of collection points, primary processing plants and facilities ➤ Organizational management: operational challenges	Interviews with the Executive members of each FC
Transportation	➤ Financing and economics: costs and revenues ➤ Infrastructure: selection criteria and accessibility of collection points ➤ Technology: markets, number of days required for transport, equipment used, and methods of quality maintenance, ➤ Market: volume handled, destination of haulage, challenges, etc. ➤ Gender: gender awareness in transportation work, division of labor by gender, training opportunities for transportation skills, working environment (e.g. presence of separate toilets for men and women, harassment), change in income	• Key informant Interviews • When conducting the survey, it is important to keep in mind that for each species of fish, whether 1) live fish from the river, 2) live fish from wetlands, 3) farm-raised fish, or 4) organic fish are differentiated for distribution and sale.
Intermediary Trader/ Whole Seller	➤ Financing and economics: costs and revenues, purchase price and selling price ➤ Technology: procurement issues, means of obtaining information on producers and collection points, and selection methods ➤ Market: destination and use, evaluation of quality and freshness, customer needs, etc. ➤ Gender: gender awareness in intermediary trade/wholesale work, division of labor by gender, training opportunities for intermediary trade/wholesale skills, working environment (e.g. presence of separate toilets for men and women, harassment), change in income	
Storage	➤ Infrastructure: facility condition, storage capacity and utilization, user profile ➤ Financing and economics: usage costs, profitability, etc. ➤ Gender: gender awareness in storage work, division of labor by gender, training opportunities for storage skills, working environment (e.g. presence of separate toilets for men and women, harassment), change in income	
Processing	➤ Financing and Economics: Profitability ➤ Technology and infrastructure: processing technology, raw material suppliers, raw material quality, processing equipment and facilities ➤ Market: shipping destinations, market needs, etc. ➤ Gender: gender awareness in processing work, division of labor by gender, training opportunities for processing skills, working environment (e.g. presence of separate toilets for men and women, harassment), change in income	

Stages of Supply Chain	Survey Item	Survey Method
Market (Consumption)	➤ Financing/economics: sources and quantities, procurement methods, procurement prices, sales prices ➤ Technology: brand, reputation for seafood, information on suppliers ➤ Market: desired and current quality, customer needs, challenges, etc. ➤ Demand prediction for each crop ➤ Gender: differences in preferences for fish between men and women, fish procurement source (supermarket, market, fishing, etc.), change in income	

4) Target area

Target sites: 26 all districts in Assam and major consumption area/ states including high end market, and neighboring countries (Bangladesh, Bhutan, etc.)

5) Implementation schedule

Survey period

February 2024 -May 2024 (approximately 3.0 months)

Survey schedule

The tentative survey schedule was followings.

	Feb-24				Mar-24				Apr-24				May-24			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Overall survey period																
Overall schedule																
No Work Item																
(1) Prepare a survey plan																
(2) Review and analysis of existing materials and field research																
A) Identify actors in the supply chain																
B) Issues concerning value addition and enhancement of added value at each stage of the supply chain																
C) Profit margin between the actors at each stage of the supply chain																
D) Needs of high-end market																
(4) Field research																
(5) Reporting																

Figure 3- 12 Schedule of Value Chain Survey on Fishery

Source: JICA survey team

(4) Result of value chain survey

In Assam, the value chain for various target fish species, including Natural fish: Borali (catfish), Catla (aquaculture fish production), Small Indigenous Species (SIS), and processed fish: dried fish, involves several distinct stages.

The detailed value chain stages of the target species, including current situation and issues of the various target fishes are provided below.

Aquaculture Fish Production: Catla

Catla is a popular and economically significant freshwater fish species in Assam's aquaculture. It is widely cultivated due to high market demand. Aquaculture of Catla in Assam typically involves pond-based farming due to the region's abundant freshwater resources. Farmers often integrate Catla with other compatible species like Rohu and Mrigal to enhance productivity and optimize resource use.

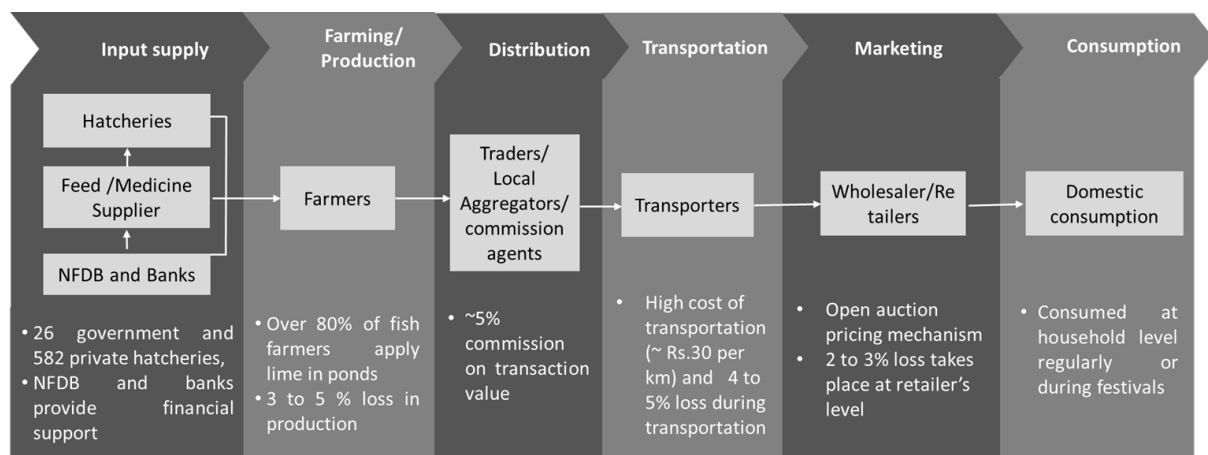


Figure 3- 13 Value chain of aquaculture fish production – Catla

Source: JICA survey team, the report of VC survey

Some of the key features of Catla value chain under aquaculture fish production have been detailed in the below table.

Value chain stage	Current situation	Challenges/Issues
Production	• Catla is the most commonly farmed fish species in Assam. It is well-suited for composite culture in ponds and tanks along with other Indian major carps like Rohu and Mrigal. • Out of 156 respondents, with 66 per cent respondents cultivating Catla in their Aquaculture. Other species include Rohu, Mrigal, Borali, Pangas, Silver Carp, Grass Carp, and local Common Carps. • Majority of fish farmers desilt ponds (43 per cent manually, 38 per cent by machinery). • Family heads often supervise desilting to ensure healthy fish habitats. • Over 80 per cent of fish farmers apply lime in their ponds for cleaning. • Feed is one of the major cost drivers for production of mentioned species with 58 per cent of fish farmers using chemical fertilizers, 10 per cent using cow dung. Also, farmers often use pellet or formulated feeds, supplemented with natural options like rice polish to save costs.	• Lack of consistent water supply in ponds due to limited irrigation facilities. • Fish farmers struggle with rising feed costs (7 Rs. to 40 Rs. per Kg) and low prices offered by aggregators impacting their profits. • Other reported issues include high fish mortality, limited finances, and limited availability of fingerlings for production. • Adverse weather conditions like Flood and droughts impacting fish and seed production. • Lack of knowledge with farmers about appropriate dosage of lime for cleaning ponds.
Transportation	• Live fish are often transported directly from ponds and tanks using mini trucks of approximately 1,000 Kg capacity. • Fish need oxygen-rich water during transport. As per the farmer survey the movement of water by hand helps to keep fish healthy.	• Effective weight of fish transported through Mini trucks is only about 400-500 kg resulting into high transportation cost (~ Rs. 30 per km. • Survey revealed ~ 3 to 5 per cent fish mortality rate during transportation. • A significant shortage of parking spaces in the markets creates

Value chain stage	Current situation	Challenges/Issues
		difficulties for vehicle owners and commuters. • Poor market road infrastructure hinders accessibility and logistic operations and traffic congestions impacting transportation.
Processing	• Catla is typically not processed and sold in local market. At household level, small quantities are consumed, which does not require any processing or storage.	• Not applicable
Distribution	• After being caught or harvested, fish are collected and distributed to local and district level consumers. This involves several intermediaries, including small and big wholesalers, commission agents, small and organized retailers, and transporters. Wholesale Markets: • The majority of wholesalers (90 per cent of respondents in wholesaler category) procure fish from local farmers, while 10 per cent obtain them from aggregators or sources outside the state. • Wholesalers assess the quality of fish by visual inspection or by touching the fish, with freshness as key quality indicators. • Buyers prefer larger size (~2-3 kg) of fish. • Open auction is the key pricing mechanism, with 60 per cent of trade finalised through open auction, while the remaining trade is based on pre-fixed price or mutually agreed spot price. Retail Markets: • Retailers purchase fish from wholesalers and sell them in local fish markets. 45 per cent of retailers are located between 21 and 40 kms away from the market. • Retail fish markets are spread throughout urban and rural areas, making fish accessible to a wide geography in the state. • Many small retailers operate on roadsides, while few small retailers often move around neighbourhoods in rural and semi-urban areas, selling fresh fish door-to-door. This ensures that even those living away from markets have access to fresh fish.	• The majority of fish farmers (76.89 per cent) reported difficulty in obtaining market data (price information, trade volumes etc.) easily and in a timely manner. There is no state-level regulatory organization to consolidate and structure market data, which could otherwise help provide price information to farmers and support better marketing decisions. • Lack of marketing infrastructure for storage, lack of adequate parking spaces near wholesale markets and lack of space for proper seating for traders, and facilities for handling transactions. • Fish wholesale markets are managed by local municipal authorities, resulting in a lack of standardized development protocols and operational guidelines.
Consumption	• Fish is a staple food in Assam, and these three species are among the most popular. However, the consumer preferences vary for Rohu, Catla, and Mrigal. • Fish is integral to various cultural and religious festivals in Assam. Dishes featuring these fish are prepared during Bihu and other local celebrations. Also, families in Assam frequently prepare these fish in traditional recipes such as fish curry, fish tenga (a tangy preparation). • Many local restaurants and roadside eateries specialize in dishes made from these fish, catering to both locals and tourists.	-

The graph below illustrates the price mark-up per kilogram of Catla production, including transportation and marketing costs. Fish harvesting is typically done by the fish farmers' families, or alternatively, the task is outsourced to aggregators. These aggregators also handle the transportation and sale of the fish at market auctions.

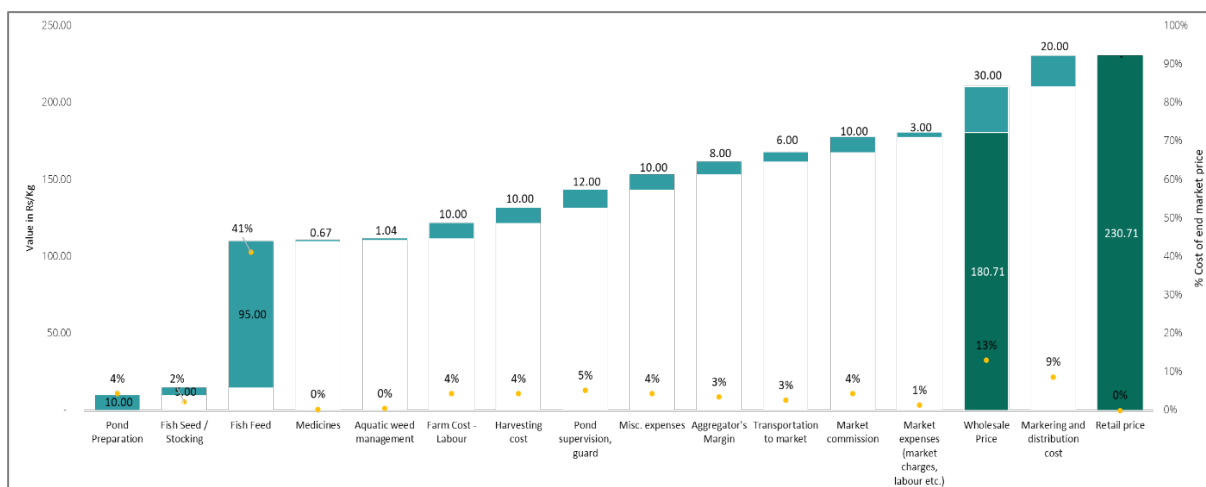


Figure 3- 14 Value chain margin build-up for aquaculture fish production – Catla

Source: JICA survey team, the report of VC survey

In the above value chain diagram, it is indicated that the feed required for the production of Catla in aquaculture in ponds and tanks constitutes approximately 41 per cent of the retail price, which is around Rs. 95 per kilogram. Therefore, the market end price (retail price) is about Rs. 230 per kilogram. Additionally, several other varieties of aquaculture fish found in Assam include Indian Major Carps (Rohu, Mrigal), catfish (Magur), Hilsa, and exotic species like Common Carp, Grass Carp, Silver Carp, and Tilapia.

Capture fishery production: borali (catfish)

Borali, also known as catfish, is a significant species in Assam's riverine fisheries. Borali is primarily found in the Brahmaputra and the Barak River systems, as well as various tributaries and floodplain wetlands.

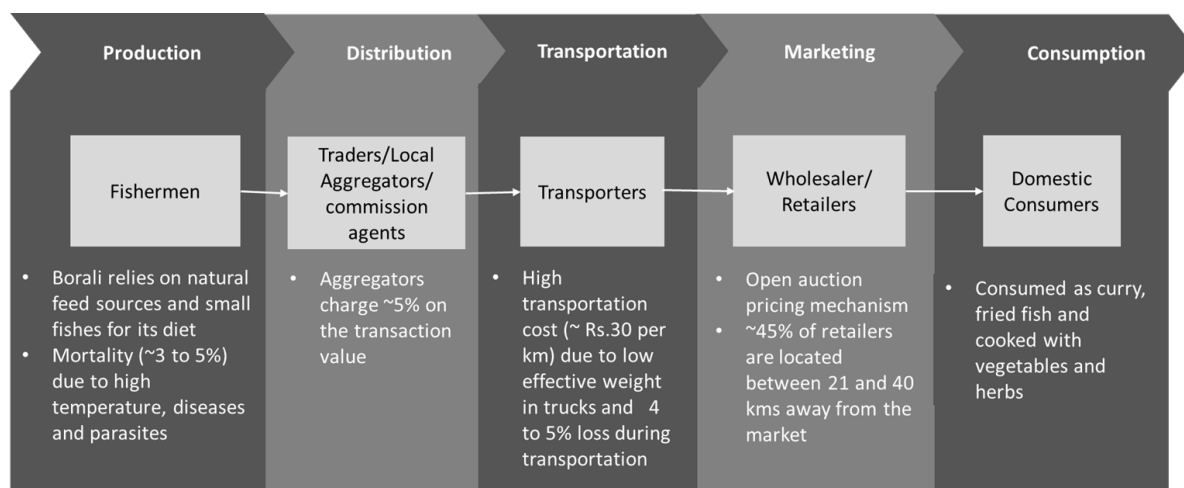


Figure 3- 15 Value chain of capture fishery production - Borali

Source: JICA survey team, the report of VC survey

Some of the key features of Borali value chain under Natural fish production have been detailed in the below table.

Value chain stage	Current situation	Challenges/Issues
Production	- Borali is the less commonly farmed than other fish species (Catla, Rohu, and Mrigal) in Assam. This species is often raised in composite culture systems, with other Indian major carps. - Assam's river systems, including the Brahmaputra and Barak rivers, are significant habitats for Borali fish. - Out of 95 respondents engaged in borali catch, 55 per cent reported borali catch from river, while the remaining from multiple sources (rivers, beel, and public ponds). - Desilting and cleaning activities are not practiced in borali. - Borali is dependent on natural feed, and small fishes.	- Pollution in beels due to waste deposits. - Mortality (~5 per cent) due to high temperature, diseases and parasites.
Transportation	- Transportation practice is same as in case of Indian Major Carps (IMCs). - Few farmers reported use of ice boxes for transportation as time taken in fish catch is sometimes uncertain.	Same challenges as in case of Indian Major Carps
Processing	Borali is typically not processed and sold in local market. At household level, small quantities are consumed, which does not require any processing or storage.	Not applicable
Distribution	- Distribution is similar to IMCs, with some key differences include: - Preferred size: Varies from ~2-4 kg	- The challenges faced by farmers are same as in case of IMC, which include - Absence of state-level regulatory organization to consolidate and structure market data - Lack of marketing infrastructure for storage, lack of adequate parking space near wholesale markets - Lack of space for proper seating for traders, and facilities for handling transactions.
Consumption	- Households regularly purchase Borali due to its versatility in cooking and consumer preference during cultural festivals. It is a common feature in weekly meal. - Borali is also popular in restaurants, where it is featured in various regional dishes. Its demand in eateries contributes to its overall consumption. - Borali is consumed as curry, fried fish and cooked with vegetables and herbs.	-

The graph below illustrates the price mark-up per kilogram of natural Borali production, including transportation and marketing costs. Fish harvesting is typically done by the fishermen, or alternatively, the task is outsourced to aggregators. These aggregators also handle the transportation and sale of the fish at market auctions.

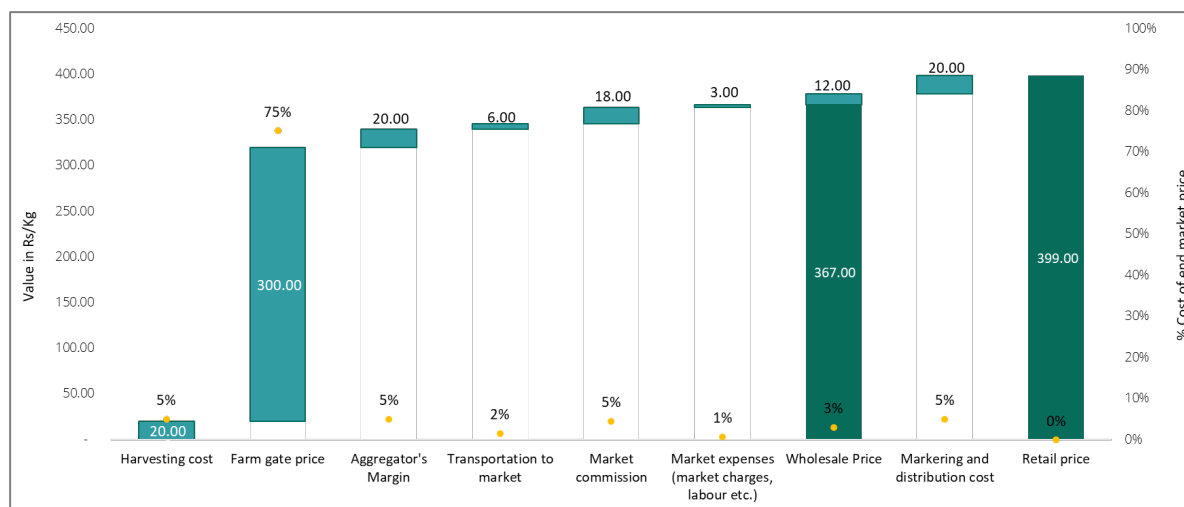


Figure 3- 16 Value chain margin build-up for Natural fish production – Borali
Source: Primary survey, STPL analysis

In the value chain diagram, it is indicated that the farmer's price for Borali (catfish) constitutes 75 per cent of the retail price, which is approximately Rs. 300 per kilogram. Therefore, the market end price (retail price) is about Rs. 400 per kilogram. Additionally, several other varieties of natural fish found in Assam include Indian Major Carps (Rohu, Catla, Mrigal), catfish (Magur), Hilsa, and exotic species like Common Carp, Grass Carp, Silver Carp, and Tilapia.

Small indigenous species (SIS)

Small Indigenous Species (SIS) of fish refer to a group of fish species that are native to specific regions and typically grow to small sizes. These species are particularly important in the context of food security, nutrition, and biodiversity. They are often found in inland water bodies such as rivers, lakes, ponds, and beels/lakes (floodplain wetlands).

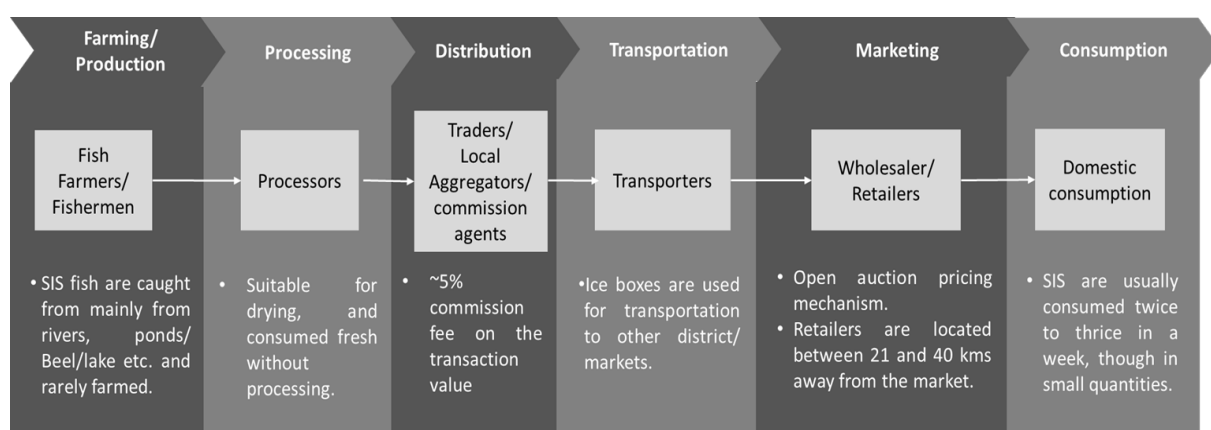


Figure 3- 17 Value chain of Small Indigenous Fish Species
Source: JICA survey team, the report of VC survey

Key Characteristics of Small Indigenous Species (SIS) of Fish have been summarised in the below table.

Value chain stage	Current situation	Challenges/Issues
Production	- Assam has a rich variety of small indigenous fish species (SIS) found in rivers, ponds, and beels. Some of the most common small indigenous fish species are mola, hingra, chenar, local magur, goroi, kawoi, carplet, puthi, chela, darkina etc. - Out of 251 respondents engaged in Small Indigenous Species (SIS) fish catch, 50 per cent reported SIS fish catch from river, while the remaining from multiple sources (pond, beel, etc.). - The small indigenous fish species occur naturally and do not need to be farmed or cultivated. - Desilting and cleaning activities are not practiced in SIS fishes. Also, SIS rely on natural food sources found in water bodies for their sustenance.	- Short lifespan, as SIS face significant threats from larger and medium-sized fishes, resulting in relatively high mortality rates. - Pollution and high-water temperatures also contribute to early disappearance
Transportation	- The fishes are typically consumed locally instead of being transported to other districts or large markets. - Few farmers reported use of ice boxes for transportation to other district/markets as time taken in fish catch is sometimes uncertain.	Because of their low shelf life, they rarely transported to distant markets.
Processing	- Small indigenous fish species are primarily suitable for drying and selling in local markets. - At the household level, small quantities are consumed fresh without the need for processing or storage.	Not applicable
Distribution	Distribution is similar to IMCs; however, the weight of small indigenous fish can vary widely depending on the species. In general, small indigenous fish can weigh anywhere from ~5 gm to 100 gm.	- Lack of availability of ice boxes with farmers, wholesalers, and retailers. - Other general challenges faced by fish farmers, including - Absence of state-level regulatory organization to consolidate and structure market data - Lack of marketing infrastructure for storage - Lack of adequate parking space near wholesale markets - Lack of space for proper seating for traders, and facilities for handling transactions.
Consumption	- The frequency of consumption of fresh fish in Assam vary as per the availability - Dry SIS are usually consumed twice in a week, though in small quantities.	SIS are generally higher priced higher as compared with other fish species; therefore, affordability is an issue for consumers.

The graph below illustrates the price mark-up per kilogram of Small Indigenous Fish Species (SIS) production, including transportation and marketing costs. Fish harvesting is typically done by the fishermen, or alternatively, the task is outsourced to aggregators. These aggregators also handle the transportation and sale of the fish at market auctions.

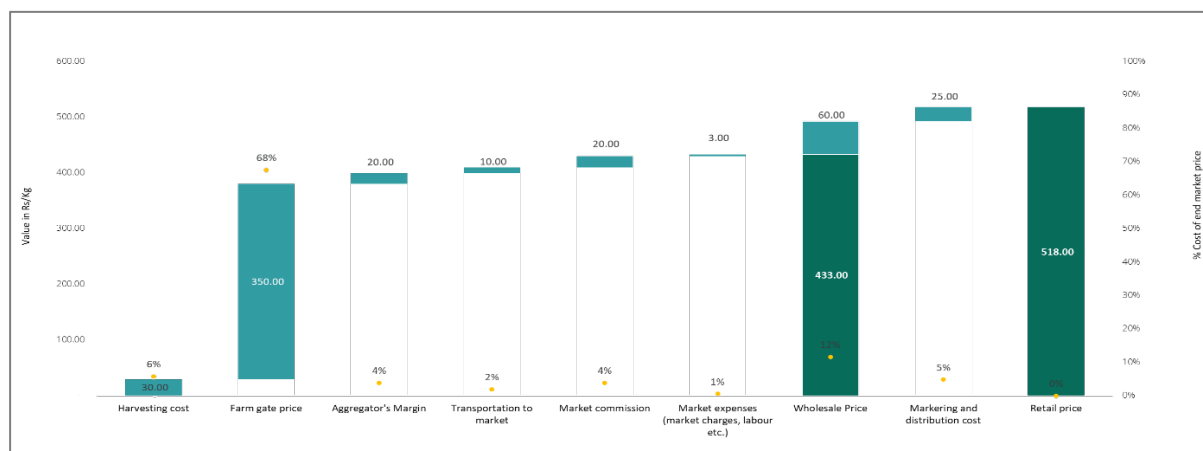


Figure 3- 18 Value chain margin build-up for Small Indigenous Fish Species (SIS)

Source: JICA survey team, the report of VC survey

In the value chain diagram presented above for the fish variety "Puthi," a small indigenous species (SIS) in Assam, it is evident that Puthi holds significant demand due to its integral role in local diets and traditional culinary practices. The diagram indicates that the farmer's price constitutes 68 per cent of the retail price, which is approximately Rs. 350 per kilogram. Consequently, the market end price (retail price) of puthi fish is approximately Rs. 518 per kilogram. Additionally, several other varieties of SIS fishes found in Assam include Mua, Hingra, Chenar, Local Magur, Goroi, and Kawoi etc.

Processed fish: Dried fish

In Assam, dried fish, locally known as "Sukuti" plays a significant role in the diet and economy, particularly in rural areas. The process of drying fish is a traditional method of preservation that allows fish to be stored for extended periods, making it a valuable source of protein and nutrients.

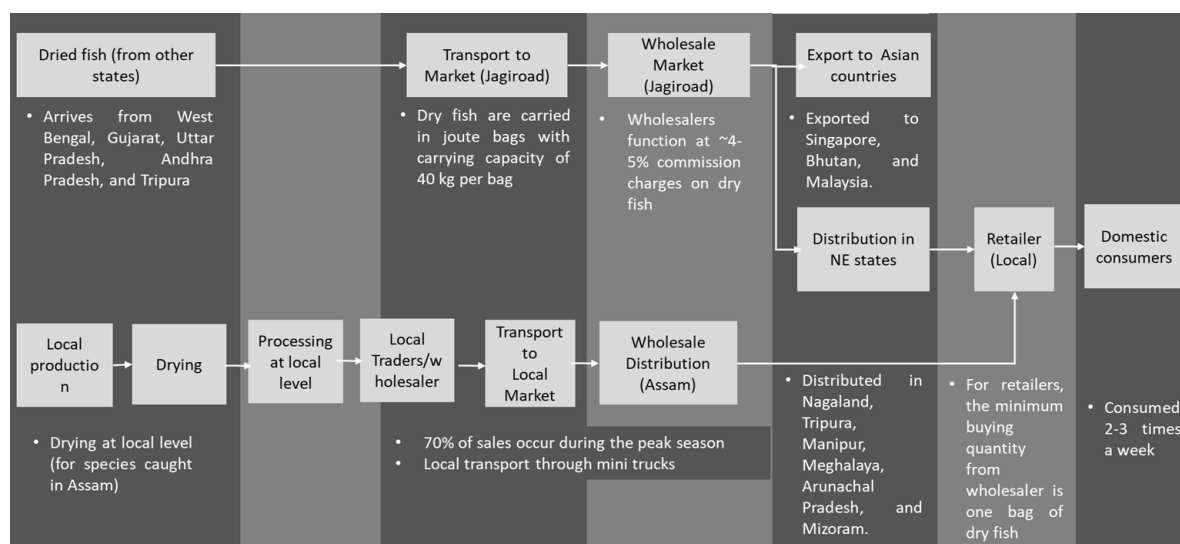


Figure 3- 19 Value chain of processed fish: dried fish

Source: JICA survey team, the report of VC survey

Key characteristics of the dried fish value chain have been summarised in the table below.

Value chain stage	Current situation	Challenges/Issues
Production	• The production of dry fish in Assam is negligible and it arrives in the state from West Bengal (Siliguri district), Gujarat (Porbandar district), Uttar Pradesh (Lucknow and Gorakhpur districts), Andhra Pradesh, and Tripura (Teliamura district). • Major dry fish species coming from aforementioned states include sea fish and freshwater species (e.g. Shidal, chula, malhik, chanda, tokila, tengra, karthi, naru, baril and gehua).	• Limited production in state, coupled with heavy dependence of production on seasonal factors such as monsoons and the availability of fish during specific times of the year. As a result, fluctuations in fish availability affects production volumes and prices.
Transportation	• Fry fish from aforementioned states are brought to a major private dry fish market (Jagiroad Dry fish Market) in Morigaon district of Assam in bulk through trucks. This market typically operates three days a week, from Thursday to Saturday. • The Market is controlled by the Jagiroad Dry Fish Merchants' Associations. • The different marketing channels in the dry fish value chain at the Jagiroad dry fish market in Assam include Dry fish producer, Assemblers, Commission Agents, Wholesalers, Retailers, and Consumers. • Dry fish are carried in jute bags with carrying capacity of 40 kg per bag.	• Dry fish are generally stored in open for approximately two weeks and it gets contaminated thereafter. Therefore, it has to be consumed within two weeks of arrival. Sometimes, these are sold at local level, even at 40-50 per cent loss.
Processing	• Dry fish are processed at a very small level in Assam by few households. Majorly, dry fish from aforementioned state are directly consumed. The only process followed in Assam for dry fish is sun-drying, while for preservation, chemicals (formalin) are generally used.	• No advanced /scientific processing (drying) practice followed, resulting in loss to shelf life by damage of insects/rodents/diseases.
Distribution	• From Assam (Jagiroad Dry fish Market), dried fish are distributed locally and to other North Eastern states (Nagaland, Tripura, Manipur, Meghalaya, Arunachal Pradesh, and Mizoram) except Assam and it is also exported to countries like Singapore, Bhutan, and Malaysia. • The availability of dry fish species fluctuates with each season, wherein winter season offers the maximum species, compared to other seasons. Also, as per the field survey, wholesale demand and supply peak during the winter season. Approx. 70 per cent of sales occur during the peak season, with the remaining 30 per cent during the off-season. • Traders pay Rs. 1000 maintenance cost per truck for transportation. • Wholesalers function at ~4-5 per cent commission charges on dry fish and they occur ~Rs. 10 per kg towards transportation costs. • For retailers, the minimum buying quantity from wholesaler is one bag of dry fish.	• Traders provide dry fish to retailers on credit basis, however, sometimes lack of timely payment from retailers, blocking funds of wholesalers. •

Value chain stage	Current situation	Challenges/Issues
Consumption	- The frequency of consumption of dry fish in Assam is 2-3 times a week, particularly in tribal areas. - At household level, the key products prepared from dry fish include dry fish chutney, curries, and stir-fries. Chutney is consumed along with daily meal and does not require any refrigeration for storage.	As the handling and drying practices are unhygienic, dry fish becomes unsafe for consumption.

The graph below illustrates the price mark-up per kilogram of processed dried fish (locally sourced), including transportation and marketing costs. Fish harvesting is typically done by the fishermen, or alternatively, the task is outsourced to aggregators. These aggregators also handle the transportation and sale of the fish at market auctions.

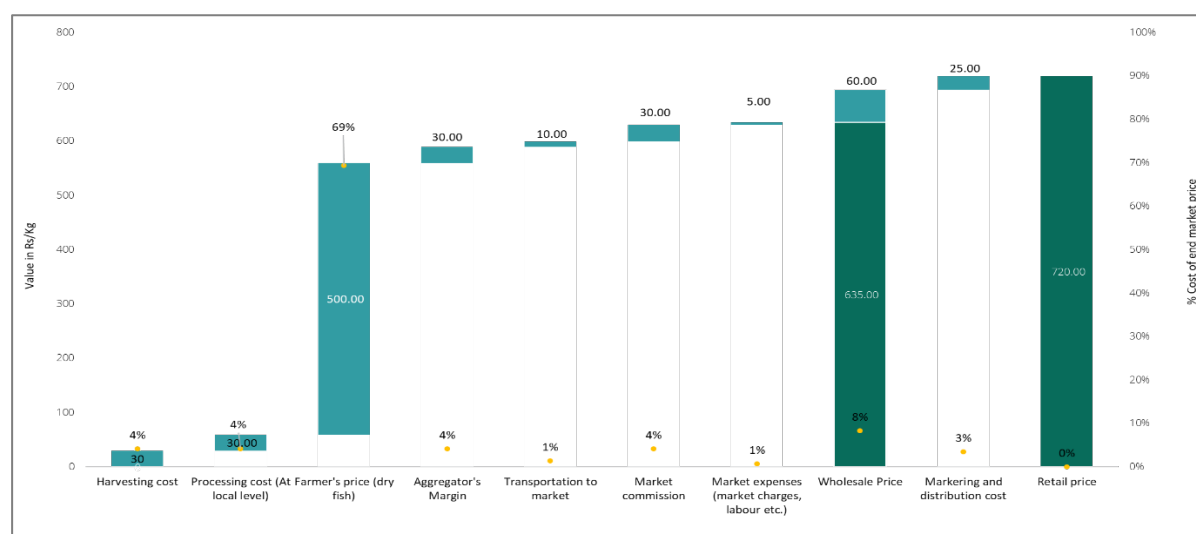


Figure 3- 20 Value chain margin build-up for processed dried fish (locally sourced)

Source: JICA survey team, the report of VC survey

In the value chain diagram presented above for the fish variety "puthi," which is locally referred to as "shidal sutuki" when dried, it is evident that this product is in high demand throughout the northeastern states. The diagram illustrates that the farmer's price constitutes ~69 per cent of the retail price, which is ~Rs. 500 per kilogram. Consequently, the end price of shidal is ~Rs. 720 per kilogram. Additionally, several other varieties of dry fish found in Assam include tengra, moa, koroti, hingara, chula, chanda, tengra, karthi, naru, baril and gehua etc.

For the other survey results, please see.

(5) Recommendation through the results of VC survey

In the pursuit of optimizing the fish value chain for sustainability, efficiency, and equitable growth, the following key recommendations derived through the study of the fish value chain in the state of Assam.

Infrastructure development

The findings of this value-chain study strongly suggest that the state needs to invest in the development of infrastructure such as hatcheries, transportation networks, and processing plants. This ensures that fish can be stored properly and transported efficiently from farms to markets, and increasing overall quality.

Some of the major areas for the infrastructure development for creating an efficient fish value chain in the state of Assam is provided in the following section:

A) Construction and Upgradation of Hatcheries for Fish Seeds

Except in Nagaon and Barpeta districts in the state, which have 125 and 83 hatcheries respectively, in all the remaining districts there is lack of sufficient infrastructure of hatcheries for fish seed production. In districts such as Morigaon, a large quantity of fish seed is being imported from West Bengal (24 South Pargana district), Odisha (Bhubaneswar), and even from Bangladesh. It is pertinent to note that there are only 608 hatcheries in the state with an annual installed capacity of 20,843 million fish seed. Out of the 608 hatcheries, 582 are managed by private operators while only 26 hatcheries are being managed by the state government. Scientifically designed hatcheries must be established in enough numbers in all the remaining 33 districts with adequate capacities to meet the demand for fish seeds, essential for the advancement of aquaculture.

In addition, there is a huge scope for improving quality of infrastructure in the existing hatcheries. The existing hatcheries need to be modified as per the scientific design and the layout for efficient production of fish seeds. This requires the hatcheries having a separate broods' stock pond, breeding tank, hatching/incubation tank, spawn receiving chamber, conditioning tank, overhead water tank, packaging and storage unit, power backup, and security fencing so that proper upkeep of fish seeds can be done.

B) Provision of Laboratory Services for Quality Control of Fish Seeds

Quality of fish seed is one of the important factors that affects production and returns in pond fish farming. Inadequate quality brood stock, poor quality fish seed prone to diseases are some important factors that affect the quality and quantity of the fish produced leading to poor returns to the fish farmers. Quality here refers to the general health, relative size and other physical and physiological characteristics of the fish.

It was noted during the visits to the hatcheries that people managing the hatcheries had no basic idea about brood stock management such as recruitment of new breeders at periodic intervals in the stock, and their proper feeding. The use of undesirable size of brood fish and generations of mating the related spawners from a small population lead to unconscious negative selection and deterioration in quality of fish seeds.

To check the quality of fish seeds being produced in the hatcheries, laboratory services need to be provided in each district in the state so that quality of seeds can be checked at regular interval. In the absence of quality testing, the quality of fish seeds deteriorates over time.

C) Provision of Veterinary Services

The veterinarian with experience in preventive medicine can help the fish farmers reduce losses and enhance their profits. The study has highlighted the fact that there is minimal presence of veterinary services for disease identification and quality control of fish seed. Although fish farmers have highlighted very few incidences of disease or any other infections such as fungus however, in general farmers do not have sufficient fish medicine support and services.

Provision of veterinary services needs to be taken up in priority to provide necessary support to the fish farmers to reduce incidence of diseases and mortality thereby increasing their profit.

D) Transportation

Poor quality of transportation facilities for transportation of seed from hatcheries to farm has been noted during the study in the state. There is lack of standard protocol for transportation of fish and seeds. Given the preference in the market is for live fish, there is often a high likelihood of mortality due to poor aeration/circulation of water or over loading of fish in general vehicles leading to lower returns as well as contamination and other public health issues.

Live fish is generally transported through open vans or trucks. Fish transportation by open van or truck needs to be curbed and curtailed and gradually banned in the state for quality management purposes. Only insulated or refrigerated fish vans needs to be permitted for transportation of seeds and fish.

Capacity building

While the fishery sector has experienced significant expansion over time in the state, there has been a notable absence of emphasis on skill development, and it is still dependent on traditional techniques. Farmers have adopted fish rearing practices, based on their learnings from their own past experiences. The most common source of information and knowledge about fish farming practices is from marketing teams of various companies and input retailers. Most of the marketing executives/field team of different companies are not technically qualified to recommend technical advisory. Their recommendations are mainly influenced by the marketing of their own products.

Consequently, in the absence of modern and scientific techniques of fish farming in the state, necessary for enhanced efficiency, hygiene, and process optimization, the fish farmers continue to suffer from deficiencies leading to lower rate of returns.

I) Training on Sustainable Fish Farming Practices

Training for fish farmers on modern and sustainable aquaculture practices including proper feeding, disease management, weed management, water quality management is bound to play an important role in the entire fish value chain. This will improve productivity and quality while minimizing environmental impact. An increase in production could be achieved by training producers in resource-conserving and efficient pond management in combination with improved access to high-quality fingerlings and feed. This should cover the following areas:

A) Pond Management Practices and Construction

Assam boasts of thousands of family-owned small-sized ponds and tanks. The period from 2019 to 2023 has been marked by significant growth in fish production under ponds and tanks in Assam. The number of ponds and tanks, the area under fish farming, and the production volume have all increased, reflecting a robust expansion of the sector.

Almost one out of five fish farmers were not conducting any pond management practices like desilting the pond indicating potential gaps in maintenance practices that could impact pond health and productivity. Farmers are also using lime without knowing the right quantity of lime to be used for the maintenance of the pond. Farmers use chemical fertilizers like potash and urea, around 10 per cent use natural cow dung fertilizer, and approximately 30 per cent do not use any fertilization in their ponds and tanks.

All these practices highlight towards the fact that it is important to provide training to fish farmers in the state on scientific knowledge on pond farming practices for sustainable aquaculture.

The training should also cover scientific construction of suitable ponds (having gentle slopes, reliable water sources for continued water availability, water level, soil quality, access to road and electricity etc.) and management practices.

B) Feed Management

Feed accounts for the major part of the production cost in fish farming in the state of Assam, as responded by majority of the farmers during the study. Therefore, management of feed is very crucial to reduce the cost of production by minimising feed cost and invest enough to get maximum fish production.

Natural feed is the most essential and cost-effective produced feed by using manures which is locally available along with appropriate plankton density. In addition, there are farm made feed and complete feeds are also available for improved fish production.

Fish farmers have not received any orientation or training on the appropriate feed management practices in the state due to which productivity is less. Training on proper feed management is critical for the farmers.

In addition, government also needs to promote production of farm made feed and complete feed at subsidized rates to the farmers to reduce their cost as feed is one of the major contributors of high production cost of fish in the state.

C) Disease Management

Almost one third of the farmer respondents expressed that they utilize medicine but lack proper knowledge regarding its application while remaining are not using any medicine. This highlights a need for improved education and guidance in disease management practices among fish farmers for appropriate usage of medicine for minor diseases and their management. Provision of vet services, as highlighted above, is also needed for the same reason.

D) Water Quality Management

Water quality management has been found to be a grey area during the study. Majority of the fish farmers are either not engaged in water quality management or depend on rainfall for the same considering it aids the water quality management thus, citing a lack of knowledge as a primary reason behind this. Training on water quality management is thus necessary for the fish farmers in the state.

E) Hygiene Management

The research findings highlight a critical absence of hygiene practices within the fish supply chain across the state. It's evident that microbial contamination stands as the primary reason behind fish quality deterioration, emphasizing the urgency to curb bacterial growth and pathogen contamination. Thus, the training of farmers need to focus on hygienic post-harvest handling of fish. By enforcing hygienic fish handling protocols, the microbial expansion can be effectively mitigated to extend the shelf life of fish products. Adhering to these practices not only ensures the delivery of safe and high-quality fish to consumers but also aligns with the standards set by national and international food safety regulatory authorities.

II) Capacity building of hatcheries' staff

There is a lack of qualified manpower to run hatcheries in a scientific manner as they follow traditional systems of breeding. The traditional system affects the level of seed production, lowers business profit, and leads to low quality seed. Training of manpower engaged currently in hatcheries needs to be done to improve fish breeding practices for efficient production of fish seeds. They also need to be trained on proper transportation of fish seeds to fish farmers to maintain the quality of seeds.

Making irrigation water available for fish farmers

Lack of reliable irrigation system has been found to be one of the major barriers in the promotion of aquaculture in the state. In view of this, to support the fish farmers in the state, it would be helpful to strengthen the irrigation channels in the state to provide reliable water sources for fish farming. Though this is a long drawn and capital-intensive process depending upon the initiatives by a different department however, this is one of the most critical infrastructure requirements for the fishery sector in the state. The state is rich in water however, despite this, fish farmers face shortages of water after the monsoon season.

Marketing and market linkages

In the state of Assam, fish value chain actors are usually divided into two segments: production and marketing. In the overall fish value chain, fish farmers are the main actors; in the production part, hatchery operators are the key actors, while fish wholesalers are the key actors in the marketing segment.

Most of the fish farmers sell their pond harvest to local aggregators/ middlemen, who intern take the produce to the market. In Assam, the main constraints at primary markets are lack of bargaining power and market information. The marketing infrastructure, including cold storage, ice and transport facilities are generally inadequate, unhygienic and in poor condition. In general, conditions in primary and retail markets are far from satisfactory with regard to: stalls, sanitation, drainage and management. In some cases, markets are running in make-shift arrangements at roadsides and are overcrowded during business hours and have no space for movement and parking of vehicles. Although, the fishes are marketed through auctioning system, however, there is hardly any data recorded by state agencies, which can help in creating authentic long-term data for decision making.

The market infrastructure needs to be improved for smooth sell and purchase by buyers and sellers.

Digital advisory services with regard to prevailing market prices in the retail and wholesale markets can help farmers to harvest and supply accordingly to ensure better returns to their produce.

In addition, there is a huge scope of exploring markets in the nearby states for the locally grown fish in Assam for better price realization to the fish farmers. This will reduce the pressure on the fish farmers to sell their produce at lower prices. State government needs to take a lead in exploring bigger markets in the nearby states to ensure fish farmers in the state has access to wider markets outside the state. To make this successful, transportation and other logistics for safe transportation in the insulated vans need to be arranged by the state government or private players.

Promotion of value-added products

Currently, the focus on value added products in the fishery sector is very low due to which mostly the live fish is being sold in the local market. The state needs to encourage the development and promotion of value-added fish products such as smoked fish, fish fillets, and fish-based snacks. This adds value to the fishery chain and creates additional income streams for farmers and processors.

Increasing access to finance

9 out of 10 respondents expressed that they lack access to finances, during the primary interactions. It is important to facilitate access to credit and financial services for small-scale fish farmers and entrepreneurs. This will enable them to invest in equipment, infrastructure, and technology upgrades to improve their operations and competitiveness.

Use of data analytics and AI in fish farm management

Data analytics, artificial intelligence, and machine learning have a huge potential to strengthen the fish value chain by reducing costs and increasing profit margin of fish farmers. Data analytics has become indispensable in farm management systems, particularly in the realm of aquaculture. Through the use of IoT devices and sensors, vital information concerning water quality, oxygen levels, and feed management is continuously collected on aquaculture farms. By carefully analysing this data, farmers can acquire invaluable insights into the condition and welfare of their fish populations, empowering them to take proactive measures to avert disease outbreaks and enhance feed efficiency. Embracing this data-driven methodology not only mitigates production risks but also translates to significant cost savings for farmers.

Government support and policy reforms

Provide policy support, subsidies, and incentives to encourage investment and growth in the fishery sector. This includes streamlining regulatory processes, providing tax incentives, and allocating funds for sector-specific development programs.

Inclusive business model

Some of the value-added products in fishery sector provides huge scope of promoting inclusive business in the state. Dry fish market is one such value-added product which has a large market in India and also outside the country as India is an exporter of dry fish.

In addition to core activities for drying the fish, there are number of service support to the value chain of dry fish such as input suppliers at processing centre including, fish farmers who supplies wet fishes to the processors, suppliers of salt, ice, packaging materials, plastics, bags, bamboo, rubbers, medicines etc. The labourers, transporters, insurance companies provide insurance during transit, financial institutions and communication services. These service supports are crucial to all stages of the value chain of dry fish.

Hence, the entrepreneurial opportunities involved in fishery sector have to be explored and utilized through entrepreneurial motivation, technology empowerment, skill up-gradation through different management techniques and sustenance mechanism.

Integrated business model

The majority of fish farmers in the state face resource constraints and employ diverse strategies to acquire production inputs. A significant initiative to cater to this problem involves the adoption of an integrated business model, wherein the private sector collaborates with fish farmers through contractual agreements. This approach facilitates a symbiotic relationship between private investors and fish farmers, addressing market imperfections and ensuring timely access to inputs, production services, credit facilities, and other essential resources. Such integrated business models play a pivotal role in enhancing the efficiency and effectiveness of the value chain while bolstering the resilience of small-scale fish farmers.

In this case, local level private hatcheries can tie up with fish farmers in the vicinity and provide fish seeds to them and also other needed inputs, if required, with an arrangement to buy back the produce ensuring a margin of profit to the farmers. This arrangement meets the major challenges related to access of finance and market and also ensures a profit of margin to fish farmers. The hatcheries buy back the fish from the farmers and forward the entire lot to local retailers or aggregators as the case may be.

3.5.4 Pilot project

(1) Introduction

JICA loan project plans to include digital transformation (DX) technology and the promotion of startups and private partnerships as key elements. To verify the benefits and challenges of DX and the inclusion of startups in Assam state, pilot projects have planned to be implemented during this feasibility study period. The pilot projects aim to provide some on-the ground insights and implications that can be reflected into JICA loan project planning and implementation.

(2) Objective and pilot projects

The objective of the pilot projects under this survey has been set as to verify the feasibility and usefulness of digital technologies for stakeholders of fishery industry in the state. To achieve this objective, the following pilot projects have been implemented to verify 2 different types of digital technologies for production and value chain stages, respectively;

Pilot Project-1: Utilization of Mobile Farm Recording App in Aquaculture Management

Pilot Project-2: Utilization of E-commerce platforms for online sales

(3) Outline of pilot projects

1) Pilot Project-1: Utilization of Mobile Farm Recording App in Aquaculture Management

Outline

Pilot Project-1 targets on the utilization of mobile farm recording app in aquaculture management. In general, farm recording enables farmers to comprehend the productivity and profitability of the farm, so that it leads to better decision making on farm management (farm planning, procurement of necessary inputs, etc.). To make it efficient and easy to record through digital technology, some startups and projects have developed mobile apps for farm record keeping in online basis.

Out of these apps developed in India, this pilot project has selected the technology developed by GIZ SAFAL project. GIZ project utilized open online-survey software “Kobo-collect” to keep farm recording data from beneficiaries. While GIZ project has developed the mechanism to collect data, the utilization of farm recording data and extension of the activities have not been implemented yet. In this background, this pilot project aims to verify the effectiveness of the farm recording technology and the potential to extend to the wide range of the areas in Assam state.

Digital Technology to be verified in Pilot Project-1

This Pilot Project-1 verifies mobile farm recording system “FIRMS” developed by GIZ project. The system of the recording is; 1. Farmers or CRPs input farm record information through open software “Kobo-collect” in regular basis. 2. The collected data will be monitored and utilized by administrators, including board members of the cooperative, through open monitoring system “Kobo toolbox”.

The contents of farm recording include 2 parts; basic information (farmers' information, pond information, location, type of businesses, etc.) and farm recording information (expenditure, working hour, feeding, fish stock, water testing result, etc.), following the hard-copy farm record book.

Activities

Activity 1-1: Training and dissemination of aquaculture records in aquaculture industry

Conduct on-site digitalization training with using the GIZ Development Aquaculture Management System (FIRMS) for members of the Champabati Fisheries Cooperative, facilitated by Community Resource Persons (CRPs) selected from among the members. Aside from the organization of trainings, CRPs will conduct regular visits to members on-site (every 2 weeks) to encourage the use of digital tools.

Activity 1-2: Data analysis and assessment of usability

Analyze data collected by FIRMS to evaluate the potential use for improving aquaculture practices at individual farms, enhancing collective benefits as a fisheries cooperative, and assessing the value for dissemination activities and government policies monitoring.

Activity 1-3: Implementation of surveys and evaluation/recommendations

Conduct in-depth interviews with CRPs, participating farmers, and fisheries cooperatives, as well as a survey of over 100 individuals to analyze usability, effectiveness of digitalization in production history records, and the impact of dissemination activities.

Activity 1-4: Organization of seminar

Organize a seminar to report on achievements, future challenges, etc., targeting government officials, industry stakeholders, etc. (approximately 50 individuals), and gather feedback.

Target area and implementation structure

[Target Area]

Morigaon district

[Target Farmers]

400 Farmers and 20 CRPs (Community Resource Persons) in Champabati Fish Farmer Cooperative

[Implementation Structure]

JICA Survey team: Management and Evaluation of overall activities

ICCSPL (sub-contractor): Implementation of pilot activities

GIZ SAFAL project: Technical support, coordination of JICA survey team and stakeholders

Implementation schedule

March 2024: Planning and Preparation of Pilot Projects

March to June 2024: Implementation of Pilot Projects (Training, Data collection, Analysis)

June to July 2024: Review of the Results

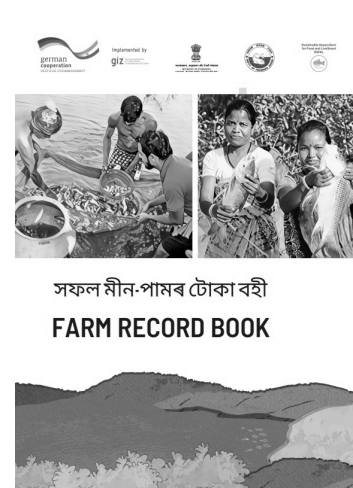


Figure 3- 21 Farm Record Book of GIZ SAFAL Project
Source: SWIFT project

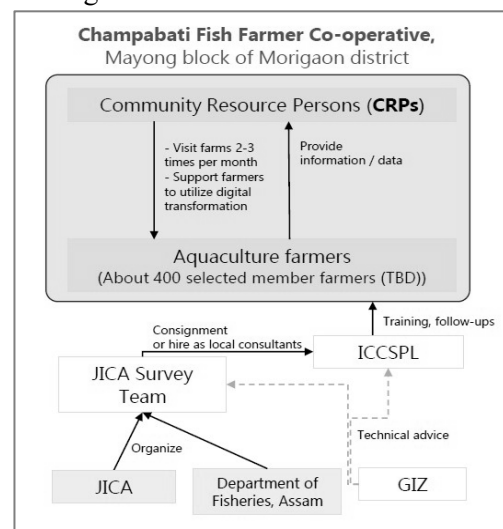


Figure 3- 22 Implementation Structure of pilot project
source: JICA survey team

Table 3 - 21 Schedule of Pilot Project for Utilization of Mobile Farm Record App

Month	Feb				Mar				Apr					May				June			
Week	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4
Planning																					
Planning																					
Familiarize with FIRMS																					
Preparation, recruiting																					
Farm-level DX																					
Kick-off																					
Farmer support																					
Analysis of data																					
Re-cap Training																					
Re-cap training prep																					
Re-cap on-site Training																					
Analysis of interventions																					
Summarize the results of interventions																					
Finalizing the report																					
Analysis of interventions																					
Preparation for a seminar																					
Conduct a seminar																					

2) Pilot Project-2: Utilization of E-commerce platforms for online sales

Outline

Pilot Project-2 targets on the utilization of E-commerce platforms for online sales. The E-commerce platform is a digital platform to all farmers, buyer-sellers, and government authorities to operate trading activities of fishes and fishery products on real time and anytime anywhere basis. Some fishery related startups have developed their own EC website and started businesses for online trading. In addition, aside from those startups dealing fishery products, there are some of the online platforms by large capital companies (Amazon.in, Bigbasket, etc.), covering the trades of fishery products in wide regions of India.

In this pilot project, some FPOs have been selected to conduct trial of online sales of fishery products (fingerling, fish, processed products). Through this pilot projects, the effectiveness of E-commerce platform, especially profitability will be verified.

Digital technology to be verified in pilot project-2

This Pilot Project-2 verifies 2 different types of E-commerce platforms, “Fish Waale” and “Indiamart”. The key features of those platforms can be summarised as follows;

Table 3 - 22 Key Features of E-commerce Platforms

Platform	Fishery Commodities	Area	Business model	Link
FishWaale	Input materials, fish feeds, fish, processed products, etc.	Assam	BtoB / BtoC	https://www.fishwaale.com/
Indiamart	Fresh fish, seafood, processed product, fish seeds, etc.	Nationwide	BtoB	https://dir.indiamart.com/indianexporters/ag_marin.html

Activities

Activity2-1: Utilization of online sales platforms

Target 1-2 groups (FPCs) producing fishery products, including fingerlings, fishes, processed products
Support the posting of products on online markets (FishWaale, Indiamart, etc.).

Activity2-2: Analysis of the usefulness of online sales platforms

Compare E-commerce platforms and online/offline sales

Analyze cost-benefits of online and offline sales with daily or weekly sales records

Conduct interviews with participating producer groups to analyze the usefulness of online sales, as well as any barriers to implementation.

Activity2-3:Report at seminars

Present a report on the achievements of online market sales at the seminar conducted in Activity 1-4.

Target area and implementation structure

[Target area]

Morigaon district

[Target farmers]

2 FPCs (one is producing fingerlings/fish, and the other is producing processed products)

[Implementation Structure]

JICA survey team: Management and Verification of overall pilot activities

National Staff: Implementation of planned activities

Aquablue (E-commerce service provider): Technical support

Implementation schedule

March 2024: Planning and Preparation of Pilot Projects

March to June 2024: Implementation of Pilot Projects (Online, Data collection, Analysis, etc.)

June to July 2024: Review of the Results

(4) Activity reports of pilot projects

1) Pilot project-1: Utilization of Mobile Farm Recording App in Aquaculture Management

The following activities were conducted under Pilot Project for utilization of Mobile Farm Recording App.

Table 3 - 23 Activity reports of pilot project-1

Activities	Works done
Pilot Project-1: Utilization of Mobile Farm Recording App in Aquaculture Management	
Activity 1-1: Training and dissemination of aquaculture records in aquaculture industry	- (as of June 2024) 20+ CRPs supported 441 farmers have registered their basic information (form#1) into the system, which include the data collected in GIZ SAFAL project. (1 CRP supports 25 farmers in average) - The Survey team explained and discussed with CRPs and the cooperative about the program - Identified 14 CRPs who want to join this program. - CRPs conducted door-to-door visits and collected data to the Kobo Collect App. - In total, more than 500 farm activity recording data has been inputted and stored in the system. (as of June, 2024) - In addition to data inputs, field trainings from CRPs to farmers have been implemented to encourage them to keep farm records twice during the pilot program period. - The seminars has been organized focusing on CRPs' data collection and updates, incorporating feedback from previous sessions to enhance effectiveness and relevance.
Activity1-2: Data analysis and assessment of usability	- The collected data, above mentioned, has been stored in the management system “Kobo Toolbox”, which can be referred to only with the given license. - GIZ project has conducted the analysis of the collected data, which can be taken over to JICA survey team. Survey team have been granted access to the login credentials by the GIZ project. Currently, we are in the process of analyzing the results. - The intensive analysis has been conducted with integrating the upcoming input data. (showed in the following part) - The project gathered feedback from CRPs and review the project's outcomes.
Activity1-3: Implementation of surveys and evaluation/recommendations	- The basic survey to capture the current status of usage of farm records was conducted in April. (The results are summarized in the following part.) - Follow-up surveys or assessments have been implemented to track changes in farm record usage over time and measure the impact of interventions implemented based on the initial survey results.
Activity1-4: Organizing seminars	- The seminar was organized on June 28th, 2024 to get feedback from government officers and stakeholders in pilot projects. (as described in the following part)

Farm recording process and items: The basic recording process is; 1) Farmers regularly record their activities in “Farm Record Book”, 2) CRPs input their data into “Kobo-collect” on behalf of farmers, with referring to their “Farm Record Book”. Therefore, the items for recording basically follow the contents of the book; Chapter 1 Culture Pond Information, Chapter 2 Expenditures,

Chapter 3 Keeping track on working hours, Chapter 4 Keeping track on feeding, Chapter 5 Keeping track on fish stock, Chapter 6 Risk Tracking, Chapter 7 Water testing and Chapter 8 Visitor's book.

Figure 3- 23 Data input screen of Kobo-Collect

Source: Kobo Collect

2) Pilot project-2: Utilization of E-commerce Platforms for Online Sales

The following activities were conducted under Pilot Project for utilization of E-commerce Platforms.

Table 3 - 24 Activity reports of pilot project-2

Activities	Works done
Pilot Project-2: Utilization of E-commerce Platforms for Online Sales	
Activity2-1: Utilization of online sales platforms	- The FPCs to conduct trial of online sales and the E-commerce platforms to be used have been selected through the discussions. - In May, FPCs listed their products on the e-fish market app. - Online sales primarily focused on processed fish products and fish culturing, meat and spawns. - Despite receiving orders, fulfillment was hindered due to unforeseen circumstances. Nevertheless, both FPCs regularly sell their produce in offline markets. - Monitor the progress closely and regularly review the performance of online sales to ensure timely and successful order fulfillment in the future.
Activity2-2: Analysis of the usefulness of online sales platforms	- The monitoring has been conducted in a regular basis. - The supplemental interview survey was conducted to grasp the current market situation in online trade.
Activity2-3: Reporting at seminars	- The seminar was organized on June 28th, 2024. (as described in the following part)

Products in online platforms:

One farmer selling fish and fingerlings chose FishWaale for online sale. The other farmer selling fishery products tried to register FishWaale, Indiamart and Facebook market. However, due to some registration issues, she did not realize to post her products in Indiamart. Thus, only Fishwaale and Facebook mart were used.



Figure 3- 24 Technical Instruction and Online Posted Products

3) Final seminar

As the wrap-up of the pilot projects, the seminar was organized to share their outputs and findings. The outline of final seminar is as follows. As the result of the discussions, the explanations and suggestions from JICA survey team were in principle accepted by the government officials and the participants

Table 3 - 25 Outline of Final Seminar

Objective	- To share insights into the implementation process of the pilot project conducted by ICCSPL - To set the context for the discussions on digital record-keeping and online sales channels in aquaculture. - To present the findings and outcomes of the pilot project on digital record entry for aquaculture - To assess the effectiveness of digital record-keeping practices among farmers associated with the Champavati Cooperative. - To explore how these technologies can be scaled and adapted for smallholders in different regions. - To discuss challenges faced and solutions implemented during the pilot project. - To provide a platform for selected startups and businesses to showcase their innovative technologies and solutions relevant to aquaculture. - To gather feedback and suggestions for future initiatives and projects in digital aquaculture.
Venue	DoF Conference Room
Participants	Total of about 50 persons (including government officials, cooperatives & industry representatives, JICA survey team members, private companies, etc.)
Period	28 June, 2024

(5) Outputs of pilot projects

1) Pilot Project-1: Utilization of Mobile Farm Recording App in Aquaculture Management

[Famer Digital Recoding Support Structure] After the explanation and discussion with 20+ CRPs and the cooperative, 19 CRPs shown interests. Among them, 14 CRPs actually joined this pilot program, and 10 of them are relatively worked actively. Then, 10 CRPs average supported 19 farmers out of 25 farmers in their group. Some of their group farmers didn't show any interest in digital recording. As a result, 354 farm activity recoding data in total has been inputted and stored in the system. CRPs conducted door-to-door visit and data inputs have been continuously taken by CRPs and farmers with the support of ICCSPL.

As a result, although it is difficult to get all farmers to take digital records, (1) aquaculture farmers in Assam have an understanding of the importance of record keeping and some experience with offline record keeping, (2) among them, there is a certain segment (about half in the target CRPs) who are interested in digital record keeping, (3) it is possible to visit individual farmers and collect data, and if these individuals can be recruited as community leaders and provided with appropriate training and a small incentive.

[Digital System] The digital system, introduced in GIZ program, has utilized the open software "Kobo collect/toolbox". This software enables users to collect information from the target beneficiaries through the digital survey. The contents of input data have been organized, referring to "Farm Record Book", developed by GIZ. The input data collected has been automatically transferred to the database "Kobo toolbox", in which we can refer to the raw input data or simple figures. Thereafter, the collected data has been further analysed in the excel to generate the tables and figures.

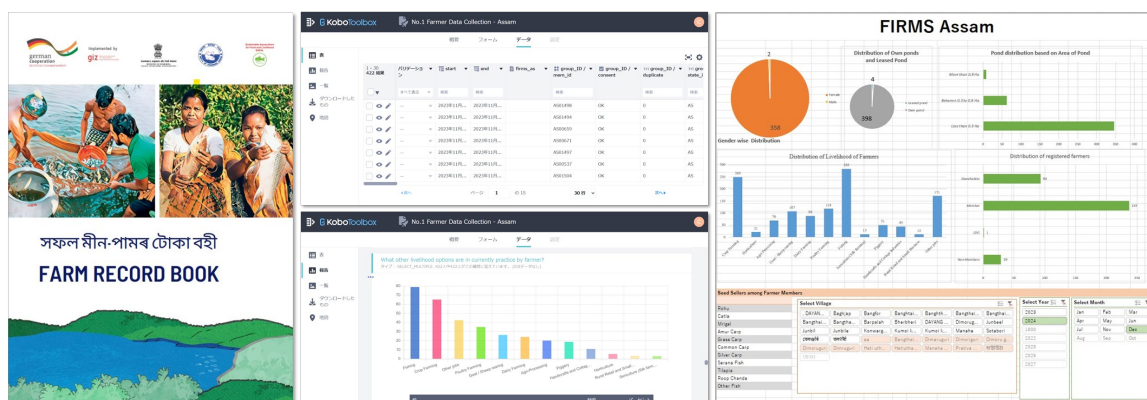


Figure 3- 25 Digital System of GIZ SAFAL Project

Source: SAFAL project

[Data Analysis] The collected data consists of 2 contents. The first one is the basic information of cooperative members. The second is the record of farming activities.

Form-1: Basic Information of Farmers: Basic information of farmers includes the following data; farmer name, gender, phone number, location, years of experience, no. of ponds, livelihood options, role in cooperative, name of CRPs, etc. The table shows some examples of the data in form-1.

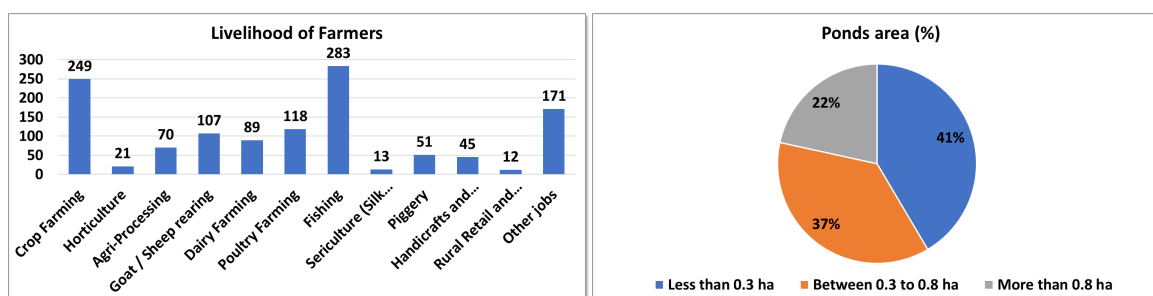


Figure 3- 26 Outputs of Farm Recording App: Form-1

Form-2: Record of Farming: Here is the data of farming activities. This form requires farmers to input data in a regular basis, like monthly or biweekly. The data includes input date, main activities in the month (trainings, input, services, farm record book update, sampling harvest, GPS), field activities in the month (netting, pumping, etc.), types of purchased input, the harvest species, etc. The table below shows some of the examples in form-2.

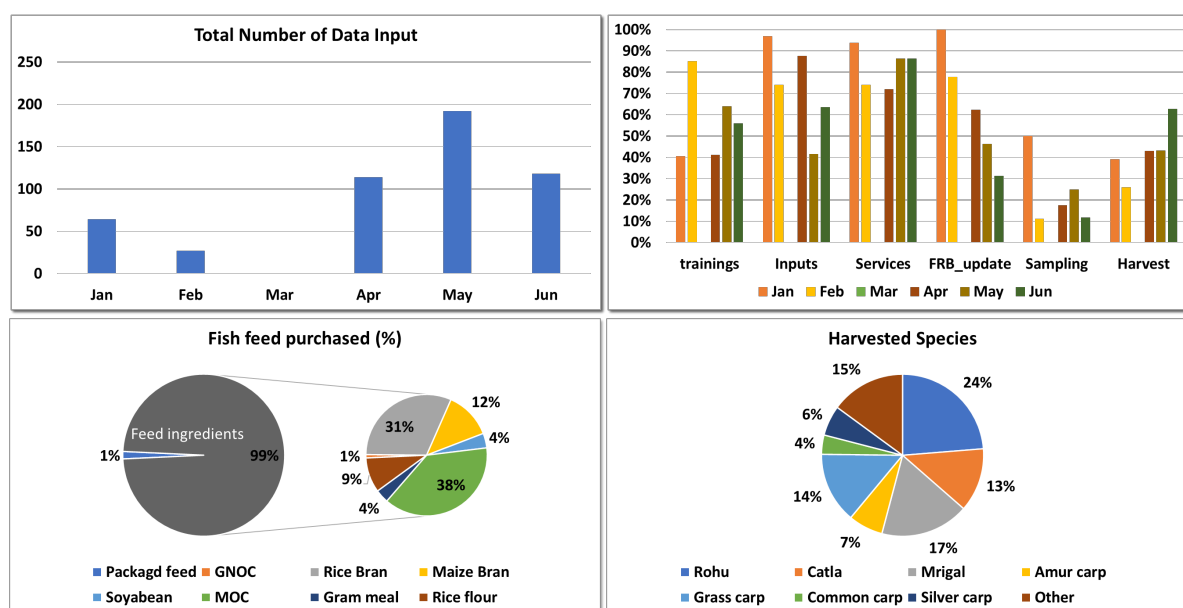


Figure 3- 27 Outputs of Farm Recording App: Form-2

[Interview Survey Results] Farmer Interview: The survey on aquaculture recording practices revealed that approximately 79% of farmers surveyed, totaling 19 respondents, maintained records, predominantly using paper-based methods such as notebooks, except for 3 non-respondents. Recording durations varied widely, ranging from one month to as long as 20 years. Among the 18 farmers who recorded data, common entries included income and expenditure, stock and catch numbers, and monthly feeding amounts; some recorded daily feedings instead of monthly. Farmers expressed keen interest in

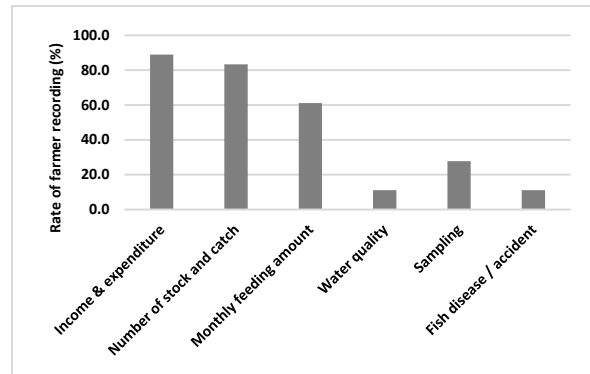


Figure 3- 28 result of Interview on Recording Items

online aquaculture management tools, with 15 respondents indicating a desire to use them for purposes like business development, continuous record-keeping, financial calculations, and expense reduction. Despite this enthusiasm, concerns about the reliability of online tools and potential data loss were raised by some farmers. Nevertheless, most farmers (13 respondents) agreed that their aquaculture records could be valuable to the government. Awareness of the Kobo app, designed for such purposes, was limited but growing, with 6 farmers informed about it through CRPs and GIZ. Of these, 4 attempted to use the app, reporting mixed experiences regarding usability. Overall, the findings suggest a strong interest in adopting digital tools among aquaculture farmers, tempered by concerns requiring ongoing training and support to address.

CRP Interview: CRPs play a pivotal role in aquaculture recording, with all but one respondent actively maintaining records using tools like the Farm Record Book or notebooks, recording various operational details to manage income, expenditure, and overall business performance. They emphasize the importance of ongoing recording and express satisfaction with the ease and utility of the Farm Record Book. CRPs also demonstrate comprehensive awareness and use of the Kobo app for uploading aquaculture records and conducting farmer surveys, finding it beneficial for business operations. Despite no reported farmer use of the Kobo app within their Producer Groups (PGs), CRPs express eagerness to utilize its data insights to enhance profitability and assess aquaculture suitability, underscoring their proactive engagement in leveraging digital tools for community aquaculture development.

2) Pilot project-2: Utilization of E-commerce platforms for online sales

[Results of EC Trade and Issue Analysis] For both farmers, only 1-2 orders have been received from the online platforms. However, one farmer, selling fish, did decide not to sell their products online since the price was comparably lower than their local market trade.

[Interview Survey Results] The survey team implemented interview survey to some of the EC platform providers (FISHFED, Aquablue, Minbury, Aquaconnect) in India. Through the discussions, the possible reasons why only a few orders have been received in pilot project were found to be lack of awareness or interest of consumers, potential technical issues of the platform, market readiness/acceptance, shipping restrictions, high engagement but low conversion rate of the offline customers, etc.

Generally, they have different types of business models of online sales. For instance, while the online platform of Aquablue mainly deals with the input supply items (such as feeds, equipment, fish seeds, etc.) to local farmers, FISHFED and Minbury rather focuses on fish products, especially value-added products, to local consumers, and the online trade of Aqua-connect is targeting on B to B matching (producers to buyers). Through the interview survey, it is found that in India the fish input items are now the majority of the online trade, since they are easy to distribute and useful for farmers to find large varieties of products. However, for fishery products, including fish, processed fish, etc., online trade is limited to some specific demands, like ready-to-cook or ready-to-eat products for high-end

consumers in the city area. This is because those items are relatively easy to find in the local markets, especially in Assam state.

(6) Findings and implications of pilot activities, and approach of JICA loan project

1) Pilot Project-1: Utilization of Mobile Farm Recording App in Aquaculture Management

Findings and Implications of Pilot Activities

[Farm Record Book] In the interview survey, 100% of farmers answered that farm recording is important. Since farm record book, developed in GIZ project, is comprehensive, if farmer can utilize it properly, it can be useful and contribute to livelihood improvement of aquaculture farmers. However, the book includes some of the contents which are difficult for farmers to record. The items for farm recording need to be simplified, and training to farmers should be provided so that farmers can collect necessary information properly.

[Digital System] Although 72% of farmers have mobile phones, CRPs have to input their collected data on behalf of farmers. And for data input, some of the contents are difficult for farmers to take records. (sampling, stock management, water testing, etc.). As for data output and utilization, the collected data could be useful for some “statistical” purposes. However, FIRMS, the digital system introduced in GIZ project, has some points to be improved. One of the key issues is that farmers cannot refer to their data by themselves. Once they input their data, they cannot track their data and refrain their activities by themselves. Moreover, even for admin side, meaning board members, it is still challenging to comprehend and utilize the collected data into practice. The digital system must have the user-friendly interface for farmers to look back their input data, and the system should make it easy to input and analyze the data so that they can refrain their farming activities to find out the way to improve livelihood.

Approach of JICA loan project to utilize mobile farm recording

Considering the outputs and findings from pilot projects, JICA loan project is going to incorporate the functionality of mobile farm recording in a digital system under DX component. The items of recording will be basically taken over from “Farm Record Book” by GIZ. Meanwhile, the digital system will be renewed, especially the interface for both admin and users will be re-designed and improved.

2) Pilot Project-2: Utilization of E-commerce Platforms for Online Sales

Findings and implications of pilot activities

The demand for online sales is limited to some specific demands. Fish products are sufficient in the local market. Consumers do not get clear benefits from online trade. Only a few consumers (elite, or relatively rich) prefer to order online for rather convenient products (cut fish, ready to eat, ready to cook, etc.). Even for farmers, it is not reasonable and benefitable to deliver only a small amount of fish to local consumers. The online market can be useful for feed sales or fishery equipment. However, in Assam state, it's possible to conclude that physical trade will continue to be the mainstream of fishery value chain.

Approach of JICA loan project to improve value chain with E-Commerce

Considering the outputs and findings from pilot projects, JICA loan project will prioritize the physical infrastructure development for fish value chain improvement. (Value Chain Development component) Also, JICA loan project will partially utilize online sales platform under some components. One is the fish seeds village component, in which online platform will be considered to introduce for the sales of fish seeds to local farmers. The other is the entrepreneurship program, in which the project will support startups or entrepreneurs of online platform to expand their business in Assam state.

3.6 Farmers organization/gender/nutrition

3.6.1 Farmers organization

(1) Category of farmers organization

- Cooperative Society

A Cooperative Society is an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise. Under the Assam Co-operative Societies Act 2007²², a minimum of 10 members is required to establish a cooperative society. Every cooperative society must have a board of directors (BODs), which consists of 15 members (1 seat must be for the scheduled castes or the scheduled tribes, and 2 seats for women). A cooperative society has obligations to hold annual general meetings and conduct internal and external audits.

The amount per share is not stipulated by law, but in most of the cooperatives visited by the JICA survey team, the amount was often between 10 to 20 rupees for membership. Regardless of the number of shares held, members of cooperative societies have equal voting rights (the rule of “one member, one vote”).

As of April 2023, there are 304 cooperative societies registered under FISHFED in Assam, and the total number of members is 43,435. However, while 134 societies (23,610 members) are active, 166 societies (17,268) are considered inactive since they do not hold annual general meetings and/or do not submit audit reports. Inactiveness of cooperative societies is an issue both in Assam and India as a whole. One reason for this situation is that while state-level laws govern the registration and obligations of cooperative societies, there are no established guidelines for operation. In response to this situation, as described in the next section, the Ministry of Agriculture established guidelines in 2013 for the Farmer Producer Organizations (FPOs), which have the same functions as cooperative societies, and promote the establishment of new FPOs as well as revitalisation of cooperative society by re-registering as a FPO.

Table 3 - 26 Cooperative Societies registered under FISHFED

Status	Total		Inland fishery cooperative societies		Aquaculture cooperative societies	
	Societies	Members	Societies	Members	Societies	Members
Registered	305	43,435	229	34,524	76	8,911
Active	134	23,610	103	17,268	31	6,342
Inactive	171	19,825	126	17,256	45	2,569

Note: data for gender-wised number of members is not available.

Source: FISHFED

- Farmer Producers Organization (FPO)

FPO is a legal entity formed by farmers and registered under the Co-operative Societies Act of the concerned states. The concept of FPO was introduced during 2011-12 in India, when the Department of Agriculture and Cooperation (DAC), Ministry of Agriculture launched a pilot programme to collectivise farmers (especially small farmers), improve productivity, enable access to inputs and services, and increase incomes of farmers. To mainstream the process of institutional development of FPOs, DAC issued the Policy & Process Guidelines for Farmer Producer Organizations²³ to encourage states to support FPOs directly. Along with the guidelines, schemes such as the Formation and Promotion of 10,000 FPOs by DAC have been developed. PMMSY has also developed Guidelines on Formation and Promotion of Fish FPOs²⁴.

The basic function of FPOs is the same as cooperative societies, so they are obligated to follow principles of cooperative societies such as “one member, one vote.” FPOs are also mandated to organise the board of directions and conduct general meetings and audits. However, various schemes and guidelines clearly mention the process of establishment, operation, funding, monitoring and evaluation, etc., to ensure sustainability and transparency of FPOs.

²² <https://assam.gov.in/sites/default/files/dms/Assam%20Co-operative%20Societies%20Act%202007.pdf>

²³ https://www.mofpi.gov.in/sites/default/files/fpo_policy_process_guidelines_1_april_2013.pdf

²⁴ <https://www.ncdc.in/documents/notice-circular/3218280721FFPOs-Guidelines.pdf>

In Assam's fisheries, however, the current mainstream is the establishment of FPCs rather than FPOs. As of December 2023, there are 5 fishery FPOs in Assam²⁵.

- Farmers Producers Company (FPC)

FPC is one form of FPO but registered as a Producer Company under Part IX-A of Companies Act. In 2002, the concept of the Producer Company emerged through the amendment of the Companies Act 1956 by the initiative of the central government. The objective was to enable incorporation of cooperative societies as companies while ensuring that the unique elements of the cooperative business remain in the new legislation. Therefore, it can be said that FPC is the hybrid of a private company and a cooperative society.

The minimum number of members required to register a FPC is 10 and it can expand its business nationwide, while the area of activity is limited in case of FPOs. Having those benefits, the establishment of FPCs is mainstream in Assam. As of December 2023, there are 27 fishery FPCs in Assam and 25 of them were established under APART.

Table 3-27 presents the significant distinctions between cooperative society, FPO, and FPC.

Table 3 - 27 Distinctions between Cooperative Society, FPO, and FPC

Category	Cooperative Society	FPO	FPC
Authorization issuer	Registrar of Cooperative Societies		Ministry of Corporate Affairs
Applied act	Assam Co-operative Societies Act, 2007		PART IXA: Producer Company from Companies Act, 1956 ²⁶
Area of operation	Restricted within the area mentioned at the time of registration		Entire land of India
Numbers of members	Minimum 10 (If a FPO follows a certain scheme, the minimum number specified in the scheme.)		Minimum 10
Voting rights	One member, one vote, but Government and Registrar of Cooperatives hold veto power		One member, one vote
Minimum share capital	Not ruled		Authorized capital ²⁷ : Rs. 500,000 Paid-up capital ²⁸ : Rs. 100,000
Number of fishery organizations in Assam ²⁹	305	5	27
Implementing agencies ³⁰	-	➤ National Cooperatives Development Corporation (NCDC) ➤ National Bank for Agriculture and Rural Development (NABARD) ➤ National Fishery Development Board (NFDB)	➤ Small Farmers Agriculture Consortium (SFAC) ➤ National Bank for Agriculture and Rural Development (NABARD) ➤ National Fishery Development Board (NFDB)

Source: Ministry of Agriculture, Department of Agriculture and Cooperation (2013), Policy & Process Guidelines for Farmer Producer Organizations., National Bank for Agriculture and Rural Development (2015), Farmer Producer Organizations - Frequently Asked Questions.

²⁵ Information obtained from Assam Rural Infrastructure and Agricultural Services (ARIAS) Society.

²⁶ The Companies Act was revised in 2013, but Companies Act of 1956 is applied for Producer Companies.

²⁷ Authorized capital is the maximum amount of the capital for which shares can be issued by the Company to shareholders.

²⁸ Paid-up capital is the amount of money a company has received from shareholders in exchange for shares of stock.

²⁹ As of December 2023

³⁰ The Implementing Agency will provide support for identification, startup, and operation of FPOs and FPCs while supervising RI and CBBO, which will be described later.

- Self Help Group (SHG)

Self-help groups (SHGs) in India are composed of minimum 15 women members. SHGs are formed and implement saving activities (saving money and lending money among members), so that they could receive assistance such as credits and training related to their income generation activities. In Assam, the promotion of SHGs is taken by the initiative called Assam State Rural Livelihood Mission (ASRLM) under Panchayat & Rural Development Department with the collaboration of NABARD. However, there is currently no SHGs in Assam which conducts exclusively fishery activity³¹.

(2) Process for the formation and development of FPOs and FPCs

In Policy & Process Guidelines for FPOs published by DAC, Ministry of Agriculture, the stages to formulate and develop FPOs and FPCs are defined as described in Figure 3-29 and Table 3-28. As seen from the process, the establishment of FPOs and FPCs is not a voluntary commencement by farmers, but rather a state initiative through investigations of potentials by a Resource Institutions (RI) or Cluster-Based Business Organization (CBBO) under monitoring by Implementing Agencies listed on Table 3-26.

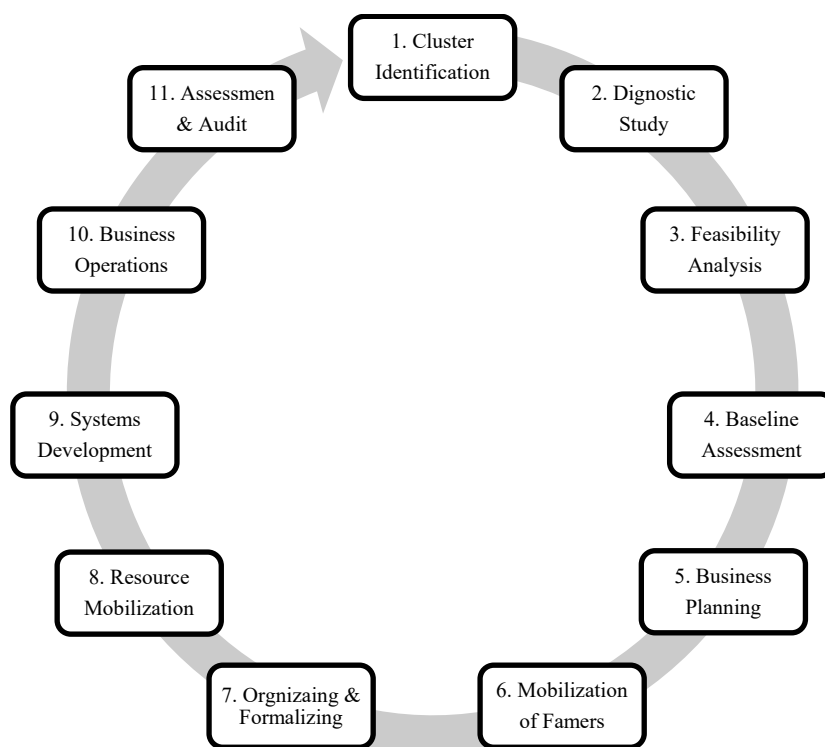


Figure 3- 29 Process of formation and development of FPO/FPC
Source: Ministry of Agriculture, Department of Agriculture and Cooperation (2013), Policy & Process Guidelines for Farmer Producer Organizations.

³¹ Information obtained from DoF.

Table 3 - 28 Activities for the formation and development of FPO/FPC

Stage	Description
1. Cluster Identification	Cluster areas are to be selected by the RIs/CBBOs in consultation with the respective State Government departments. However, it should be ensured that a cluster of 8,000-10,000 farmers should be formulated, within 1 or 2 blocks, identifying 80 to 120 contiguous villages of a particular district.
2. Diagnostic Study	A Diagnostic Study is to be conducted by the RIs/CBBOs in the selected cluster area to assess the preliminary situation of the farmers and level of agriculture. The study will also help in identifying the potential interventions required and understand the specific project implementation context.
3. Feasibility Analysis	Feasibility Analysis for the formation of FPOs/FPCs should be carried out by RIs and then appraised by hired external experts in financial, technical, legal, political, socio-cultural, environmental, economic and resource perspectives.
4. Baseline Assessment	Baseline Assessment, to be carried out by RIs/CBBOs, will help in generating data related to the current prevailing situation of farming and small, marginal and tenant farmers. The assessment shall be conducted using stratified random sampling through structured household-level interviews and open-ended focus group discussions with a variety of stakeholders.
5. Business Planning	Business planning carried out by RIs/CBBOs is a process through which the strategic and operational orientation of an emerging FPO/FPC is shaped. Using a variety of tools and systematic collective reflections, a business plan with proper projections on various aspects needs to be developed.
6. Mobilization of Farmers	Once a strong case has been established through the business planning process, farmers can be mobilized into FIGs and eventually as farmer-members of FPOs/FPCs.
7. Organizing and Formalizing	FIGs in an aggregated cluster together form FPOs/FPCs. Typically, around 50-70 FIGs can come together to form a FPO/FPC. The final form which the FPO/FPC assumes (i.e. cooperative, producer company, multi- state cooperative etc.) must be a decision taken by FIG members.
8. Resource Mobilization	Before initiating the operations of FPO/FPC, all required resources should be mobilized by RI. Based on the business plan, RIs/CBBOs should liaise with various financing agencies and mobilize resources for hiring/purchasing and developing various resources.
9. Management Systems Development	RIs/CBBOs should facilitate the development of management systems in the FPO/FPC. Guidelines and operation procedures for management systems should be able to address all requirements related to financial services, input and output management services.
10. Business Operation	Business operations is the commencement of procurement, production, processing, marketing and financial service activities of a FPO/FPC. RIs/CBBOs should train both the governing and operational structures of the FPO/FPC in order to ensure smooth functioning of business operations.
11. Assessment and Audit	RIs/CBBOs should facilitate constant assessment of performance of various stakeholders such as farmer members, governing BOD and service providers. Internal process and accounting audits will help maintain both transparency and accountability.

Source: Ministry of Agriculture, Department of Agriculture and Cooperation (2013), Policy & Process Guidelines for Farmer Producer Organizations.

(3) Financial access of farmers organizations

- Financial support under PMMSY

PMMSY is a national flagship scheme aiming at increasing fish production and productivity, enhancing fisheries management and conservation, modernizing infrastructure and technology, and promoting entrepreneurship and creating employment opportunities in the fishery sector. The beneficiaries include fishers, fish farmers, cooperative societies, FPOs, FPCs, SHGs, entrepreneurs and private firms. Table 3-29 shows the cost share of the government and beneficiary. If there is a female member among beneficiaries, the burden of cost by beneficiary will be reduced from 60% to 40%, which encourage groups to invite women as members.

Table 3 - 29 Financial support under PMMSY

Category	Financial Assistance	
	Government Share	Beneficiary share
All central Projects	100%	-
Individual/group activities through entities of Government of India or National Fishery Development Board	40%	60%
General Category	40%	60%
Scheduled caste/Scheduled Tribe/Women	60%	40%

Source: Operational Guidelines of PMMSY

- Fishery and Aquaculture Infrastructure Development Fund (FDIF)

FIDF is a loan fund established by The Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying to promote creation of fisheries infrastructure facilities both in marine and inland fisheries sectors. The beneficiaries include state governments and union territories as well as cooperative societies, groups such as FPOs, FPCs, and SHGs. The scheme's duration was initially from 2018-19 to 2022-23 and was later extended to 2025-26. The project under FIDF shall be eligible for loan up to 80% of the estimated/actual project cost and the interest rate is up to 3% per annum.

- Loans from banks to FPOs and FPCs

Major banks such as Central Bank of India, State Bank of India, Union Bank, Punjab National Bank provides loan programs to FPOs and FPCs with the conditions in the table below.

Table 3 - 30 Loan programs to FPOs and FPCs by major banks in India

Name of bank	Central Bank of India	State Bank of India	Union Bank	Punjab National Bank
Eligibility criteria	FPOs/FPCs	FPOs/FPCs with 1) a minimum capital of Rs. 5 lakhs, 2) minimum 33% of shareholders are small, landless or tenant farmers, 3) in operation for at least 2 years.	FPOs/FPCs with 1) its productive land around 500 to 4,000 ha, 2) minimum number of its producers is 500, 3) in operation for at least 6 months, 4) a minimum capital of Rs.5 lakhs.	FPOs/FPCs with 1) minimum number of its producers is 500, 2) minimum 33% of shareholders are small, landless or tenant farmers, 3) Maximum shareholding by any one member other than an Institutional member is not more than 5% of total equity of the FPO/ FPC, 4) a business plan and budget for 18 months.
Loan amount	Up to 5 crores	1 lakh to 5 crores	Up to 1 crore	Need based
Interest rate	Loan up to Rs. 3 lakhs: 1.35% Above 10 to 100 lakhs: 2.50% Above Rs. 100 lakhs: 3.00%	Loan up to Rs.50 lakh: 3.60%. Above Rs. 50 lakhs: As per Bank Guidelines.	Loans up to Rs 50,000: 0.10% Above Rs 50,000 to Rs 2.00 lakhs: 0.65% Above Rs 2 lakhs to 5 lakhs: 1.90% Above Rs 5 lakhs to 25 lakhs: 2.65% Above Rs 25 lakhs to 1 crore: 2.90%	(Information unavailable)
Collateral requirement	Loan up to Rs. 2 crores: not required. Above Rs. 2 crores: required.	Loan up to Rs. 1.6 lakhs: not required. Above Rs. 1.6 lakhs: required.	Loans covered under credit guarantee scheme of SFAC: not required. Other cases: required.	Loan up to Rs. 100 lakhs: not required. Above Rs. 100 Lakhs: As per extant Bank guidelines.

Source: Website for each bank

(4) Needs and challenges identified for farmers organizations.

- Less capacity of cooperative society

As described previously, more than half of fishery cooperative societies are inactive in Assam. Those inactive societies fail to organize general meetings and audits. The reason behind could be that members of BOD do not have managing skill. Members of BOD are basically farmers and do not have enough experience of management of organizations. It is also found that even though training for management is provided by NCDC, no cooperative societies interviewed by JICA survey team have taken those trainings. Having those issues, schemes such as the Formation and Promotion of 10,000 FPOs or formation of FPCs by APART put more focus on the capacity building of management, e.g. assigning CEOs who have business backgrounds and providing trainings to members of BOD.

- Lack of benefits of to be a member of FPOs/FPCs or cooperative societies

To ensure members of a cooperative society or FPC to be active, they must feel the benefits of joining the organization. However, during the field survey of JICA survey team, it was observed especially among aquaculture cooperative societies that the members do not feel benefits of their membership other than having a pond provided by the cooperative societies. On the other hand, good examples below were also found where a cooperative society or FPC provides benefits to its members.

- Launch of a new activity reflecting the needs of members: Uttaran Farmer Producer Company is an aquaculture FPC in Kamrup District established in 2021. Its initial activity was mainly aquaculture where women were difficult to participate. However, receiving the demand from its female members, the FPC started food processing activity where female members process fish pickle and sell to the local shops. This activity is still at the initial stage but would contribute to the income generation of female members.
- A system to enhance quality and price of fish: Under the project implemented by GIZ, female aquaculture farmers are grouped into aquaculture FIGs and adopted the “Peer-to-Peer Review System” in which members monitor and advise each other’s aquaculture activities. This system enables farmers to produce high-quality fish and eventually increase the price of fish.

- Lack of access to finance

Finance-related issues faced by fishers or groups include 1) high interest rates when fishers or groups do not have collateral, 2) limited availability of loan protection insurance, and 3) inconsistency of a repayment grace period with fishery cycles. Regarding 1), as shown in the table -29, banks demand collateral when the loan amount is large. However, when fishers or groups cannot prepare collateral, banks demand higher interest rate (above 10%). Regarding 2), fisheries are recognized as high-risk by insurance companies, making it difficult for fishers and groups to use loan protection insurance. Regarding 3), for example, even if a fishers or groups wish to start repayment after 6 months from the perspective of the aquaculture cycle, banks’ standards do not allow the repayment grace period to be set for more than 3 months.

- Lack of actual implementation of gender mainstreaming

In the grants provided by APART and PMMSY, if there is even 1 woman in the FPC, the cost burden for beneficiaries will be reduced. For this reason, many FPCs are actively inviting female members. In addition, the Assam Co-operative Act 2007 requires 2 women to be included on the BOD of cooperative societies, so female members can be seen even in cooperative societies and FPCs of inland fishery or aquaculture.

However, in practice, there is a case that women do not participate activities or enjoy benefits of belonging cooperative societies or FPCs at the same level of men. During the interview by the JICA survey team, female members of a FPC answered that they do not participate in general meetings because they are busy with housework and childcare. In another interview with an aquaculture cooperative society, 2 ponds are provided to a household since both husband and wife participate in the cooperative society, but only the husband does the aquaculture, and the wife is not involved in any fishery activities. Not only to increase female members, but the efforts to enhance active participation of women is needed.

3.6.2 Gender

(1) Women's situation in Assam

Table 3-31 shows some of the indicators related to gender with the comparison of Assam and India.

Table 3 – 31 Demographic Indicators related to Gender in Assam and India

Indicators	Assam		India	
	Male	Female	Male	Female
Literacy rate (%)	81.6	75.1	84.4	71.5
Median years of schooling completed (years)	6.3	5.3	7.3	4.9
Labor force participation rate (%)	90.1	20.3	57.5	25.1
Life expectancy (years)	67.0	69.7	68.2	70.7
Population aged 18-29 who were first married by age 18 (%)	18.6	31.6	15.2	24.7
Population of ever-married women aged 18-49 who have ever experienced emotional, physical, or sexual violence from their husband (%)	-	34.3	-	31.9

Source: Labor force participation rate is from Economic Survey India 2022-23³², Economic Survey, Assam 2023-24³³. Other indicators are from National Family Health Survey (NFHS-5) 2019-21.

Including above indicators and field visit by the JICA survey team, gender-related issues in Assam are listed as follows.

1) Women's less participation in economic activities

As shown in the table above, women's participation in economic activities is much less compared to men. Reasons behind would include burdens of housework and child rearing, lack of education, lack of transportation, and early marriage. Various studies reveal the social norm in Assam that women should engage in reproductive work such as housework and child rearing, while men should engage in economic activities. It is also notable that most of the women interviewed by the JICA survey team do not drive vehicles, so they can travel to remote areas only when they can get support of transportation by husbands or other men, which would prevent women to join economic activities.

2) Gender-based violence

In 2022, the rate of crimes against women³⁴ in Assam was 81.2%, which was the 7th highest among all 28 states and 8 union territories in India. High crime rates were observed in 2 aspects - domestic violence and kidnapping. The table 3-31 reveals that more than one in three ever-married women in Assam have experienced spousal physical, sexual, or emotional violence. This rate is 5th highest among all 28 states and 8 union territories in India. Possible causes of domestic violence include men's alcoholism or drug addiction, financial pressure, suspected infidelities, women's refusal to have sex, neglecting household chores, arguments over money and others³⁵. Not only the domestic violence, but crimes against women in public space is noteworthy in Assam. Regarding the high incidence of kidnapping of women, the reason behind is not clearly revealed, but one possible factor is that Assam shares borders with Bangladesh and Bhutan, which would increase the possibility of human trafficking.

3) Early marriage

Early marriage is more prevalent in Assam than in other states of India, as shown in the table 3-31. In some districts in Assam, more than 40% of women get married before age 18 years. In response to this situation, the Government of Assam state government has further strengthened its crackdown on early marriage from February 2023. As a result, nearly 4,000 people suspected of being involved in early marriages were arrested. The Government also designated all the gaon panchayat (structure of village level) secretaries in the state as Child Marriage Prohibition Officers whose responsibilities

³² <https://www.indiabudget.gov.in/economicsurvey/doc/echapter.pdf>

³³ <https://des.assam.gov.in/information-services/economic-survey-assam>

³⁴ The crime rate is calculated as per one lakh of population. National Crime Records Bureau (2019), *Crime in India 2019*.

³⁵ Hearing results from the Directorate of Social Welfare (Women and Child Development Sector) and organizations implementing gender-related activities, and cited from Northeast Network (2015), *Unheard: Domestic Violence in Rural Assam*.

include taking action to prevent child marriage, collecting evidence for the effective prosecution, raising awareness about the harms of child marriages, etc.

4) Women's burden at household

Table 3-32 is an example of activity profile between wife and husband who were interviewed by JICA survey team. The wife belongs to the aquaculture cooperative society and also engages in food production as her individual income-generation activity. The husband also belongs to the aquacultural cooperative society and engages in agricultural activities as well. It should be noted that women engage in reproductive activities including cleaning of house, preparation of meals, as well as income-generation activities. If the Project encourages women's participation in fishery, the visualization and reconsideration of activities at household should be conducted.

Table 3 - 32 An Example of Activity Profile between Wife and Husband in Assam

Time	Wife	Husband
4:00	Wake up, preparation for raw materials for food processing business	-
5:00	Cleaning house	-
6:00	Preparation for breakfast	-
7:00	Breakfast	Wakeup, breakfast
8:00	Cleaning up of breakfast	-
9:00	Packaging for food production, feeding of fish	-
10:00	↓	Pond cleaning
11:00	↓	-
12:00	Preparation of lunch	Other home activities
13:00	Lunch	Engaging works in paddy field
14:00	Rest	-
15:00	-	-
16:00	Packaging for food production	Rest
17:00	Cleaning of pond, feeding of fish	Engaging works in paddy field, fishery, horticulture
18:00	-	-
19:00	Preparation of dinner	-
20:00	Dinner	Dinner
21:00	-	↓
22:00	Sleep	Sleep

Source: prepared by JICA survey team

(2) Gender policy and implementing organization in Assam

- Population and Women Empowerment Policy of Assam (2017)³⁶

The Government of Assam has implemented above policy in 2017 to 1) optimize family size to realize higher standard of living in terms of education, healthcare and employment opportunities, and 2) ensure women's right to have access to equal opportunities and resources and realize women's empowerment. The policy states five goals as below. Although women's economic empowerment, maximizing education for girls, and strengthening laws on violence against women are included in the Goal 3, the policy put more emphasize on improvement of reproductive health to optimize population in Assam.

Goal 1: Maintain current declining trends in fertility so as to achieve a stable population size at least by the middle of the 21st century.

Goal 2: Ensure safe motherhood and reduce reproductive health system related morbidity and mortality.

Goal 3: Achieve gender equality in the truest sense; although Assam is one of the states with a perceived improved situation for women in society, this is not enough.

Goal 4: Promote responsible adolescent and youth behavior.

³⁶ https://hfw.assam.gov.in/sites/default/files/swf_utility_folder/departments/hfw_lipl_in_oid_3/menu/document/Population%20and%20Women%20Empowerment%20Policy%20of%20Assam.pdf

Goal 5: Provide adequate health care and welfare services for the elderly and differently abled.

- Assam 2030 (2016)³⁷

The development plan "Assam 2030", lists gender equality as its fifth goal. It aims to eliminate discrimination and violence against women and girls, promote share responsibilities in the household, and ensure equal participation and opportunities of men and women in political, economic and public life.

- Directorate of Social Welfare (Women and Child Development Sector)³⁸

The Women and Child Development Sector in the Directorate of Social Welfare in Assam has the mandate to ensure proper care and protection of the most vulnerable sections of the society, i.e. women, children, pregnant and lactating mothers. One of their programs for the empowerment of women is "Pradhan Mantri Matru Vandana Yojana (PMMVY)", the nation-wide program being implemented by the Ministry of Women and Child Development from 2017. The objective of PMMVY is to provide financial assistance to pregnant and lactating women to ensure proper nutrition and health during their pregnancy and post-delivery. Other programs under the Directorate are the operation of "One Stop Centre" and "Women Helpline" to provide integrated support and assistance to the women affected by violence in private and public spaces. The Directorate also provides programs such as "Mahila Shakti Kendra Scheme" to provide one-stop support for empowering rural women with opportunities for skill development, employment, digital literacy, health and nutrition. The Directorate generally conducts above programs independently, so that the collaboration with other directorates is limited.

(3) Gender in fishery sector in Assam

In Assam, people participate in fishery activities in multiple areas including inland fishery (fishing in beel and river), aquaculture (farming in pond or tank), production of ornamental fish and food processing. Based on the interview with DoF and members of cooperative societies and FPCs, Table 3-33 to 3-36 were prepared by JICA survey team to show the division of fishery activities between men and women.

- Inland fishery

Table 3-33 shows the activity profile of men and women in inland fishery. In Assam, most of the processes of inland fishery are conducted by men because it is considered as a "heavy work". Women partially participate in "light work" such as waving and repairing a fishing net. After capturing, fish are usually brought to wholesale and retail markets by men. Some women, however, buy fish from the wholesalers and sell them to retailers at the same market.

Table 3 - 33 Activity profile of men and women in inland fishery

Activities	Both	Men/Husband	Women/Wife
Weaving/Repairing a fishing net	✓		
Purchasing a fishing net	✓	✓	
Purchasing a fishing boat		✓	
Sailing a fishing boat	✓	✓	
Capturing fish	✓	✓	
Bringing fish to market		✓	
Selling fish at market	✓	✓	
Obtaining fishery-related information (price of inputs, market prices, etc.)	✓		
Deciding how to use income	✓	✓	
Attending technical training		✓	
Attending marketing training		✓	

Source: Prepared by JICA survey team based on answers from interviewed members of cooperative society.

Note: If tick is both on "Both" and "Men/Husband," it implies that both men/husband and women/wife involve but men/husband's involvement is more (same in further tables).

³⁷ <https://transdev.assam.gov.in/portlet-innerpage/assam-2030-our-dream-our-commitment>

³⁸ <https://socialwelfare.assam.gov.in/about-us/what-we-do>

- Aquaculture

In Assam, people generally have 2 ways to be involved with aquaculture – producing fish in their own ponds at home or participating in aquaculture activities at ponds or tanks owned by cooperative societies or FPOs/FPCs. For the former, many cooperative societies and FPOs/FPCs provide their members with ponds at their home so that members can manage producing, maintenance, and selling by their own.

Table 3-33 shows the activity profile of men and women of aquaculture at household. It implies that both men and women join the aquaculture activities. In most of the field visited by JICA survey team, it is generally seen that men “take lead of aquaculture” by managing feeding, maintaining pond, capturing, and selling at the market, while women “support aquaculture” by feeding and maintaining pond when men are not at home. In particular district such as Morigaon, women also take lead of aquaculture by asking their husband or neighbors to help physical work such as capturing. However, even women take lead of aquaculture, there was cases that they do not involve in decision making of income earned by aquaculture.

In addition, during the interviews by JICA survey team, many women demanded more opportunities of on-sight training (training held in their vicinity or sights of farmers group they belong) since they have responsibilities of housework and childrearing, and it is difficult to go to the training center at remote places.

Table 3 - 34 Activity profile of men and women in aquaculture

Activities	Both	Men/Husband	Women/Wife
Planning aquaculture activities	✓		
Deciding what fish to produce	✓	✓	
Weaving/Repairing a fishing net	✓		
Purchasing a fishing net	✓		
Purchasing fish seeds	✓		
Preparing pond/tank	✓	✓	
Maintenance of pond/tank	✓		
Feeding	✓		✓
Capturing		✓	
Bringing fish to the market		✓	
Selling fish in the market	✓	✓	
Obtaining fishery-related information (price of inputs, market prices, ets).	✓	✓	
Deciding how to use income	✓	✓	
Attending technical training	✓		
Attending marketing training	✓		

Source: Prepared by JICA survey team based on answers from interviewed members of cooperative societies and FPCs in Assam.

- Ornamental fishery

Production of ornamental fish is one of the active businesses in Assam. Since it requires relatively less physical effort than inland fishery or aquaculture, more women are involved in this sector. Based on the interview with a cooperative society whose 90% of members are women, Table 3-35 was created to show the activity profile of men and women in ornamental fishery. The representative and secretary of the interviewed cooperative societies are male, and they work on external relations such as soliciting funds and obtaining fishery-related information. Since the size of fish and tanks is small compared with aquaculture, women actively participate in capturing and maintenance of tanks which were provided to their home by the cooperative society. Women usually sell fish in village markets, but in case of selling at remote markets, the secretary collects fish that members produce and sell.

Table 3 - 35 Activity profile of men and women in ornamental fishery

Activities	Both	Men/Husband	Women/Wife
Planning ornamental activities	✓		
Deciding what fish to produce	✓		
Soliciting funds to government or other funders		✓	
Purchasing fishing net		✓	
Purchasing fish seed	✓		✓
Preparation of tank	✓		✓
Maintenance of tank	✓		✓
Releasing fry to the ponds		✓	
Feeding	✓		✓
Capturing	✓		✓
Bringing fish to the market	✓		
Selling fish in the market	✓		
Obtaining fishery-related information (price of inputs, market prices, etc.)		✓	
Deciding how to use income	✓		
Attending technical training	✓		
Attending marketing training	✓		

Source: Prepared by JICA survey team based on answers from interviewed members of cooperative societies in Assam.

• Fish Processing

In Assam, women are usually involved in processing fish into value-added products. During the field survey, JICA survey team interviewed one cooperative society and one FPC which conducts food processing. As shown in Table 3-36, women are the main actors in most of the activities. If the local shop to sell products is not within walking distance, women use bicycles or ask men to drive vehicles to the market.

Table 3 - 36 Activity profile of men and women in food processing

Activities	Both	Men/Husband	Women/Wife
Deciding what to produce			✓
Deciding design of package			✓
Producing fish through beel fishery or aquaculture		✓	
Processing fish			✓
Drying fish			✓
Packing			✓
Bringing products to the local shop	✓		
Selling products at the local shop			✓
Keeping money after sales of products			✓
Obtaining market-related information (market price, etc.)			✓
Attending technical training			✓
Attending marketing training			✓

Source: Prepared by JICA survey team based on answers from interviewed members of a cooperative society and a FPC in Assam.

(4) Gender in ongoing fishery schemes

The main fishery schemes undertaken in Assam is the Pradhan Mantri Matsya Sampada Yojana (PMMSY), national scheme to promote sustainable development of the fisheries sector, and the Assam Agribusiness and Rural Transformation Project (APART), the World Bank-supported project aiming to add value and improve resilience of selected agriculture value chains including fishery. PMMSY is encouraging women's participation through financial support to its beneficiaries. While 40% of the total budget is allocated as government subsidy for beneficiaries in the general category and 60% for beneficiaries in scheduled tribes and castes, 60% is allocated to women, irrespective of their category. Under APART, it is aimed that 30% of all beneficiaries are women.

(5) Gender-related issues in fishery in Assam

Based on above information and field study by JICA survey team, gender related issues in fishery in Assam are listed as below.

1) Gender-based perception about Fishery:

Field study by the JICA survey team confirmed that some communities, cooperative societies, and women themselves perceive that "fishing is men's job." The factor of this perception would be that fishery needs physical power, especially capturing fish. Due to this perception, there is a case where women who start aquaculture receive negative reactions from their family and communities. Additionally, even when fishing training is provided by the cooperative societies, it was heard that female members hesitate to participate because they do not have a confidence on doing fishery.

2) Less involvement of women in the decision making on expenditure of income:

As written above, it was heard during the interview by JICA survey team that husbands decide how to spend the income, even though both husbands and wives participate in aquaculture. One reason for this may be that in Assam, husbands are the ones who sell fish at the market, so there may be a perception that "it is the husband who earns money in the household." Also, women's involvement in aquaculture activities at home may be considered as a "part of the housework," not the contribute to the household economy.

3) Lack of knowledge about the management of farmers group with gender perspective:

The Assam Co-operative Act, enacted in 2007, requires that a cooperative society's board of directors must include at least two women (the same act applies when establishing an FPO). In addition, as written above, schemes such as PMMSY and APART encourage the inclusion of female members in FPOs/FPCs. Although women have the membership of these farmers group, it should be noted that not all female members are able to participate in activities on the same level as male members. For example, if a general meeting is expected to last a long time, it was heard that female members who are responsible for housework and childcare at home may choose not to attend the meeting.

4) Unequal share of burdens on housework and childcare at household:

In Assam, women often take on the responsibility of housework and childcare. As a result, when women are going to participate in training, especially long-continued training or training in remote areas, women sometimes face opposition from their husbands, or they themselves are hesitant to participate in those trainings.

5) Lack of opportunities for Fishery Development Officers (FDOs) to receive gender training:

FDOs play a key role in supporting fishers, including both men and women, on the front lines. However, currently there are no opportunities for them to receive gender training in the Assam DoF. Providing gender training will enable FDPs to understand the situations of male and female fishers and provide appropriate support based on their respective needs.

3.6.3 Nutrition

(1) Nutrition situation in Assam

Main health issues and concerns in Assam can be summarised as follows: 1) more than every third of children face stunting and underweight, 2) increasing population of obesity and consequent life-style diseases, and 3) every second woman of reproductive age is anaemic.

• Nutrition situation among children

Table 3-37 provides the micronutrient deficiency among children. As per the data reports, folate deficiency in the preschoolers, schoolers and adolescents seems very serious in the Assam with a percentage of 59.9, 62.8 and 73.3 respectively, with a hike of 23.3 (preschoolers), 28.3 (schoolers) and 36.7 (adolescents) when compared at national level. Folate deficiency is linked with the hindered growth and development in children, so children may experience stunted growth, delayed development, and megaloblastic anaemia.

Deficiency of zinc and vitamin A is also high in the preschooler, schooler, and adolescent children of Assam in comparison to India. Since zinc and vitamin A play a vital role in growth, overall health, and immunity of the children, deficiency of these nutrients may cause the impaired growth, weak immune system which leads children susceptible to diseases and infections, delayed wound healing, cognitive impairment (difficulty in learning, memory, attention, and problem-solving skills), and night blindness (most common disease of vitamin A deficiency).

Table 3 - 37 Micronutrient deficiency among children in India and Assam

Age-group	Vitamin A		Vitamin B12		Vitamin-D		Zinc		Folate (Vitamin B9)	
	India	Assam	India	Assam	India	Assam	India	Assam	India	Assam
Pre-Schoolers (1-4 years)	17.6%	21.4%	13.8%	2.8%	13.8%	1.1%	18.9%	27.1%	23.3%	59.9%
Schoolers (5-9 years)	21.5%	16.6%	17.2%	3.1%	18.2%	4%	16.9%	18.2%	28.2%	62.8%
Adolescents (10-19 years)	15.6%	14.3%	30.9%	10%	23.9%	7.1%	31.7%	33.9%	36.7%	73.3%

Source : Comprehensive National Nutrition Survey (2016-2018) (2019)³⁹

Note: Gender segregated data is not available

Table 3-38 shows the health situation of children under 5 years old. The average number of stunted and underweight children are similar for both India and Assam with a percentage of 35.5, 32.1 and 35.3, 32.8 respectively. However, as shown in bold letters, out of 33 districts (excluding the newly formed districts), 19 districts seem to have more than 35% of stunted children and 15 districts are having more than 32% of underweight children. However, in case of wasted, severely wasted and overweight children Assam is overreaching the national percentage with an increase of 2.4% (wasted), 1.4% (severely wasted) and 1.5% (overweight) respectively. The factors of stunting, wasting, and underweight include the deficiency of macronutrient (i.e. energy, protein) and micronutrient (i.e. vitamin, iron, folate).

³⁹ <https://www.unicef.org/india/media/2646/file/CNNS-report.pdf>

Table 3 - 38 Health status among children under 5 years in Assam

Indicator		Stunted (%)	Wasted (%)	Severely wasted (%)	Underweight (%)	Overweight (%)
1	Kokrajhar	34.6	20.5	8.9	35.2	4.3
2	Goalpara	38.9	24.3	14.3	35.4	5.4
3	Barpeta	29.8	19.5	7.5	26.2	6.1
4	Morigaon	43.2	16.1	7.5	30.5	4.3
5	Lakhimpur	38.5	18.2	7.5	34.4	2.3
6	Dhemaji	37.2	18.3	10.1	25.7	3.5
7	Tinsukia	32.8	21.5	9.4	32.2	2.7
8	Dibrugarh	27.3	20.6	8.4	32	2
9	Golaghat	26.3	19.2	5.4	25.5	2.4
10	Dima Hasao	30.6	23.6	11.3	21.7	12.5
11	Cachar	28.7	30.7	12.5	38.2	3.3
12	Karimganj	29.1	48	30.5	52.9	1
13	Hailakandi	42.9	22.2	8.2	42.4	2
14	Bongaigaon	46.2	20.2	7.4	35.3	8.8
15	Chirang	42.7	19.5	8.5	39.7	4.5
16	Kamrup	22.6	14.8	5.3	19.7	7.5
17	Kamrup Metro	25.4	18.2	7.3	25	8.7
18	Nalbari	27.5	15.4	4.9	26.7	4.6
19	Baksa	41.2	17	6.2	34	8.6
20	Darrang	42	27	9.1	33.1	5.6
21	Udalguri	33.8	21.3	11.6	32.5	5.2
22	Biswanath	42.7	27.1	13.7	41	3.3
23	Charaideo	39	23.5	7.3	34.8	4
24	Dhubri	48.5	21.5	6.7	37.8	6
25	Hojai	39.3	12.7	4.6	28.4	6
26	Jorhat	38.7	15.5	5.1	33.2	5.4
27	Karbi Anglong	31.6	17.2	8.7	28.2	4.3
28	Majuli	35.4	14.1	3.9	22.2	3.8
29	Nagaon	38.9	19.4	5.2	32.4	7.4
30	Sivasagar	26.1	21.1	6.1	25.9	3.5
31	Sonitpur	36.7	13.1	4.5	21.9	3.2
32	South Salmara Mancachar	38.9	18.2	7.1	27.9	5.9
33	West Karbi Anglong	40.9	23.2	12.7	31.1	3.9
Assam		35.3	21.7	9.1	32.8	4.9
India		35.5	19.3	7.7	32.1	3.4

Source: National Family Health Survey-5 (2020-2021)

- Nutrition situation among adults

Table 3-39 reflects the district wise Body Mass Index (BMI) of the women and men of Assam. The average BMI level of adults in the state is comparatively lower than India. However, the table shows a higher level of underweight women than the average percentage of the state. The percent levels of under-weight adult women belonging to the Dibrugarh, Golaghat, Cachar, Hailakandi, Biswanath, Charaideo, Dhubri, Hojai, Jorhat, Majuli, Nagaon, Sivasagar and Sonitpur districts are higher than the remaining districts of the state. Similarly, the magnitude of overweight/obesity in the adult women belonging to Barpeta, Tinsukia, Dibrugarh, Golaghat, Dima Hasao, Bongaigaon, Kamrup, Kamrup Metropolitan, Nalbari, Baksa, Hojai, Jorhat and Sivasagar districts is above average of Assam. Out of the total, the 5 districts namely Dibrugarh, Golaghat, Hojai, Jorhat and Sivasagar, prevalence of both underweight and overweight/obesity is confirmed.

Table 3 - 39 Health status of adults aged 15-49 in Assam

Indicator		Women whose BMI is below normal (%)	Men whose BMI is below normal (%)	Women who are overweight (%)	Men who are overweight (%)
1	Kokrajhar	10.6	NA	13.7	NA
2	Goalpara	12.2	NA	15.3	NA
3	Barpeta	14.6	NA	16.6	NA
4	Morigaon	15	NA	14.2	NA
5	Lakhimpur	17.3	NA	12.4	NA
6	Dhemaji	12.1	NA	15.6	NA
7	Tinsukia	17.6	NA	16.9	NA
8	Dibrugarh	20.3	NA	20.9	NA
9	Golaghat	25.1	NA	16	NA
10	Dima Hasao	10	NA	16.2	NA
11	Cachar	19.7	NA	9.1	NA
12	Karimganj	17.8	NA	6.6	NA
13	Hailakandi	25.7	NA	10.9	NA
14	Bongaigaon	13.1	NA	16.9	NA
15	Chirang	17.2	NA	13.3	NA
16	Kamrup	12.9	NA	23.5	NA
17	Kamrup Metro	12.6	NA	21.3	NA
18	Nalbari	16.4	NA	21.8	NA
19	Baksa	15.1	NA	18.8	NA
20	Darrang	17.4	NA	13.3	NA
21	Udalguri	16.1	NA	14	NA
22	Biswanath	22	NA	10.6	NA
23	Charaideo	24.7	NA	10.3	NA
24	Dhubri	22.2	NA	12.4	NA
25	Hojai	19.3	NA	20.1	NA
26	Jorhat	22.5	NA	19.9	NA
27	Karbi Anglong	10	NA	15.7	NA
28	Majuli	18	NA	14.4	NA
29	Nagaon	21.5	NA	13.2	NA
30	Sivasagar	20.5	NA	21.5	NA
31	Sonitpur	21.4	NA	13.1	NA
32	South Salmara Mancachar	11.9	NA	8.5	NA
33	West Karbi Anglong	13.1	NA	9.4	NA
Assam		17.6	13.4	15.2	16.2
India		18.7	16.2	24	22.9

Note: Normal level of BMI is under 18.5 kg/m² and overweight or obese level of BMI is more than 25.0 kg/m².

Source: National Family Health Survey-5 (2020-2021)⁴⁰

- High prevalence of anemia among female adults in Assam

The prevalence of anemia is very high both in Assam and India. Table 3-40 shows that more than half of the women aged 15-49 in Assam are anemic. The prevalence of anemia among women aged 15-19 is severe, scoring higher percentage of India nationwide. On the other hand, the prevalence of anemia among pregnant women is the same level of the average of Assam. This may be due to the various interventions taken by national and state level initiatives.

⁴⁰ https://rchiips.org/nfhs/factsheet_NFHS-5.shtml

Table 3 - 40 Anemic status of women in Assam

Indicator		All women aged 15-49 years who are anemic (%)	All women aged 15-19 years who are anemic (%)	Pregnant women aged 15-49 years who are anemic (%)
1	Kokrajhar	59.5	63.7	59.5
2	Goalpara	64.9	66.9	49.2
3	Barpeta	64.8	70.7	47.6
4	Morigaon	64.2	71.8	48
5	Lakhimpur	65.4	71.5	42.3
6	Dhemaji	62.9	59.3	61.7
7	Tinsukia	72.8	71.5	71.7
8	Dibrugarh	70.8	64.3	47.2
9	Golaghat	77.2	74.7	76.7
10	Dima Hasao	60.5	70.9	43.3
11	Cachar	57.4	57.6	44
12	Karimganj	52	60.6	41.9
13	Hailakandi	61.4	58.1	58.7
14	Bongaigaon	70.6	73.8	51.2
15	Chirang	65.2	68.8	54.1
16	Kamrup	71.5	72.5	66.5
17	Kamrup Metro	74.6	80.6	56.4
18	Nalbari	66.4	66.8	53.2
19	Baksa	73.6	76.6	65.3
20	Darrang	70.4	69.9	51.6
21	Udalguri	81.5	72.6	63.9
22	Biswanath	64.4	67.8	45.1
23	Charaideo	72.3	76.1	61.6
24	Dhubri	63.2	65.2	69.7
25	Hojai	56.3	54.3	51.4
26	Jorhat	71.8	75.1	56.4
27	Karbi Anglong	59	57.5	42.1
28	Majuli	67.8	65.5	NA
29	Nagaon	61	65.1	62.4
30	Sivasagar	67.6	67.2	54.3
31	Sonitpur	63.6	55.5	47.3
32	South Salmara Mancachar	57.1	64.5	37.6
33	West Karbi Anglong	57.9	58.8	38.8
Assam		54.2	65.9	54.2
India		57	59.1	52.2

Source: National Family Health Survey-5 (2020-2021)

(2) Recommended dietary allowances and daily per capita nutrient intake

National Sample Survey Organization (NSSO) have provided the recommended dietary allowance (RDA) for adults and actual daily per capita energy intake, protein intake, and fat intake at national and state levels. Table 3-41 reflects that the energy intake of Assam and India is lower than the recommended norms. However, the protein and fat intake are quite higher than the recommended norms, which is due to the changing lifestyle and dietary preferences of people in India. Also, there has been a steady increase in meat consumption, junk food and availability of processed food in the last few years resulting in the higher consumption of these nutrients.

Table 3 - 41 RDA and Daily per capita Energy, Protein and Fat intake for India and Assam

Categories	RDA* for Energy (Kcal)	Energy Intake (Average Kcal)	RDA* for Protein (grams)	Protein Intake (Average grams)	RDA* for Fat (grams)	Fat Intake (Average grams)
India	2,420	2,220	49.8	60.5	28.3	52.05
Rural India		2,233		60.7		46.1
Urban India		2,206		60.3		58
Assam		2,140		55		34.4
Rural Assam		2,170		55.1		29.6
Urban Assam		2,110		54.9		39.2

Note*: The recommended calorie intake level for Indians set by the National Institute of Nutrition, ICMR, is based on age, sex, body mass, and nature of work. The norm set for the reference Indian man of age 19-39 years and woman of age 18-29 years with a normal body mass index and body weight 65 kg and 55kg respectively in Short Report of NUTRIENT REQUIREMENTS FOR INDIANS published by ICMR (2020). Here, the RDA is calculated using the average moderate weight of a man and woman (60 kg)

Source: Nutritional Intake in India, 2011-2012, 68th round of NSSO Consumer Expenditure Survey published by Ministry of Statistics and Programme Implementation, Government of India (October 2014).

(3) Causes of nutrition issues in Assam

- Poverty

Assam, like many parts of India, faces issues of poverty. The National Multidimensional Poverty Index, Baseline Report, 2023⁴¹ has revealed that an estimated 19.35 % population of Assam lives in multi-dimensional poverty (6th highest among 28 states and 6 union territories) and face deprivation from adequate health, nutrition, education, and standard of living.

- Lack of awareness

Comprehensive National Nutrition Survey (CNNS) (2016-18)⁴² pointed out that parents may lack knowledge on appropriate foods and feeding practices for the child's age and have inadequate awareness and or means for proper caring and health-seeking behavior. A study targeting Dibrugarh District also points out that malnutrition is more common among children with mothers who are illiterate or have primary level education than those with higher education⁴³.

- Food insecurity

Food insecurity, which can result from factors such as erratic weather patterns, crop failures, and inadequate food distribution systems, can contribute to macro and micronutrient deficiency. The same study mentioned in the previous paragraph revealed that food insecurity of household leads wasting, stunting, or underweight.

- Cultural practices

Certain cultural beliefs and practices may influence dietary habits, leading to imbalanced nutrition. For example, Assamese people have a habit of chewing betel nuts as one of their most common and traditional practice. Studies have shown that excessive chewing of betel nut is associated with abdominal obesity and other health related issues including, tooth decay, diabetes and hypertension⁴⁴.

- Dietary Preferences

Assam's traditional diet is rich in rice, fish, and vegetables. However, recent years have seen a shift towards more calorie-dense and processed foods. The increasing availability and consumption of fast food, sugary beverages, and snacks which contains large amount of fats and sugars have significantly altered dietary patterns. The young population of the state is more inclined towards the junk or processed foods.

⁴¹ <https://www.niti.gov.in/sites/default/files/2023-08/India-National-Multidimensional-Poverty-Index-2023.pdf>

⁴² <https://nhm.gov.in/WriteReadData/1892s/1405796031571201348.pdf>

⁴³ https://journals.lww.com/ijcm/fulltext/2020/45040/Malnutrition_and_Household_Food_Insecurity_in.4.aspx

⁴⁴ Chaudhary, M. & Sharma, P. (2023). *Abdominal obesity in India: analysis of the National Family Health Survey-5 (2019–2021) data*. [https://www.thelancet.com/journals/lansea/article/PIIS2772-3682\(23\)00068-9/fulltext](https://www.thelancet.com/journals/lansea/article/PIIS2772-3682(23)00068-9/fulltext)

(4) Intervention by the Government of Assam

To tackle the nutritional issues, the Government of Assam provides programs shown in the Table 3-42. Although several nutrition intervention programs have been implemented for children, there do not seem to be any programs that contribute to resolving adult health issues, including anemia in women.

Table 3 - 42 Nutritional Intervention by the Government of Assam

Scheme	Objective/details
Integrated Child Development Services (ICDS) ⁴⁵	ICDS is world's largest community-based program. The scheme is targeted at children up to the age of 6 years, pregnant and lactating mothers. It covers all blocks of the state and covers all habitations and areas in the entire state based on health and nutrition status of the beneficiaries. The scheme is implemented through 61,715 Angwadi Centers (AWC) in the Assam state. The scheme is funded by central and state government in the ratio 90:10 for general assistance and 90:10 for supplementary nutrition for all states of north-east region. SNP supplies the Take Home Ration (THR) among the children of 6 months to 3 years, pregnant women and lactating mother.
POSHAN Abhiyaan ⁴⁶	The Prime minister's overarching scheme for holistic nourishment (POSHAN) adopts a life cycle approach with greater emphasis on the first 1,000 days (from conception to 2 years of age of a child) through convergent efforts. The objective is to direct the country's attention to the problem of malnutrition and address it in a mission mode.
Scheme for Adolescent Girls (SAG) ⁴⁷	The scheme provides nutritional support to adolescent girls (14-18 years of age) for improving their health and nutritional status under the nutrition component and providing them IFA (Iron and Folic acid) supplementation, health checkups and referral service, Nutrition and Health Education (NHE) etc.
PM POSHAN (formerly Mid- Day-Meal) ⁴⁸	With a view to enhancing enrolment, retention and attendance and improving nutritional levels among children, the National program of nutritional support to Primary Education (NP-NSPE). The scheme was initially known as "mid-day-meal scheme, which was changed to Pradhan Mantri Poshan Shakti Nirman (PM-POSHAN). The scheme is implemented as a part of national food security mission and by the educational department. The beneficiary of the schemes are <i>Bal Vatika</i> , primary and upper primary children.
Targeted Public Distribution System ⁴⁹	Under Targeted Public Distribution System, the families of below poverty line get minimum ration like Rice, sugar, oil, pulses etc.

Source: Economic Survey, Assam, 2022-2023; Website of PM POSHAN, the Government of Assam; Website of Targeted Public Distribution System, the Government of Assam.

(5) Good practice: Pilot project of implementing fish powder in school meals

Under the APART, WorldFish conducted a series of mass awareness programs to increase the consumption of aquatic foods, particularly small fishes rich in micronutrients. The public was educated on the health benefits of small fish consumption and the inclusion of small fish-based nutrition in the diets of women especially, pregnant, and lactating women as well as infants and young children. In the month of September 2022, the inclusion of small fish powder in the Integrated Child Development Scheme (ICDS) Supplementary Nutrition Program was launched at 4 Anganwadi Center⁵⁰ at Kukumara village of the Kamrup district. The pilot project is sponsored by Indian Oil Corporation Limited (IOCL), in collaboration with and support from the Directorate of Fisheries as

⁴⁵ <https://womenandchildren.assam.gov.in/portlet-innerpage/icds>

⁴⁶ https://socialwelfare.assam.gov.in/sites/default/files/swf_utility_folder/departments/sw_webcomindia_org_oid_3/menu/document/poshan_abhiyaan_guideline.pdf

⁴⁷ https://socialwelfare.assam.gov.in/sites/default/files/swf_utility_folder/departments/sw_webcomindia_org_oid_3/menu/document/guidelines_of_scheme_for_adolescent_girls.pdf

⁴⁸ <https://ssa.assam.gov.in/portlets/pm-poshan-mid-day-meal>

⁴⁹ <https://pds.assam.gov.in/>

⁵⁰ Anganwadi Centers are grassroots childcare and development centers that provide nutrition, health, and preschool education services to children under 6 years old and pregnant/lactating mothers in rural and urban slum areas.

well as the Directorate of Social Welfare. The College of Fisheries at Assam Agricultural University (AAU), Jorhat provided the quality control and analysis of small fish powder.

The main objective of this initiative is supposed to tackle malnutrition of the children through the inclusion of dried small fish powder in their diet. The powder is prepared by using mola fish (*Amblypharyngodon mola*). As shown in Table 3-43 the mola fish has large amounts of calcium, iron, zinc, and vitamin A, compared to the large freshwater fish such as carp, catfish, and tilapia.

Table 3 - 43 Production of Fish Powder

Group	Scientific name (common name)	Protein (g/100g)	Calcium (mg/100g)	Iron (mg/100g)	Zinc (mg/100g)	Vitamin A (RAE)
Large freshwater fish	Carp	17.8	41	1.2	1.5	9
	Catfish	15.6	9	0.5	0.7	15
	Tilapia	20.8	10	0.6	0.3	0
Small freshwater fish	Amblypharyngodon mola (Mola)	-	776	5.7	3.2	>2680
	<i>Esomus danricus</i> (Darkina)	-	775	12	4	500-1500
	<i>Puntius ticto</i> (Puti)	-	992	3	3.1	500-1500
Other animal-source foods	Chicken breast	14.7	19	1.1	0.8	0
	Chicken egg	35.6	171	3.2	1.1	140
	Chicken liver	16.9	8	9.0	2.7	3292
	Cow milk	3.3	119	0.1	0.4	33

In the pilot project, the dried small fish powder is being included in the children's meals twice a week for a period of 6 months. The dried small fish powder is derived from locally available small fish and prepared by the Samaria Farmers Producers Company and Grameen Sahara (NGO). The pilot project was being proceeded in the 43 primary schools and 73 Anganwadi centers of the Bongaon block of Kamrup District where fish powder is being served (by adding it in the daal and sabji) in the mid-day meals of the children. The pilot studying was implemented from August 2023 to March 2024. Below Table shows the production of fish powder by the Samaria Farmers Producers Company and Grameen Sahara.

Table 3 - 43 Production of fish powder (continue)

Name of producer	Samaria Farmers Producers Company	Grameen Sahara
Raw material	Directly purchase dried mola fish from the local market due to the unavailability of the electrical dryer.	Purchase fresh mola fish from the market and dry it at their own establishment.
Producing method	1) Grinding/powdering of the purchased dried fish. 2) Sieving. 3) Weighing. 4) Packaging	1) Drying fresh fish in electrical dryer. 2) Grinding/powdering of the dried fish. 3) Sieving. 4) Weighing. 5) Packaging.
Producing cost*	Raw material: Rs. 300/kg for dried mola fish.	Raw material: Rs. 170/kg for fresh mola fish
Daily Production	50kg	100kg
Quantity	1 kg dried mola fish produces 280 grams of powder	(Confirming)
Mode of Business	Retail (Wholesale price- Rs 1,200/kg)	Wholesale (Wholesale price: Rs. 750/kg) Retail (Retail price: Rs. 1,000/kg)

Note: *The producing cost has been calculated for the 10 Packets of the powder (1 packet= 100g)

Source: Prepared by JICA survey team based on interviews with Grameen Sahara and Chamaria Farmer Producer Company Limited

As mentioned above, children in Assam are deficient in folic acid, vitamin A, and zinc. Zinc deficiency is a serious problem which leads to growth disorders in children. Zinc can be obtained from the mola fish so that the above pilot project using fish powder is considered an effective approach. In school

meals, egg used to be the only protein before the inclusion of fish powder. The introduction of fish powder, therefore, also contributes to the fulfillment of protein among children, which can prevent stunting, wasting, and underweight. Additionally, since mola fish has iron, if women take the fish powder, it could lead the prevention of anemia.

3.7 Private sector partnerships/entrepreneurship support

3.7.1 Current status of private sector partnerships/entrepreneurship support

In the fisheries and aquaculture sector in Assam, the national flagship program PMMSY and the World Bank-backed APART program have provided grants for facilities of private companies, including feed mills, hatchery ponds, RAS/bioflock/pen culture system, transportation vehicles, etc. NABARD's RIDF also provided funds for fish feed plants and vehicles.

In addition to those grant and funding supports to private companies in the sector, startup/entrepreneurship support programs have also been provided through PMMSY and APART as well as through GIZ's SAFAL and Startup Assam.

The following is a summary of these programs.

(1) PMMSY	
■ Private company support PMMSY provides grants to private companies under many different items, including feed milling facilities, hatchery ponds, RAS systems, bioflock systems, pen culture systems, and transport vehicles. Each District has an allocation, and the district office determines grant recipients by soliciting applications from private companies and other entities like producer groups within its jurisdiction. For more details, refer to Section 4.9.	
• Entrepreneur support:	
Scheme:	Fisheries Startup Grand Challenge
Area:	Nation-wide
Objectives:	The program aimed to identify, reward, and recognize startups making significant impacts in the fisheries/aquaculture ecosystem. The solutions should be devised for resolving issues across the fisheries value chain for increasing aquaculture productivity from the current national average of 3 tons to 5 tons per hectare, doubling exports earnings and reducing post-harvest losses from 25% to 10%.
Government agents	Department of Fisheries, India collaboration with the Startup India hub and DPIIT (Department for Promotion of Industry and Internal Trade) of the Ministry of Commerce and Industry
Organizer	Startup India hub
Eligible targets	DPIIT recognized Startups working in the areas indicated in the following problem statements. Stage: from ideation stage to scaling stage Themes for challenges include: • Design and develop technology/solutions for enhancing productivity so that the fishers & fish farmers can achieve better price realization. • Develop infrastructure and post-harvest management solutions that will enable fishers, fish farmers in creating value addition, value creation, and value realization ensuring minimal wastage across the fisheries value chain. • Develop business solutions and outreach activities that will make fish and fish products easily accessible, acceptable and popular among the meat consuming population in the country. • Develop sustainable solutions to reduce/stop soil erosion, siltation of the water bodies, and develop eco-friendly solutions for coastal fishers
Application	Online through Startup India portal.
Applicants	A total of 121 startups submitted

Companies selected	12 startups ⁵¹ selected. Among them, the following company has a footprint in Assam. Aqua Connect: Aquaculture platform provided with fintech and satellite sensing and AI functions. The company recently expanded its footprint to Assam.
Benefits	A cash grant of INR 0.2 million per startup, incubation support (9 months) and training at Masterclasses directly from Startup India. And up to 10 startups among them were provided worth INR 25 million seed grant through PMMSY scheme.
(2) WB APART	
■ Private company support In APART, although direct grant provision to the private companies was limited, provided some funding for the installation of small-scale feed milling facilities. For more details, refer to Section 4.9. • Entrepreneur support:	
Scheme:	Assam Agribusiness Growth Lab
Area:	Assam state
Objectives:	The program aims to support 100 enterprises in the sector (including aquaculture/fishery-related companies) in 4 years. The initiative supposed to create local success stories related to agri-entrepreneurship that will usher in a paradigm shift in the mindsets of the youths in Assam towards entrepreneurship.
Government agents	Department of Fisheries, Assam
Organizer	CIIE.CO (A startup accelerator/incubator located in Ahmedabad, Gujarat State) and ICCSPL
Eligible targets	Enterprises working in the areas like farm inputs, agriculture production equipment and services, food processing, agriculture-based warehousing and logistics, farm to fibre, farm to market connect services. • The enterprise should be sorting as a 'For-profit entity. • Should be in operation for 1-5 years in agri-allied sector. • Should be looking to raise funds between Rs 10 lakhs and Rs 5 Cr in next 8-12 months.
Application	For the first cohort, they organized 3 roadshows and 2 webinars.
Applicants	For the first cohort, there were 202 applications.
Companies selected	100 enterprises should be selected (include 30% women-led businesses) in 4 years. (About 25 companies/year.) After the three-stage screening processes, they selected 27 companies for the first cohort that was formed in August 2021. The aquaculture/fishery-related companies included in the first cohort were ⁵² : • Aqua Blue Global Aquaculture Sol: B2B E-fish market (fingerlings, feed, processed fish, etc.) • Mahabahu Fisheries: An integrated aquaculture company with a seed business and feed mill. • AroohanAgro Feeds: Animal and fish feed manufacturing company • Premier Agro Bio-Tech: Fish feed manufacturing company, planning to expand to the floating fish feed manufacturing
Benefits	Business Workshops and Technical Knowledge Sessions, Assistance for mobilizing finance & market access, Support for developing new products and services, Support for improving food quality standards, Handholding for new technology adoption
(3) NABARD RIDF	
■ Private company support In RIDF program, NABARD provided funding for transportation vehicles, feed milling facilities, etc. For more details, refer to Section 4.9.	

⁵¹ Winners of Fisheries Startup Grant Challenge
https://www.startupindia.gov.in/content/dam/invest-india/Templates/public/Winners%20of%20Fisheries%20Startup%20Grand%20Challenge_30.12.2022_Final.pdf

⁵² CIIE.CO, ICCSPL, Assam Agribusiness Growth Lab, Phase-1
<http://www.arias.in/download/APART/conreport/AAGL%20Cohort%20Selection%20Report.pdf>

(4) GIZ SAFAL	
■ Private company support GIZ SAFAL focused primarily on providing capacity building (business and technical training) through Kalong Kapili and ICCSPL, without providing funding or other financial support, with the main focus on smallholder aquaculture farmers. Beneficiaries in the training included private seed companies. For more details, refer to Section 4.9.	
• Entrepreneur Support:	
Scheme:	Aqua Entrepreneurship Initiative
Area:	Karbi Anglong, Sonitpur, Biswanath, Kamrup, Nalbari, Udalguri, and Nagaon, Assam state
Objectives:	The objective of the program was to provide capacity-building and networking opportunities for aspiring aquaculture/fishery industry-related entrepreneurs. They focused on selecting local entrepreneur groups who have the least risky business ideas and provided opportunities for those entrepreneurs to prepare their own business plans with professional support and to pitch their business strategies to local government/private finance organizations and individual investors.
Government agents	Department of Fisheries, Assam
Organizer	Kalong Kapili conducted the entire process in collaboration with ICCSPL and SeSTA.
Eligible targets	NA
Application	The process started in May 2022 and completed in February 2024. The activities included road shows, identifying about 1,000 aqua-entrepreneurs, screening tests, four boot camps (targeted 200 entrepreneurs).
Applicants	1,000 Aqua entrepreneurs
Companies selected	They selected 21 aqua-entrepreneurs (12 women) after the boot camps and provided opportunities to 4 district-level pitch events. Then, they selected the top 4 entrepreneur groups pitched their plan at the state-level investment evening.
Benefits	Provide trainings for selected entrepreneurs to create their own investable business plans and provide a chance to pitch their business plans to government/private investors.
(5) Startup Assam	
• Entrepreneur support Ministry of Commerce and Industry, India has a program called Startup India initiative to create a start-up ecosystem at the national level, and Startup Assam (https://startup.assam.gov.in/) is its state-level initiative under the Department of Industries & Commerce of the Assam State. Eligible companies can get recognized as Startups by the institution and then can get tax reductions and other benefits. Their service also includes various types of activities, including incubation and training, incubator support, providing networking opportunities, as determined by the Assam Startup Policy 2017⁵³. Some examples of the aquaculture/fishery-related businesses supported by Assam Startup include: • Aqua Blue Global Aquaculture: Cohort 3, B2B E-fish market (fingerlings, feed, processed fish, etc.) • Jolkuwori: Biofloc technology provider • Dorikona Fish Farming: Fish farming and retailing business using biofloc technology • Fish-A-Live: Fish farming and providing live fish to small fish retailers at the markets • Kolong: Fish online sales channel and offline outlet Under the Assam Ease of Doing Business Act 2016, the Assam government also has set up a Single Window Agency (SWA) and has created a comprehensive Single Window Portal called Ease of Doing Business, Assam (https://eodb.assam.gov.in/) together with National Informatics Centre of India.	

⁵³ Assam Startup Policy 2017 https://startup.assam.gov.in/wp-content/uploads/2019/01/sp_2017.pdf

3.7.2 Current status of private sector enterprises/entrepreneurs in aquaculture business

Private businesses are the main drivers of the industry.

In the case of aquaculture, 60~80% of variable costs are feed costs. Therefore, apart from the aquaculture operators, fish feed suppliers (feed mills, feed dealers, and feed retailers) form the largest private sector in the upper stream of the aquaculture value chain. The second largest business in the upper stream of the chain is hatchery businesses, followed by other inputs suppliers, like fertilizer, medicine, feed additives, etc.

In addition to the input suppliers, aquaculture infrastructure/system providers (biofloc, RAS, aeration facilities, feeding facilities, etc.) are also important players in the industry supply chain.

In the downstream side of the value chain, there are fish distribution players (wholesalers, aggregators, retailers and online market) and transportation-related companies (live transportation technology providers, refrigerated truck/storage providers, and ice suppliers.).

Feed About 30%	Seed/ fingerlings About 8%	Fertilizers /medicine About 7%	Gross income at farm (including infrastructure, labor, etc.) About 55%	Wholesalers / transportation	Retailers
Valuable input supply (about 45 billion INR)					
Farm gate value (about 100 billion INR (about 180 billion JPY))					
Retail value of Assam aquaculture fishes					

Figure 3- 30 Image of value breakdown of Assam aquaculture industry

Source: JICA Survey Team

This section describes the status of those private businesses in upstream side of the value chain, including (1) aquaculture feed suppliers, (2) feed supplement / pharmaceutical suppliers, (3) seed suppliers and fish doctors, and (4) aquaculture infrastructure/system providers.

The fish farmers are discussed in Section 4.4. The downstream side of the value chain will be covered in the results of the Value Chain Survey, that will include fish distribution players (wholesalers, aggregators and retailers) / live transportation technology, cold chain transportation/storage, ice suppliers. The digital/IT players are covered in the next Section.

(1) Aquaculture feed suppliers

Assam has an annual aquaculture production of approximately 300,000 tons. Therefore, the theoretical feed demand is about 300,000 tons, considering that the feed efficiency of freshwater carp is around 1.0. Traditionally, freshwater carp have been raised on plankton and aquatic plant matter as a nutrient source without feeding, or on a diet consisting of rice bran (rice polish) and mustard oil cake (MOC) mixed in-house with natural plankton and plant matter. It is estimated that about 40% of fish farms are still feeding in this way today.

However, in recent years, commercial floating pellet feeds have expanded in the industry. As discussed in Section 4.4.4, considering the limited commercial feed production capacity locally, at least 125,000 tons/year of commercial feed produced in other states is coming into Assam, and that amount is increasing every year.

Currently, the only commercial feed produced in the state is mash feed or sinking-type of pellet feed. Their use is limited because they are less productive and less efficient than floating feed.

Here, we overview the situation of a) commercial floating pellet feed manufactures (outside of the states), b) local small/medium-scale feed mills, c) local feed wholesalers and retailers, and d) local feed ingredient suppliers (Mustard oil mills and rice mills).

a) Commercial floating pellet feed manufactures (outside of the states)

Almost all commercial floating pellet feed come from outside of the state. The major players in the Assam markets included the ones in the neighbouring states like West Bengal and Bihar, as well as

major nationwide feed manufacturers, like IB Group, Deepak Nexgen, Growel Feed, Cargill, Godrej Agrovet as shown in the table 3-45.

Commercial floating pellet feed price has a large difference, ranging from Rs. 45 to Rs. 80/kg at the retail price. Wholesalers and farmers do not understand the reasons for the scientific/evidence-based difference in detail, but the significant price difference is caused by brand power, financial and kickback conditions, and the sales power of wholesalers, etc.

Table 3 - 44 Examples of commercial floating pellet feed manufacturers supplying to the Assam market

Manufacturer	Brand	Location	Note
Neighbourhood states			
Anmol ⁵⁴	Nouriture	West Bengal	360,000 MT animal feed capacity
Nippai Shalimar Feeds ⁵⁵	NSF	West Bengal	JV between Shalimar and Nippon Feed Manufacturing Company
CP	CPF	West Bengal	Thai feed giant who has a mill in West Bengal
Sreema Feed ⁵⁶	Ganga Kaveri	West Bengal	A group company of Sreema Rice Mill
New Hope	New Hope	West Bengal	New Hope has a feed mill in Kolkata
Kalyani Uno's Aqua Feeds ⁵⁷	Kalayani's	West Bengal	Kalayani is one of the leading rice mills in the region.
Nova Feed Industries ⁵⁸	NOVA	West Bengal	Established in 2017
Sona Gold Agrochem ⁵⁹	Sona Gold	Bihar	Established in 2003, started from poultry business
National major players			
IB Group ⁶⁰	ABIS	Chattisgarh	IB Group company is strong in poultry feed and poultry production. About 300,000 MT floating fish feed capacity ⁶¹ .
Deepak Nexgen ⁶²	Kingfish	Andhra Pradesh	The company claims that it has a 25% share in the market, 210,000 MT floating fish feed capacity ⁶³
Growel Feed ⁶⁴	Carpmax, Growfin, etc.	Andhra Pradesh	300,000 MT aqua feed capacity.
Cargill	Ewos, Aquaxcel	Andhra Pradesh	120,000 MT of floating fish feed production capacity. ⁶⁵
Godrej Agrovet	NutriFry, Spark, etc.	Maharashtra	They claim the #1 player in the feed industry. 30+ animal feed plants. Have palm oil and processed food businesses.

Sources: JICA Survey Team

b) Local small/medium-scale feed mills

There are 41 commercial feed mills in the state as discussed in section 4.4.4. Assam state does not have any large-scale floating feed mills. Most of these mills are producing either mash feed or small quantity of sinking pellets, and production capacity is mainly at the several hundred tons/year level.

⁵⁴ <https://www.nouriture.in/>

⁵⁵ <https://shalimarcorp.in/aqua-main/>

⁵⁶ <https://5.imimg.com/data5/SELLER/Doc/2021/7/XT/CH/QJ/96841680/floating-fish-feed-nursery.pdf>

⁵⁷ https://www.kalyanigroup.co.in/aqua_feed/

⁵⁸ <https://www.indiamart.com/novafeedindustries/profile.html>

⁵⁹ <https://www.sonagoldagro.com/fishfeed.php>

⁶⁰ <https://www.ibgroup.co.in/>

⁶¹ <https://www.ibgroup.co.in/indamara-plant/>

⁶² https://www.nexgenfeeds.in/nexgen_admin/company_images/0Company_Profile_compressed.pdf

⁶³ https://www.careratings.com/upload/CompanyFiles/PR/25032022093116_Deepak_Nexgen_Foods_and_Feeds_Private_Limited.pdf

⁶⁴ <https://growelgroup.com/>

⁶⁵ <https://www.cargill.co.in/en/2018/cargill-opens-first-dedicated-fish-feed-plant-in-india>

Therefore, overall, there is probably only about 10,000 tons/year capacity of commercial feed in the state. Very recently, 1 medium-scale feed mill (having a capacity of 15,000 tons/year) was established under PMMSY program and started its operation.

The main ingredients of the commercial feed are locally manufactured corn, rice bran, mustard oil cake, fish meal, bone meal, and soybeans, of which bone meal and soybeans must be procured from other states, but the rest can be procured within the state. They also add mineral supplements that are purchased from the suppliers outside of the state.

c) Local feed wholesalers and retailers

The feed distribution chain is shown in the figure 3-31.

Most of the commercial floating pellet feed mills outside of the state employ sales reps and technical advisors in the Assam state and supply farmers through a network of affiliated feed wholesalers and retailers, technical advisors provide water quality testing and other extension services to farmers free of charge to retain customers.

Here, feed wholesalers play a critical role in the chain in terms of logistics and finance. Each of the major feed manufacturers has several affiliated wholesalers, which are assigned to different regions in the state.

In terms of logistics, wholesalers have warehouses to store inventory and deliver by truck to retailers as needed. Retailers can also pick up the products if they have transportation.

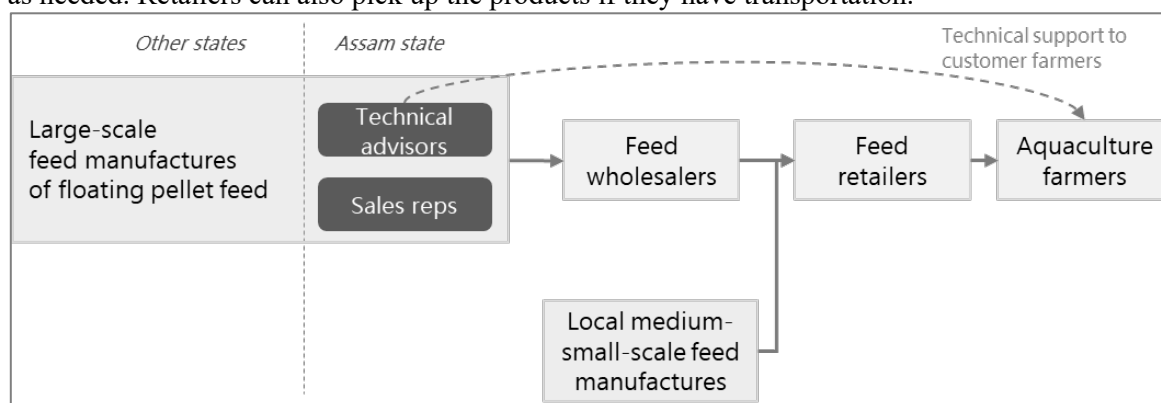


Figure 3- 31 Image of the distribution chain of feed for the Assam aquaculture industry

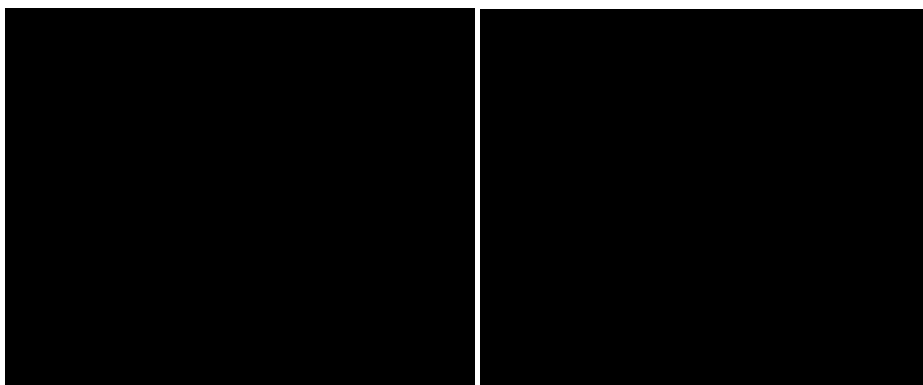
Source: JICA Survey Team

In terms of finance, wholesalers buy feed for cash from manufacturers out of the states and provide it to retailers and farmers on cash / credit. Farmers pay for the feed sometimes after they harvest and sell fish, which is then collected by the retailers and they send money back to wholesalers.

The wholesaler sells the feed to the retailer, adding logistics costs and normal wholesale margins. In addition to this, feed manufacturers pay incentives (kickbacks) to wholesalers based on the volume handled. Therefore, the more the state's intensive and semi-intensive aquaculture industry develops, the majority of its revenue just goes to wholesalers and out-of-state feed manufacturers as feed cost accounts 60~80% of variable costs of intensive/semi-intensive aquaculture production.

In addition to logistics costs, wholesalers face the challenge of access to finance. In many cases, local authorities are using their own capital instead of borrowing from banks or other formal financial institutions, which may create a financial bottleneck for some wholesalers to further expand their scale.

In the list prepared by DoF, 17 feed dealers, 32 feed wholesalers and about 60 feed retailers are recorded in the list.



Pictures: Mafin Fish Feed Center handling Deepak Nexgen and Sona Gold Agrochem products

d) Local feed ingredient suppliers (Mustard oil mills and rice mills)

Assam produces 6 million tons of paddy rice and 250,000 tons of mustard/rapeseed, and has a large number of small-scale milling facilities and rice millers.

They are the suppliers of mustard oil cake (MOC) and rice bran (rice -frass) those can be utilized as feed ingredients. In total, 480,000 mt of rice bran and 150,000 tons of mustard oil cakes are available in the state.⁶⁶

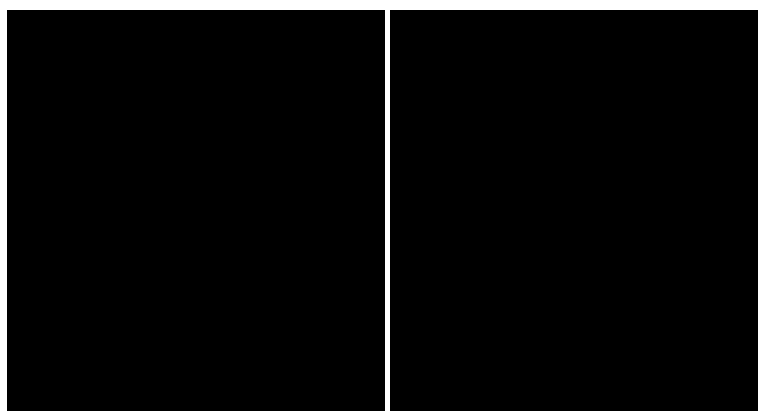


Figure 3- 32 Mustard oil cake and mustard oil mill in Mayong District

(2) Feed supplement / pharmaceutical suppliers

Lime, fertilizer, and zeolite are used during the pond preparation phase. In addition, various chemicals, hardness regulators, oxygen supply pellets, and probiotics are utilized to control water quality. Mineral and vitamin supplements, other growth promoters, sustainment agents, and agents for parasites, pests, diseases, and algae control agents may also be used. Refer to the table below.

These products are handled by veterinary drug dealers/retailers. In many cases, products from abroad or domestic pharmaceutical-infrastructure are distributed in the state through dealers in neighbouring states such as West Bengal.

⁶⁶ Assuming that the rice bran contains 8% of the puddy rice weight and the mustard oil cake contains 60% of the mustard oil seed weight.

Table 3 - 45 Examples of major manufacturers of feed supplements and pharmaceuticals supplying to the Assam market

Company	State	Note
International		
Virbac	France	Major animal pharmaceutical manufacture
Bayer	Germany	Major chem company
Indian companies		
Bhuvan Biologicals	Andhra Pradesh	Animal pharmaceutical manufacture
Apisa Biotech	Hyderabad	Animal pharmaceutical manufacture
Neospark	Telangana	Animal pharmaceutical manufacture
The Himalaya Drug Company	Karnataka	Himalaya Wellness subsidiary
Godrej- Living Acua	Maharashtra	One of the major feed suppliers

Source: Sonmoina Bhuyan, et. Al., 2023, Present status of application of aquaculture inputs in the state of Assam, India <https://www.thepharmajournal.com/archives/2023/vol12issue4/PartN/12-4-111-728.pdf>

Table 3 - 46 Examples of fertilizers, feed supplements, pharmaceuticals supplying to the Assam market

Input	Commecial name	Active Component	Manufacturer
Lime, fertilizers, zeolite			
Liming	Quick Lime	CaO	Balaji Trading
	Dolomite	CaMgO	Samden Dolomite
	Fish CaCo3	CaCo3	Essential Aquatechpvt. Ltd
Fertilizer	Urea	Nitorgen	HFCL
	DAP	N, P	Arawali phosphate Ltd
	SSP	P	Arawali phosphate Ltd
	Growmuss	Bio-NPK, Humic acid, Minerals	Krishi Bharati
Zeolite	Aqua Magic Powder and granules	Zeolite	Excellar Healthcare Pvt Ltd
Water quality control			
Water sanitizer	Medisan	Not disclosed	Essential Aquatech Pvt. Ltd
	Clear Pond	Yucca, Bacillus	
	Sucrena WS	Didecyldimethylammoniumchloride	Virbac
	Kohrsolin TH	Glutaraldehyde etc.	Virbac
	AOP Plus	Metaborate Peroxyhydrate	Neospark
	Bionex-80	Alkyl Dimethyl Benzyl Ammonium Chloride	Neospark
	Trudine 20%	Iodine	Bhuvan Biologicals
	Hunter	Not disclosed	Krishi Bharati
Water hardness controller	Water Soft	EDTA Stabilizer	Essential Aquatech Pvt. Ltd
Probiotics			
Probiotics	Eco-Clean-P	20 strains of beneficial microbes	Bhuvan Biologicals
	Phyto Plus	Spirulina, Chlorella, Bacillus etc.	
	Excellent Bottom	Bacillus group of bacteria	Excellar Healthcare Pvt. Ltd
	Zeoclean	Not disclosed	Krishi Bharati
	Pond Shield	Beneficial microbiota	The Himalaya Drug Company
	V5	Microbial elements	Virbac
	BioClear	HSAS, Nitrosomonas etc.	Neospark
	Bio Remid-Aqua	Bacillus group of bacteria	
Supplements			
Mineral Supplement	Him TRACE	Ca, Mg, K	The Himalaya Drug Company
	HimCal	Ca. K	

Input	Commecial name	Active Component	Manufacturer
	Minforte+	Ca, Mg, Zn, S, Co etc.	Bhuvan Biologicals
	Agrimin	Phosphorus and Ca	Virbac
	Chelavet forte	Ca	Apisa Biotech
Vitamin and Mineral Supplement	Minerax Forte	Vitamin A, D3, E, Cobalt, Copper, Fe	Excellar Healthcare Pvt Ltd
	Fishmin-SP	Minerals with vitamin and amino acid	Bhuvan Biologicals
	Fishtech	Vitamins	Apisa Biotech
	LIV Active	Vitamin C	Essential Aquatech Pvt. Ltd
	Vitabin Gel	Vitamins	
	Nutri-Vet Powder	Vitamins	Save eco agro Pvt Ltd
	ASPHOS C	Vitanmin C (Ascorbyl 2 mono phosphate)	Godrej- Living Acua
	Him- C	Vitamin C	The Himalaya Drug Company
Biologicals, others	Liver Plus	Ecliptaeratica etc.	Bhuvan Biologicals
	Biozymes	Enzyme, Vitamin, Mineral etc.	Apisa Biotech
	Bio- KC	BKC-80%	
	Ultra Zyme-P-FS	Amylase, Cellulose	Neospark
	Liv.52 Protect	Solanum nigrum, Vitamin C	The Himalaya Drug Company
	Omny Gel	Fortified with Protein, Vitamin, Mineral and Carbohydrate	Godrej- Living Acua
Medicinal products			
Oxygen releasing Tablets	O ₂ Marine	Sodium Perborate	Virbac
	OXSEA Pearls	Sodium Perborate	Godrej- Living Acua
	DO PLUS	Sodium Perborate, Calcium peroxide	Essential Aquatech Pvt. Ltd
	OXY Magic-Gran	Sodium Perborate	Bhuvan Biologicals
	KmnO ₄	KmnO ₄	AGARWAL DRUGS Pvt. Ltd.
Toxin binder	Toximar	Natural hydrated Sodium Calcium Aluminum Silicates	Virbac
	Aqua doan	Silicon oxide, Aluminum oxide	Godrej- Living Acua
	Him TOX	Dipolat toxin binder	The Himalaya Drug Company
	Zeopond	Aluminium oxide, Silicate	Essential Aquatech Pvt. Ltd
Antibiotics	CEF-XLR Powder	Cephalexin	Excellar Healthcare Pvt Ltd
Insecticide	Cleaner	Cypermethrin	Virbac
	Decis	Deltamethrin	Bayer
Parasiticide	Expell	Albendazole	Excellar Healthcare Pvt Ltd
	Endectin Powder	IVERMECTIN IP	
Bactericide and Fungicide	Exorena (4S)	4 th Generation Quaternary Ammonium Compound	Excellar Healthcare Pvt Ltd
Algaecide	Copper Sulphate	Copper Sulphate	Balaji Trading
Plant extract	C-FAX	Plant extract	AspiyerAgro Industry
	Gaso Rid-FS-AQUA	Yucca extract	Neospark
	Yucca fresh	Yucca extract	The Himalaya Drug Company
Others	CIFAX	Not disclosed	Agarwal aquaculture

Source: Sonmoina Bhuyan, et. Al., 2023, Present status of application of aquaculture inputs in the state of Assam, India <https://www.thepharmajournal.com/archives/2023/vol12issue4/PartN/12-4-111-728.pdf>

(3) Hatcheries and ‘fish doctors’

The private sector is leading seed production as discussed in Section 4.4.4. There are 582 private hatcheries in Assam, while 26 government-owned hatcheries in the state, based on the Statistical Handbook of Assam 2023⁶⁷. It can be started with relatively low capital, and there are many small players. The seed industry in Assam is already large enough to supply the state’s seed demand, and exports to other states.

The Assam Fish Seed Act, 2005⁶⁸ requires all fish seed businesses to be registered with the State government through the District Fishery Development Officer (DFDO) and obtain licenses from the state. The quality certificate shall be obtained from the District Fishery Officer for sales of fish seed. However, verification of brood stock size, source, replacement of available 30% stock on annual basis, single species or cross- species breeding etc. is done or not, need to be ascertained before issuing certificate.

Hormone inoculation necessary for breeding is done by individuals called ‘fish doctors’ with local knowledge and has not grown into a corporate form. Fish breeding hormones are supplied to fish doctors through distributors. The manufactures of those hormones who are supplying to the Assam market include the Apisa Biotech, HEMMO Pharma, Essential, Amrit Pharmaceuticals, L-Kaliya Foods, and Bhoomi Aqua International⁶⁹. More recently, fish pituitary gland hormone has also attracted the few ‘fish doctors’ again for its better performance though cumbersome in use, which was earlier the only source of hormone - infrastructure.

Hatcheries interested in seed production of local indigenous river fish species with high unit price, are also interested in training in breeding of those new varieties.

(4) Aquaculture - infrastructure/system providers

Most of aquaculture ponds in the region are unsupported excavated ponds and no special commercial technologies are used. Biofloc systems are introduced for some businesses, and a few entities utilize RAS.

1) Biofloc

There are only 193 entities who implemented biofloc system among total 552,607 ponds/tanks in the states, based on the Statistical Handbook of Assam 2023.

There are many biofloc tank and polythene liner dealers in Assam.

Manufacturers of tanks and other equipment appear to be located outside the state. At the national level, R.S. Polymers (New Delhi), Ambrotechs (Hyderabad), Garware Technical Fibers (Maharashtra), Texcel Industries (Gujarat), Das & Kumars (Uttar Pradesh), Plastikraft (Maharashtra), Redox (Norway) are major tank manufactures / polythene liner suppliers for the biofloc system based on the Biofloc booklet prepared by the National Fishery Development Board⁷⁰.

2) RAS facilities

There are only 9 entities who are operating with RAS facilities based on the Statistical Handbook of Assam 2023.

There are a couple of RAS facility dealers located in Assam. At the national level, same 6 local manufacturers as shown in 1) Bioflock are the major manufacturers of tanks and equipment for

⁶⁷ Statistical Handbook of Assam 2023 is available here:

https://des.assam.gov.in/sites/default/files/swf_utility_folder/departments/ecostat_medhassu_in_oid_3/this_comm/statistical_handbook_assam_2023.pdf

⁶⁸ The Assam Fish Seed Act, 2005

https://fisheries.assam.gov.in/sites/default/files/swf_utility_folder/departments/fishery_uneecopscloud_com_oid_3/menu/right_menu/right_menu/The%20Assam%20Fish%20Seed%20ACT%202005.pdf

⁶⁹ Sonmoina Bhuyan, et. al., 2023, Present status of application of aquaculture inputs in the state of Assam, India

<https://www.thepharmajournal.com/archives/2023/vol12issue4/PartN/12-4-111-728.pdf>

⁷⁰ National Fisheries Department Board, Recent Trends in Aquaculture, Biofloc Fish Culture

<https://www.nfdb.gov.in/PDF/Biofloc%20booklet%20v6.pdf>

3.7.3 Indian startups and enterprises who are interested in Assam aquaculture/fishery industry

In order to identify potential private sector partners for the JICA aquaculture project, a desktop survey was conducted to compile a long list of start-up companies that provide products and services to the aquaculture industry or have products that could potentially be used in aquaculture. After checking each company's website, a simple questionnaire was sent to 25 companies. Six of them responded, and all of them showed strong interest in collaborating with the JICA aquaculture project. Based on the completed questionnaire, additional questions were asked by e-mail for clarification and/or further details.

The table 3-48 summarises their aquaculture businesses and potential areas/elements of collaboration based on the questionnaire survey.

Table 3 - 47 Summary of a questionnaire survey conducted for Indian startups

Enterprise	Type of Aquaculture	Potential Areas/Elements of Collaboration		Geographic Areas (States) of Current Business
Aquaconnect	Smallholder Inland Aquaculture	☒	Input supply	Andhra Pradesh, Assam, Gujarat, Odisha, Tamil Nadu, Uttar Pradesh, and West Bengal
		☐	Infrastructure/pond/farm development/rehabilitation	
		☐	Machinery/equipment manufacturing and supply	
		☐	Technical/ICT/digital solutions	
		☒	Cold chains, distribution/ marketing	
		☒	Others (advisory for entrepreneurs, credit support services, etc.)	
BHARAT H RHINO BIOTECH	Inland Aquaculture	☒	Input supply	Andrapradesh, and Tamil Nadu,
		☐	Infrastructure (pond/farm) development/rehabilitation	
		☐	Machinery/equipment manufacturing and supply	
		☒	Technical solutions (ICT/digital solutions, etc.)	
		☐	Cold chains, distribution/ marketing	
		☐	Others	
ECKLIEN 4RAS MarscoNur oceuticals	Marine/Inland Aquaculture	☒	Infrastructure (pond/farm) development/rehabilitation	Chennai, Tamilnadu Andhra Pradesh and Telangana
	Smallholder Inland Aquaculture	☒	Machinery/equipment manufacturing and supply	
		☒	Technical solutions (ICT/digital solutions, etc.)	
		☐	Cold chains, distribution/ marketing	
		☐	Others	
		☒	Input supply	
MarscoNur oceuticals Robic Rufarm	Smallholder Inland Aquaculture	☒	Infrastructure (pond/farm) development/rehabilitation	Andhra Pradesh and Telangana -
	-Smallholder Inland Aquaculture	☐	Machinery/equipment manufacturing and supply	
	-Industrial Scale Inland Aquaculture	☒	Technical solutions (ICT/digital solutions, etc.)	
		☐	Cold chains, distribution/ marketing	
		☐	Others	
		☒	Input supply	

⁷¹ National Fisheries Department Board, Recent Trends in Aquaculture, Recirculatory Aquaculture System (RAS) https://nfdb.gov.in/PDF/06_Ras%20Booklet%20Eng.pdf

Enterprise	Type of Aquaculture	Potential Areas/Elements of Collaboration		Geographic Areas (States) of Current Business
Robic Rufarm SNRASSY STEMS (Fishmonger)	-Smallholder Inland Aquaculture	☒	Infrastructure (pond/farm) development/rehabilitation	- Assam, Bihar, Jharkhand, Karnataka, Maharashtra, and West Bengal
	-Industrial Scale Inland Aquaculture	☒	Machinery/equipment manufacturing and supply	
	-Smallholder Inland Aquaculture	☒	Technical solutions (ICT/digital solutions, etc.)	
	-Industrial Scale Inland Aquaculture	☒	Cold chains, distribution/ marketing	
	-Industrial Scale Inland Aquaculture	☒	Others (study on shrimp gender switching)	
	-Industrial Scale Inland Aquaculture	☒	Input supply	
SNRASSY STEMS (Fishmonger)	-Smallholder Inland Aquaculture	☒	Infrastructure (pond/farm) development/rehabilitation	Assam, Bihar, Jharkhand, Karnataka, Maharashtra, and West Bengal
	-Industrial Scale Inland Aquaculture	☒	Machinery/equipment manufacturing and supply	
	-Industrial Scale Inland Aquaculture	☒	Technical solutions (ICT/digital solutions, etc.)	
	-Industrial Scale Inland Aquaculture	☒	Cold chains, distribution/ marketing	
	-Industrial Scale Inland Aquaculture	☐	Others	

Source: JICA Survey Team

Of the companies that responded to the questionnaire, those with technologies and services that could potentially be used for the JICA project in Assam are described below with an overview of their products/services and possible areas of collaboration.

- Aqua Connect⁷²

Aqua Connect provides various digital solutions for the aquaculture industry using AI & satellite remote sensing technologies. As of April 2024, Aqua Connect is operating inland-aquaculture business targeting smallholder farmers in seven states: Andhra Pradesh, Assam, Gujarat, Odisha, Tamil Nadu, Uttar Pradesh, and West Bengal. In the state of Assam, the company works mainly with Indian Major Carps (IMC) such as Catla, Rohu, Mirgal and other freshwater fish, while in Andhra Pradesh, Odisha, West Bengal and Gujarat, the focus is on shrimp.

Aqua Connect has developed a full stack aquaculture support platform consisting of four systems: Aqua-sat; Aqua-partner; Aqua-bazaar and Aqua-cred.

Aquasat is a data analytics system that uses AI and satellite remote sensing to collect geospatial data. In addition to real-time monitoring of fish ponds, Aqua-sat can predict input demand.

Aqua-partner is a one-stop shop for fish farmers. The company creates links between fish farmers and input shops run by Aqua Connect's retail partners. The one-stop shops sell a variety of high quality aquaculture inputs such as fish feed, supplements, probiotics, growth enhancers, disinfectants, disease controllers and water quality management products. In addition to marketing inputs, Aqua Connect works with fisheries specialists and rural entrepreneurs to provide fish farmers with advice on sustainable aquaculture practices.

Aquabazaar is a matching service between aquaculture farmers and buyers. Aqua Connect has a database of a wide range of buyers (e.g. processors, retailers, etc.) through which reliable market linkages between fish farmers and buyers can be realised.

Aquacred is a credit access support programme. It acts as a facilitator to help aquapartners and seafood buyers access formal credit to sustain and grow their businesses.

<Possible area for collaboration>

Aqua Connect works across the value chain, from input supply to markets, ensuring access to necessary services such as technical advice and financial services. The company has not yet worked

⁷² Aqua Connect: <https://aquaconnect.blue/>

with international organisations but is keen to partner with the JICA aquaculture project. Aqua Connect targets small-scale fish farmers and already has extensive networks with aquaculture stakeholders in Assam State, including fish farmers, input suppliers (aquapartners), seafood processors and buyers. The company's products and services can help digitise the aquaculture industry in the state of Assam.

- Bharath Rhino Biotech⁷³

Operating in Andhra Pradesh and Tamil Nadu, Bharath Rhino Biotech is a manufacturer and supplier of feed supplements and aqua care products for fish, shrimp and prawn farming. The company also provides technical consultancy services on biofloc, open pond, water quality control, fish health diagnosis and treatment, fresh and brackish water systems, etc. Biotech's feed supplements include regular feed supplements and therapeutic feed supplements. The regular feed supplements are suitable for all species including IMC, tilapia and shrimp. As for the therapeutic supplements, each species requires a different supplement formulation. The company also offers water treatment products that can be used in all types of aquaculture systems.

<Possible area for collaboration>

While Bharath Rhino Biotech's products are primarily targeted at commercial-scale aquaculture production, the company has the capability to formulate therapeutic feed supplements for various species. Depending on the scale of aquaculture production targeted for the JICA loan project, the company may be a possible partner for providing aquaculture inputs (supplements and water treatment products).

- Marsco Nutraceuticals⁷⁴

Marsco Nutraceuticals (Marsco) is a manufacturer and marketer of animal and aquaculture feed supplements and a provider of technical consultancy services. Marsco is developing smallholder inland aquaculture in the states of Andhra Pradesh and Telangana, focusing mainly on shrimp. They produce shrimp/fish feeds and supplements and provide technical support services in the full cycle of an aquaculture investment project/business, including business plan development services, project management services and investment advisory services.

<Possible area for collaboration>

Consultation can be provided on the establishment of new aquaculture facilities, site selection, feed formulation, water quality management, etc., and various partnership possibilities can be explored, depending on the nature of the project.

- Robic Rufarm India⁷⁵

Robic Rufarm India (Robic Rufarm) provides digital solutions for inland aquaculture, both small-scale and industrial, offering intelligence and sensor solutions to improve the quality of aquaculture. The company focuses on implementing an indigenous autonomous real-time aquaculture monitoring system using IoT and AI platforms to provide data and alerts through a mobile application that synchronises fish farmers, lab technicians and pond technicians to solve the time-lag problem in pond activities.

A team from Robic Rufarm is working on pond analytics and analysis of creature behaviour, water quality management and underwater crop analytics in collaboration with incubation centres such as Indian Institute of Technology (IIT) Bombay SINE, Indian Council of Agricultural Research (ICAR), Indian Agricultural Research Institute (IARI) and National Academy of Agricultural Research Management (NAARM) and Ag-hub.

⁷³ Bharath Rhino Biotech: <https://bharath-rhino-biotech.my-online.store/>

⁷⁴ Marsco Nutraceuticals: <http://marsco.in/>

⁷⁵ Robic Rufarm: <https://robicrufarm.com/about-us/>

<Possible area for collaboration>

Robic Rufarm's products can be used for small-scale aquaculture and the company is interested in partnering with JICA projects.

- SNRAS Systems Pvt.Ltd.⁷⁶

SNRAS Systems is engaged in inland aquaculture, both small-scale and industrial, in six states: Assam, Bihar, Jharkhand, Karnataka, Maharashtra and West Bengal. SNRAS is developing the aquaculture business along the entire value chain from input supply, production, distribution and marketing using innovative technologies and systems developed by the company.

The company designs, builds and installs the Recirculating Aquaculture System (RAS). During implementation, they provide monitoring services such as water quality testing, etc. In addition, SNRAS manufactures a variety of aquaculture machinery and equipment (e.g. Biofloc, IoT, aerators, hatcheries, feed mills, etc.).

SNRAS has also developed a technology-based live fish supply chain platform called Fishmonger. Through its corporate network of fish farmers, the company sources fish from rivers, ponds or the sea, and monitors the water quality (pH, ammonia, oxygen, etc.) and stress levels of the live fish using biotechnological water treatment equipment that can neutralise all potential pathogens. As a result, Fishmonger has reduced fish mortality during transport from 50% to 5% and eliminated price fluctuations for live fish, as the system ensures a consistent quality supply, allowing wholesalers to accept pre-orders.

<Possible area for collaboration>

SNRAS already has a footprint in Assam and is able to provide a range of inputs and services along the value chain, depending on the nature of the project.

3.7.4 Japanese companies who are interested in Assam aquaculture/fishery industry

In order to identify potential Japanese private sector partners for the JICA aquaculture project, a desktop survey was conducted to compile a list of Japanese companies that provide products and services to the aquaculture industry or have products that could potentially be used in aquaculture. In the selection of the companies, consideration was also given to whether they were already active outside Japan. A simple questionnaire was sent to 23 companies to inquire on their interest in developing business in the Indian aquaculture industry and in working with JICA projects.

Table 3 - 48 Business support platforms for public-private partnerships

Platform	Host Organization
Public-Private Partnerships for the Promotion of Global Food Value Chains	Ministry of Agriculture, Forestry and Fisheries (MAFF)
SDGs Business Co-Creation Lab - Tsunagaru Lab	JICA India
SME-SDGs Business Support Partnership	JICA
Global Business Support: Get out of Japan!	Ministry of Economy, Trade and Industry (METI)

Of these, three companies responded and follow-up interviews were conducted with these companies. In addition, interviews were conducted with four companies that were separately approached for an interview.

Below is an overview of companies with products and services that could potentially be utilised in the Indian aquaculture sector, and areas where partnerships could be possible.

Case studies:

- TBR - Bio-cord (Purifies water quality by efficiently propagating beneficial microorganisms)⁷⁷
TBR manufactures a range of functional braided rope products mainly for fishing, agricultural and water treatment industries. The company has a product called "biocord" which purifies water by

⁷⁶ SNRAS: <https://www.snrasystems.com/about>

⁷⁷ https://tbrjp.co.jp/?page_id=558

efficiently propagating microorganisms in the water. TBR is exploring the product's potential for use in India for river purification and is conducting a study under JICA's SME Support Scheme from 2022.

The company's product portfolio also includes materials for aquaculture, including shelters using artificial seaweed for banana shrimp, filter media, denitrification materials and foam separator (protein skimmer). TBR's banana shrimp shelter is effective in preventing cannibalism of banana shrimp and are currently targeted at banana prawn farming. The shelter has been tested in Vietnam, where a demonstration of hanging artificial seaweed on the four sides of ponds in shrimp farms showed that the growth rate of shrimp could be improved. The feasibility of introducing these products to Indian shrimp aquaculture will also be investigated in Chennai during the study.

TBR has been actively expanding overseas. The company set up a production plant in Shanghai in 1995 and established a sales office in 2010. In addition to this, the company has distributors in Malaysia, Indonesia and Taiwan and is actively expanding overseas. In India, the company sells its products through a company specialising in water purification. The partner has many connections with aquaculture companies, and TBR is considering expanding into the aquaculture industry in the future. The partner company has branches in Hyderabad, Pune and Bangalore and cover the whole of India.

<Possible area for collaboration>

TBR is interested in developing the water treatment and aquaculture business in India and already has a distribution network in place through a partner. While the effectiveness of using TBR's materials for fish farming needs to be demonstrated, TBR will be able to provide equipment for Assam's aquaculture such as "biocord", filter media, denitrification materials and foam separators depending on the needs of the proposed project. Considering the cost of introduction, there is a high potential to introduce these into aquaculture for fish species with a certain high unit price. Price and cost effectiveness are likely to be issues in the future diffusion of the system.

- Tokyo8 Global⁷⁸

Tokyo8 Global manufactures a biostimulant product (Tokyo8) derived from the sludge treatment technology of an affiliate company Taiyo Yuhka. The product is made up of an aggregate of more than 1,400 micro-organisms and used as a bio-stimulant in the cultivation of various agricultural products. Tokyo8 Global is actively expanding overseas, with some operations in 25 countries, mainly in Africa. It uses an on-site production and franchise model to ensure that prices are affordable to local farmers.

Their biostimulant product is currently used for agriculture and has not been tested for aquatic life. Nevertheless, Tokyo8 was originally developed using know-how on sludge/water treatment and if its non-toxicity to aquatic life and water quality improvement effects are confirmed, it could potentially be used in aquaculture and other fields, according to the company's representative. Due to manpower constraints, while it is difficult for Tokyo8 to actively participate in joint research or in JICA projects in the short-term, they may be able to supply the product for research purpose if needed.

- Effective microorganisms laboratory- microorganisms

EM Research Organization (EMRO) provides a microbial solution to soil/water-related problems through the research and development of EM.⁷⁹ EM, which represents a line of microbial products, is created by combining specific microorganisms, all of which work together synergistically, such as lactic acid bacteria, yeast, and phototrophic bacteria. EM, mixed with rice bran, is used as Bokashi fertilizers, while mixed with molasses, it is used in liquid as supplements of fish feeds or as water

⁷⁸ <https://www.tokyo8global.com/>

⁷⁹ EM is a people-friendly and environmentally safe product of EMRO (EM Research Organization) that achieves synergistic effects by combining beneficial microorganisms which exist in nature, such as lactic acid bacteria, yeast and phototrophic bacteria. EM is a trademark and a brand name owned by EMRO. For further details, <https://emrojapan.com/what/>

purifiers. EM can be used regardless of the type of fish or seafood. EMRO uses EM in agriculture, fisheries, aquaculture, and wastewater treatment, which contributes to environmental conservation as well as sustainable industry development.

EMRO started producing EM in India about 20 years ago, based on a license agreement on both the EM brand and technology, with an Indian partner enterprise.⁸⁰ Initially, in Sikkim State, EMRO began to apply EM to the production of organic fertilizers, which became widespread throughout the state.⁸¹ Following the success in agriculture, EMRO started the EM application to aquaculture in Kolkata, where EM is used to control the water quality of aquaculture ponds. At present, EM, marketed by the partner through B2B or B2C,⁸² is distributed across the country. In proportion to the sales, the partner pays royalties to EMRO.

For about 20 years, EMRO has produced EM in 55 countries (as of April 2024) and rolled out the EM-related activities, not necessarily in business. As part of its Corporate Social Responsibility (CSR), EMRO provided Bhutan with EM, which was used for agriculture and poultry farming. For business activities, in principle, EMRO has a sole partner per country. Not only private enterprises but also public enterprises can become partners. In Egypt, for instance, EMRO worked with two government partners (Ministry of Agriculture and Land Reclamation, and Ministry of Environment), which contributed to soil improvement and natural resource management in the country. In 2024, EMRO plans to launch a shrimp aquaculture with a Thai partner.

3.7.5 Challenges in private sector collaboration/entrepreneurship support

In relation to the private sector and startups, the following are considered to be the main issues:

- Limited numbers of investable enterprises
- Limited access to finance for new challenges
- Limited opportunity to learn new technologies
- Challenges in feed supply (Quality, cost, low self-sufficiency)

(1) Limited numbers of investable enterprises

It is essential to support and promote local entrepreneurs in order to promote industry to growth. APART program is aiming to support 100 aquatic enterprises in 4 years, and a couple other programs has been conducted in the past by the Startup Assam to identify and support entrepreneurs. However, they often select the same entities as a target for their support.

Since there may not be a sufficient number of existing entrepreneurs in the field, careful identification of potential micro entrepreneurs and the provision of training opportunities targeting the business preparation stage for wider range of such personnels, including teaching the know-how for starting a business, would be effective.

(2) Limited access to finance for expansion and new challenges

Majority of enterprises fund their business through self-financing and/or informal financing, while formal financing sees limited use among local enterprises. The limited availability of access to low-interest formal financing is making it difficult for the SMEs to take risks for new challenges⁸³. The

⁸⁰ Inoculum is either brought from Japan or produced in India.

⁸¹ Sikkim State became “fully organic,” and was awarded by the Food and Agriculture Organization (FAO) in 2018.

⁸² B2B: Business-to-Business; B2C: Business-to-Consumer

⁸³ Non-banking Financial Institutions (Small Industries Development Bank of India (SIDBI), National Bank for Agriculture and Rural Development (NABARD)), cooperative credit institutions, commercial banks (State Bank of India, Union Bank of India, etc.) provide loans to aquaculture and related industries, and NBARD provides loans to Self Help Groups (SHGs). However, Assam in general has low access to Public Finance. Even in urban areas of Assam only 40% of SMEs accessing Public Finance, which is mainly self-financing and informal financing. In rural Assam, banks and other locations are very limited and not easily accessible. Furthermore, access to finance related to small-scale aquaculture in India as a whole is considered very poor, with an article reporting that the interest burden can be as high as 40% in some cases with informal finance for aquaculture.

provision of seed funding through low-interest-rate loans and grants for new challenges is considered effective.

In addition, the lack of experience with formal finance suggests that training in basic business finance knowledge is needed to enable continued access to financing in the future.

Some of the interesting areas to be considered includes;

- Hatchery & production of seed of- local indigenous varieties / non-native species (shrimp, tilapia, ompok species, murels, magur, puti (sor puti- *Puntius sarana* etc.)
- Setting up of brood bank farm⁸⁴
- Seed transportation supported with proper aeration facilities
- Setting up bio-fertilizer/ compost industry using water hyacinth
- Organic / naturally-grown aquaculture farms
- Processing of value-added products including preparation of ready-to-cook fish
- Online sales channel
- Feed processing focusing on locally available ingredients

(3) Limited opportunities to learn / compare existing technology

There are not many dealers of materials for bioflocs, auto-feeding facilities, aerators, water quality improvement materials, vitamin and mineral materials, and biological materials. There is very limited chance for farmers to learn this new technology and the impacts on productivity.

- The government/extension service organizations need to have a function to verify the effectiveness of these new technologies, and to compare available technologies and its suitability for small-holder farmers.
- To organize an Assam Aquaculture Fair to provide exhibition opportunities for tech start-ups and companies in developed areas such as Andhra Pradesh and international companies already existing in India. These events provide companies with understandings of the current situation and future opportunities in Assam.

(4) Challenges in feed supply

On the upstream side of the supply chain, there is an adequate supply of seedlings (though sizes below 125 gm) within the state, but most other feed, additives, and pharmaceuticals are supplied by out-of-state manufacturers through in-state wholesalers.

In particular, feed accounts for more than 50% of valuable costs for the operations using commercial compound feed, so if aquaculture using compound feed continues to expand at its current rate, much of the revenue will be transferred out of Assam. Feed is a key area of consideration if the state is to increase the profits that remain within Assam.

1) No feed quality assurance in Assam

A key issue in the aquaculture feed supply in the state is the lack of aquaculture feed quality control regulation. The state has not established aquaculture feed quality control and certification system yet, while other major aquaculture states have such system. Therefore, the industry is suffering from fake, pirated or low-quality feed products.

Sources “New partnership brings access to formal credits for Indian fish and shrimp farmers”

<https://hatcheryfm.com/news/latest-news/new-partnership-brings-access-to-formal-credits-for-indian-fish-and-shrimp-farmers/>
Prasenjit Bujar Baruah, M.P. Bezbaruah, 2020, “Financial Access and Business Performance of Urban Unorganized Sector Enterprises: A Study of Assam in Northeast India” <https://journals.sagepub.com/doi/pdf/10.1177/0971355719893502>
JBIC, 2023, “India’s Investment Environment”

https://www.jbic.go.jp/ja/information/investment/image/inv_india17.pdf

⁸⁴ System and particular place/pond to keep the quality fish for the reproduction of blood stock and supply to hatcheries for quality seed production through creation of a network of distribution channel

2) High cost of commercial feed: To promote home-made feed using local ingredients
Feeding with home-made mixes of locally available feed ingredients has the potential to provide a higher return to small-holder farmers considering its low cost. It may be worth to examine its economic efficiency and to promote it if it works well.

3) Lack of large-scale local floating pellet feed mills: To promote out-of-state or foreign feed manufacturers' investments in Assam

The commercial floating feed pellet business, in particular, is difficult to succeed without a large scale, a strong brand, a strong financial background, and technological capability. Therefore, it cannot be solved this challenge by providing 30-50 million INRs to small and medium-sized feed suppliers in the state. It may be possible to consider whether it is worth promoting inbound investments to establish JVs with a company in the state (such as a local feed mill or a large-scale rice mill) by attracting out-of-state or foreign feed manufacturing companies.

Table 3 - 49 Comparison of model cost of freshwater carp aquaculture in Assam

Unit: INR/0.1 ha

INR/0.1 ha	Source (1)			Source (2)
	Mash feed	Sinking pellet feed	Floating pellet feed	Home-mix of rice bran and MOC
Feed	21,807	25,467	31,913	6,107
Fingerlings	4,267	4,267	4,267	4,286
Lime, Urea, DAP, Cow Dung	4,180	4,180	4,180	2,825
Medicine	NA	NA	NA	NA
Total valuable cost	30,253	33,913	40,360	13,218
Gross sales	48,133	62,953	76,620	64,286
Gross margin per 0.1 ha	17,880	29,040	36,260	51,068
Share (out of gross sales)				
Feed	45%	40%	42%	10%
Fingerlings	9%	7%	6%	7%
Lime, Urea, DAP	9%	7%	5%	4%
Medicine	NA	NA	NA	NA
Total valuable cost	63%	54%	53%	21%
Gross sales	100%	100%	100%	100%
Share (out of total variable cost)				
Feed	72%	75%	79%	46%
Fingerlings	14%	13%	11%	33%
Lime, Urea, DAP	14%	12%	10%	21%
Medicine	NA	NA	NA	NA
Total valuable cost	100%	100%	100%	100%

Sources: (1) Ranju Kafle, et al., 2021, Evaluation of different types of feed in carp polyculture

<https://www.fisheriesjournal.com/archives/2021/vol9issue2/PartA/9-1-58-119.pdf>

(2) Assam Agricultural University, Package of Practices on Fisheries and Aquaculture in Assam

<http://www.arias.in/download/APART/PoP%20on%20Fisheries%20and%20Aquaculture%20In%20Assam.pdf>

3.8 Data utilization and digital transformation for fishery in India

3.8.1 Present condition of data utilization and digital transformation for fishery

There are 2 varieties of digital technologies to be considered for development of fishery in Assam state. One is the digital technologies for government, in which the digital technologies will be utilized to improve governmental functions. (extension activities, data collection, project implementation, etc.) The other is the digital technologies for fishery businesses in Assam state, in which the digital technologies will be adopted to improve fishery businesses, including both production and VC stages. (automation of production techniques, sensing of water body environment, utilization of mobile apps for farm recording, e-commerce, etc.)

This section consists of 3 parts to describe data utilization and digital transformation for fishery: 1) data utilization and digital transformation for governmental functions, 2) data utilization and digital transformation for fishery industry, and also 3) related law, regulation, and infrastructure.

Table 3 - 50 Digital technologies to be considered for fishery in Assam state

Category	Main Actor	Contents
Digital Technologies for Governmental Functions	Central government	- Related organizations and their digital technologies - Existing digital systems
	State government	- Related organizations and their digital technologies - Development schemes and projects in Assam state
Digital Technologies for Fishery Businesses	Private companies and startups Other related institutions (research or educational institutions, etc.)	- Digital services for fishery production - Digital services for VC businesses
External Environment for Digital Technology	-	- Law, Regulation, Act, etc. - IT Environment

Source: JICA survey team

3.8.2 Present condition of digital technologies for governmental functions

(1) Digital technologies under central government

1) Digital Technologies of Governmental Organizations in Central Government

The Department of Fisheries, under the Government of India is responsible for matters relating to formulation of policies and schemes pertaining to development of inland, marine and coastal fisheries and fishery institutes including its four subordinate institutions, one autonomous body and one regulatory authority. For the development of fishery sector, not only the Department of Fisheries, some other departments or governmental organizations also contribute to it from the aspects of different duties and different approaches.

Within this context, those governmental organizations, including the Department of fisheries, have been trying to utilize digital technologies in some parts of their activities and works for aiming at digital transformation (DX). The duty of those departments and digital technologies utilized can be summarized in the table3-52.

Table 3 - 51 Digital technologies under central government

Department/Organizations	Duty	Digital Technologies or Activities
Government of India (www.india.gov.in)	It is official platform for all information and disclosure of public domain	
Department of Fisheries (www.DoF.gov.in)	The Department is responsible for matters relating to formulation of policy and schemes relating to Development of Inland, Marine and Coastal Fisheries.	Flagship Program like - Blue Revolution - PMMSY (as summarized in the following part)
National Fisheries Development Board (NFDB), Hyderabad (www.nfdb.gov.in)	The National Fisheries Development Board (NFDB) was established in 2006 as an autonomous organization under the administrative control to enhance fish production and productivity in the country and to coordinate fishery development in an integrated and holistic manner.	NFDB is working on various digital activities, funded by Government of India. One is to develop some mobile apps for fishery sector. One of the mobile apps, named “Matsya Setu” is the app for e-leaning tool of fishery & farming. NFDB has also provided market information system, in which the visitors can find the latest market price in various wholesale market in the nation. Currently, NFDB has submitted proposal for development of integrated data system, named “fishery-stack”.
Ministry of Electronics and Information Technology (MeitY) (www.meity.gov.in)	It is a nodal department of GoI, while not directly focused on the fisheries sector however providing all digitalisation and technology	MeitY provides managed digital infrastructure including Broad band connectivity, Implementation various e-governance initiatives (fishing license,

Department/Organizations	Duty	Digital Technologies or Activities
	advancement information and building blocks (software, hardware and services)	permits and regulatory compliances also facilitated for management of fishing resources including catch reporting, vessel tracking and stock assessment), promotes digital literacy & skill development, monitor cyber security and encourages research and innovation in technology etc.
Digital India (www.digitalindia.gov.in)	A programme to transform India into digital empowered society and knowledge economy.	Digital India is leading Digital Infrastructure Development, providing High-Speed Internet networks, E-Gov and Digital services (i.e. Digi locker, eMarketplace etc), Mobile app and platform development (Umang etc) etc.
National Informatics Centre (NIC) (www.nic.in)	Science & Technology Institution, primary mandate is to provide digital and e-governance solutions.	NIC Provide infrastructure and IT consultancy to the government department, Design and implementation of IT system with its operationalisation and has ICT Network with all government departments.
Invest India (www.investindia.gov.in)	Invest India is the advisor, guide, and facilitator to every investor looking to make a home in India.	Invest India provides comprehensive guidance on entering the Indian market, offer end-to-end handholding support, provide post invest care, work with investment promotion agencies (sector specific). The sectors, covered in Invest India, includes fishery sector, including promotion of digitalization in fishery industry.
Startup India (www.startuindia.gov.in)	An initiative of Government of India aims to foster innovation, entrepreneurship and job-creation.	Startup India supports incubator Frameworks, provides environment for fast-tracking of patent applications and assist in intellectual property applications process, Startup Ecosystem Building etc., covering fishery sector and digital technologies.

Source: JICA survey team

2) Digital technologies of development scheme and project under Government of India

Recognizing the potential of the sector, to consolidate the achievements of Blue Revolution and provide focused attention to the sector, the Department of Fisheries is implementing Pradhan Mantri Matsya Sampada Yojana (PMMSY). The Government of India in May 2020 approved PMMSY with an estimated investment of Rs. 20,050 Crores for a period of five years from FY 2020-21.

PMMSY (Pradhan Mantri Matsya Sampada Yojana)⁸⁵Government of India

PMMSY is a scheme to bring about ecologically healthy, economically viable, and socially inclusive development of the Fisheries sector of India. PMMSY encompasses policies and strategies for data utilization and digital transformation in the fisheries sector with below key aspects:

- Digital Platforms: The government is developing a digital platform, named “PMMSY portal” to provide work-based identities for 40 Lakhs small and micro-enterprises in the fisheries industry. This platform aims to streamline data collection, management, and dissemination. (as follows)

⁸⁵ <https://pmmsy.DoF.gov.in/>

- **Data Sharing:** The Open Government Data (OGD) Platform India offers access to fisheries-related datasets, catalogues, APIs, and services. This facilitates data sharing, research, and informed decision-making.
- **Technology Adoption:** PMMSY emphasizes the adoption of technology for sustainable fisheries management. This includes digitizing processes related to fishing, aquaculture, and value chains.
- **Capacity Building:** The policy encourages training and capacity-building programs for fisherfolk, officials, and stakeholders to enhance digital literacy and data utilization skills.

PMMSY has introduced its own system, “PMMSY portal” as management information system (MIS). The MIS portal shall facilitate effective and efficient monitoring of all the key objectives of PMMSY project. The MIS seeks to be a one stop solution for all information related to the scheme. It helps states manage their targets, reporting and report submission process. It also helps to identify and manage missteps early in the process so as to help redirect the efforts of the scheme.

Meanwhile, as for technical components, under PMMSY, some advanced technologies have been promoted; Re-circulatory Aquaculture Systems (RAS)/Bio-Floc/Aquaponics/High Density Pond Aquaculture/Integrated Multi Trophic Aquaculture/Pen Culture. However, there are no dedicated digital technologies and services for fishery business promoted under PMMSY project.

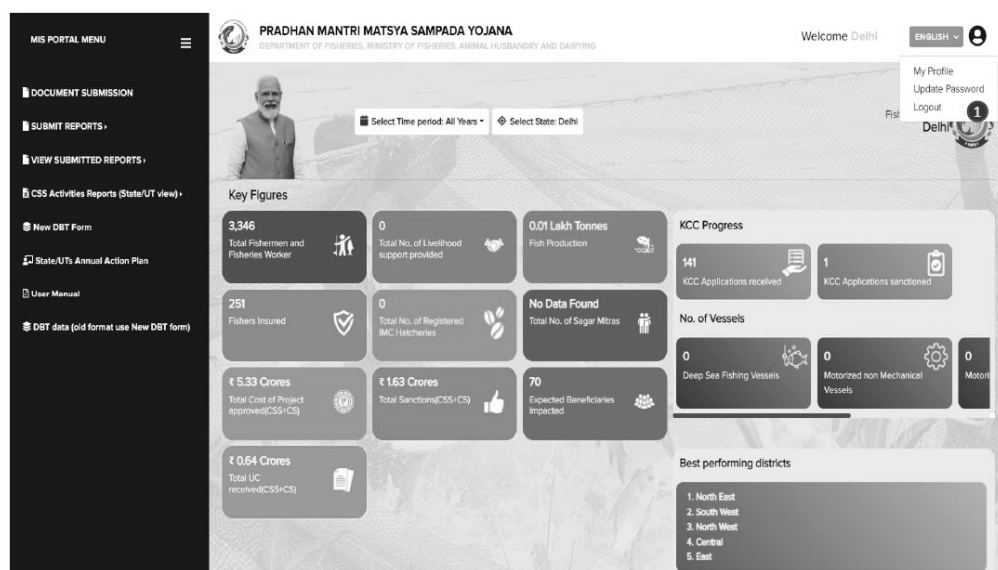


Figure 3- 33 Home screen of PMMSY Management Information System Portal

Source: PMMSY project

(2) Digital technologies under state government of assam

1) Digital technologies of governmental organization in Assam state

As well as the central Government of India, some digital systems or portals have been introduced in governmental organisations in Assam state, as summarized in the table 3-53. Mostly, digital systems have been utilized for monitoring and management purposes of works and activities of governmental agencies.

Table 3 - 52 Digital technologies under State Government of Assam

Organizations	Digital Technologies or Activities
Government	
Government of Assam (https://assam.gov.in/)	The government of Assam has developed the standardized website framework, “ePrastuti”. With using this framework, departments under government of Assam, including directorate of fisheries (DoF), maintain their own websites. (ePrastuti has been designed and developed by National Informatics Centre; NIC) The state government also has developed the portal website for integrating the information of governmental activities, named Assam State Portal.
Directorate of Fisheries (https://fisheries.assam.gov.in/)	DoF owns its website with governmental standardized website framework “ePrastuti”. Also, DoF has partially introduced digital platforms for development scheme and project management (as summarized in the following part).
Company under Assam state government	
Assam Fisheries Development Corporation Ltd. (AFDC) (https://afdc.assam.gov.in/)	AFDC Ltd. Was established to enhance fish production of the state focusing on development of Beel Fisheries in Assam state. At present, there are 185 nos. of Beel Fisheries with total area of 12,016.48 Ha and total productive water area of 9365.00 ha under the management and administrative control of AFDC Ltd. In terms of digitalization, there are no dedicated digital activities introduced in AFDC Ltd.
Fish Marketing & Processing Federation Ltd. (FISHFED)	FISHFED is the federation of fishery cooperative societies in Assam state. The major functions of FISHFED are 1) to facilitate marketing of fish production, 2) to promote value-added products and 3) to strengthen capacity of cooperative societies. In the sense of digital activities, FISHFED has introduced the online home delivery service of fishery products (through website and app).
IT or other related Institutions	
Assam State Space Application Centre (ASSAC) (https://assac.in/)	ASSAC is a registered society under Science, Technology and Climate Change department. The activity of the centre is to develop Remote Sensing Techniques and their application for Natural Resources Management in the State and to generate resource information both in spatial (map) and non-spatial (attribute) forms using Remote Sensing & Geographical Information System. DoF has made memorandum of agreement (MoA) with ASSAC to develop geo-tagged data system of water bodies in Assam state. As of now (Feb. 2024), the data collection has been completed in 2 districts (Kamrup and Kamrup Metro districts), but it has been suspended. (the continuous works plan to be restarted)
Northeast Development Finance Corporation Ltd. (NEDFi) (https://www.nedfi.com/)	NEDFi provides financial assistance to micro, small, medium and large enterprises for setting up industrial, infrastructure and agri-allied projects in the Northeastern Region of India and also Microfinance through MFI/NGOs. Besides financing, the Corporation offers Consultancy & Advisory services to the state Governments, private sectors and other agencies. NEDFi has developed the database, named NER database, to store data and information of various industries in northeast region. (https://databank.nedfi.com/content/fishery-assam)

Source: JICA survey team

2) Digital Technologies of Development Scheme and Project under Government of Assam

DoF has been implementing several development projects, being funded by state government, central government, and/or donor agencies. Under those development projects, some digital technologies or services have been introduced in some parts of activities.

GGPGGM (Ghare Ghare Pukhuri Ghare Ghare Maach)⁸⁶ -completed in 2022-NABARD

The GGPGGM was the project targeting construction of 1,000 ha of farmers' individual ponds and 430 ha of village community tanks throughout the state. In the project, it was intended to capture details of the asset created (both ponds and tanks) and beneficiaries thereof under the project through geo-tagging. Accordingly, the mobile App 'Matsya Baibhav' has been developed by National Informatics Centre (NIC), Assam State Centre for Department of Fisheries, Assam for geotagging the assets created under GGPGGM.

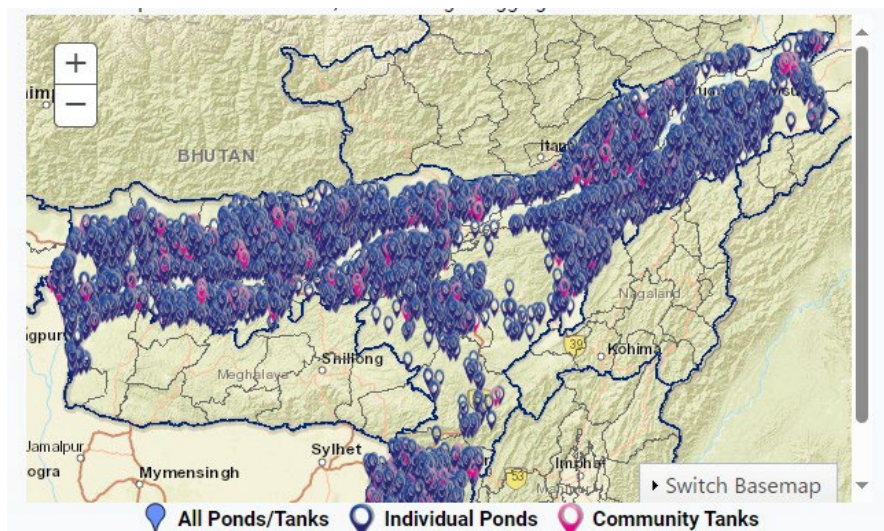


Figure 3- 34 Geo-tagged Map of “Assets of Fishery Department”

Source: JICA survey team

SAFAL (Sustainable Aquaculture for Food and Livelihood)⁸⁷ GIZ

The program concept of SAFAL is that “the food-insecure population in Assam and Odisha has more fish products and a higher income from sustainable and re-source-efficient aquaculture in pond management.”

SAFAL project has utilized digital technologies in some parts of the activities. One of the interventions of SAFAL project is to develop knowledge adoption and sustainable tools on sustainable aquaculture; knowledge products (KP; Farmers Handbook, Trainers Manual, Didactics), Information, Education Communication (IEC) materials, digital tools, 2D animated videos, board games and Farm Record book, etc. In accordance with this intervention, the project has published those materials in public online platforms (agricultural skill council of India, project-own website, etc.).

Also, the project has utilized a data collection tool “Kobo toolbox” for online farm recording. With this tool, farmers can easily input farm recording data in regular basis. The contents of farm recording include pond information, expenditure, working hour, feeding, fish stock, water testing, etc., which is also organized as a hard-copy book.



Figure 3- 35 Farm Record Book of SAFAL Project

Source: SWIFT project

⁸⁶ <https://fisheryassets.assam.gov.in/>

⁸⁷ <https://snrd-asia.org/sustainable-aquaculture-for-food-and-livelihood/>

SWIFT (Sustainable Wetlands and Integrated Fisheries Transformation Project)-under planning-ADB

DoF is planning to launch new project, named SWIFT project, being funded by ADB. This project will aim at improvement of fisheries of beels in the state through infrastructure development with some technical supports. In advance to the project commencement, GIS system has been utilized to capture the location and information of the beels existing in Assam state as geo mapped data.

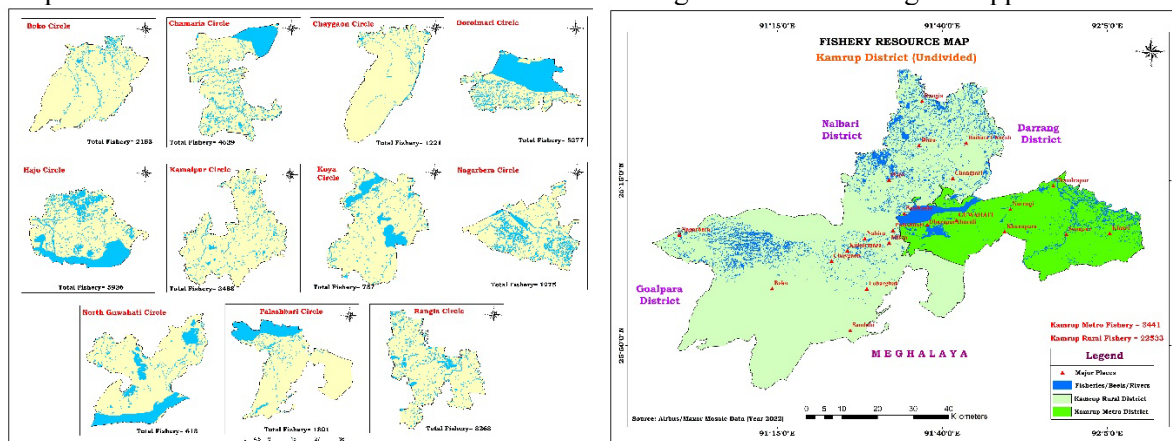


Figure 3- 36 Geo-mapped data of beels in Assam state

Source: Assam State Space Application Centre (ASSAC)

3.8.3 Present conditions of digital technologies for fishery businesses

Digital technologies or services for fishery business have been developed and launched by some startups, private companies and other related institutions (research or educational institutions, etc.).

In production stage, some startups and private companies have developed digital tools like digital water management system, mobile apps for farm recording, e-learning tools, etc. Meanwhile, in VC stages, digital services such as e-commerce, matching support, etc. have been introduced in some parts of India.

This part describes some of the advanced digital technologies in India (but not limited to Assam state).

(1) Digital technologies for businesses on production stage

1) Water Management System (with IoT sensor)

Water management is one of the fundamental activities for production improvement in inland fishery and aquaculture. The conventional way to control water body is being conducted by farmers' experience or simple water test kit. Some companies have utilized the IoT technology to develop digital tool for water monitoring and management systems. In those systems, water quality (such as PH, dissolved oxygen, salinity, etc.) can be monitored with IoT sensors and the detected data can be stored in cloud storage. Thereby, farmers can always comprehend the condition of water quality from their mobile phone, tablet or laptop, and then precisely manage water bodies with real-time data.

Table 3 - 53 List of Existing Digital Water Monitoring and Management Systems

System and Supplier	Services	Link
AQU by Ambrotechs	IoT water quality measurement system	https://www.ambrotechs.com/aqu.html
NeoQuantic by NeoAura Technologies Pvt. Ltd	IoT water body sensing system	https://neoaura.com/#/NeoQuantic
AqunNurch by NatureDots Private Limited	Nature sensing systems with deep tech tool for a climate resilient nature-positive economy	https://naturedots.com/
RAS by Manjeera Aqua	Re-circulatory Aquaculture Systems (RAS) with monitoring system	https://manjeeraaqua.com/recirculating-aquaculture-system/

Source: JICA survey team

AQU -IoT Water Quality Measurement System-

Ambrotechs

Ambrotechs has developed an IoT water quality measurement system, named “AQU”. AQU allows the farmers and the extension workers to measure the critical water quality parameters at the pond site for a fraction of the current cost.



Figure 3- 37 Water measurement system “AQU”

Source: Ambrotechs

2) Mobile App for farm recording and diary

Farm recording has several benefits for farmers, so that it is highly recommended to be taken in regular basis. Farm recording enables farmers to comprehend the productivity and profitability of the farm. It leads to better decision making on farm management, such as farm planning, procurement of necessary inputs, etc. To make it efficient, some startups have developed mobile apps for farm recording.

Table 3 - 54 List of mobile Apps for farm recording and diary

System and Supplier	Services	Link
Fishwaale by Aqua Blue	Multifunction mobile app for farm-recording, e-commerce, social net working	https://play.google.com/store/apps/details?id=com.fishwaale.app
BlueBay by Ambrotechs	A SaaS platform for Farm digitization and traceability	https://www.ambrotechs.com/blubay.html

Source: JICA survey team

FishWaale -Mobile App for Farm Recording-

Aqua Blue Global Aquaculture Solutions Pvt. Ltd.

Aqua Blue is the manufacturer and trader of a wide range of fishery products (including fish seeds, fresh fish, aqua feed supplement, etc.). The company has developed mobile app for fishery farmers. The app has several functions; farm recording, e-commerce, social networking board.

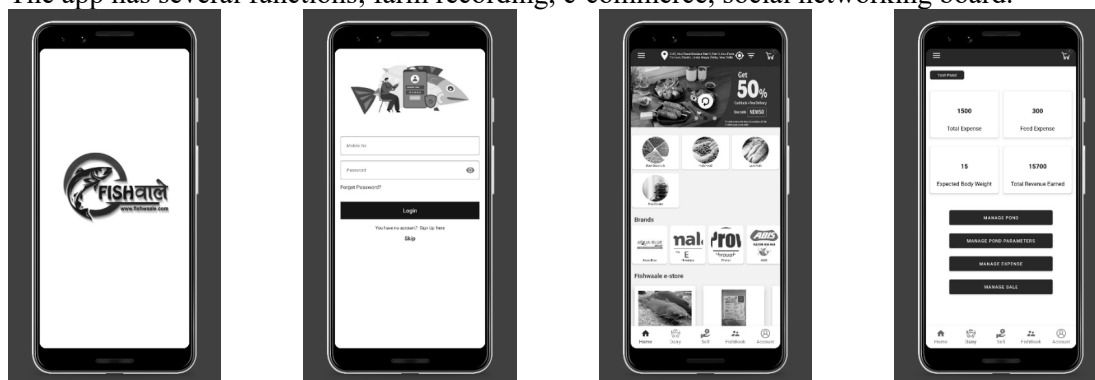


Figure 3- 38 Mobile Apps for farm recording “FishWaale”

Note: The app includes the E-commerce function and social-networking board.

Source: Aqua Blue Global Aquaculture Solutions Pvt. Ltd.

3) E-Learning or advisory app

Some educational organizations such as ICAR, ASCI etc. have been providing e-learning services for fishery farmers with mobile apps or online platforms.

Matsya Setu -Mobile App for E-Learning-⁸⁸

ICAR Central Institute of Freshwater Aquaculture

The Union Ministry for Fisheries, Animal Husbandry, and Dairying launched an online course mobile app named 'Matsya Setu'. The app was developed to disseminate the latest freshwater aquaculture technologies to the aqua farmers of the country. It came into existence with the combined effort of ICAR-Central Institute of Freshwater Aquaculture (ICAR-CIFA), with the funding support of the National Fisheries Development Board (NFDB).

ICAR also organized mobile app gallery as agricultural knowledge resources and information system hub for innovations⁸⁹.

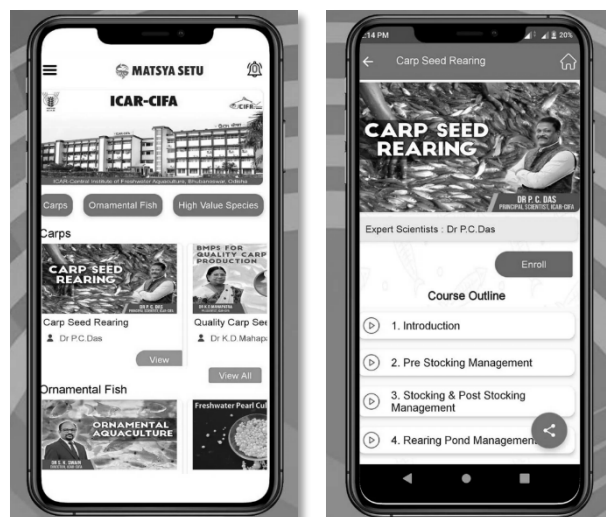


Figure 3- 39 Mobile App for E-Learning “Matsya Setu”

Source: ICAR Central Institute of Freshwater Aquaculture

(2) Digital technologies for businesses on value chain stage

1) E-Commerce

The Online marketplace is a digital platform to all farmers, buyer-sellers, and government authorities to operate trading activities of fishes and fishery products on real time and anytime anywhere basis with geographical limitation. Some fishery related startups have developed their own EC website and started businesses for online trading. In India, there are also some of the online platforms by large capital companies (Amazon.in, Bigbasket, etc.). Those platforms also cover the trading of fishery products in wide regions of India.

Table 3 - 55 List of online EC platforms for fishery products

Platform	Fishery Commodities	Area	Link
FishWaale	Input materials, fish feeds, frozen fish	Assam	https://www.fishwaale.com/
Minbury	Fresh fish (mature), Processed products, etc.	Guwahati/ Delhi	https://minbury.com/#/
FISHFED Mart	Fresh fish, Processed product	Assam	https://fishfedassam.org
Aquaconnect	Input materials	Uttar Pradesh/ West Bengal/ Gujarat/ Odisha	https://aquaconnect.blue/
Indiamart	Fresh fish, seafood, processed product, fish seeds, etc.	Nationwide	https://dir.indiamart.com/indianexporters/ag_marin.html
Bigbasket	Frozen Fish. Processed products, etc.	Nationwide	https://www.bigbasket.com/store/
Amazon.in	Frozen Fish. Processed products, etc.	Nationwide	https://www.amazon.in/ref=nav_logo

Source: JICA survey team

⁸⁸ <https://play.google.com/store/apps/details?id=com.fish.cifa>

⁸⁹ <https://krishi.icar.gov.in/mobileapp/>

FishWaale -E-Commerce platform- ⁹⁰

Aqua Blue Global Aquaculture Solutions Pvt. Ltd.

Aqua Blue also provides e-commerce platform for fishery farmers. This EC site is the India's first e-commerce market for fishery-related products. The registered items for sale in this platform include fish products, input materials for fishery, fish seeds, etc. The trading area covers Assam state.

For sellers, FishWaale provides a platform to showcase fish and fish inputs to a wide customer base. Whether a commercial fisherman, a hobbyist breeder, or an aquaculture farmer, sellers can create own store on FishWaale and easily manage listings. The platform connects with potential buyers and expand business through our platform, which offers visibility and accessibility to a large and diverse audience.

2) Matching support

Another practice of digital activities on VC stage is a platform to support business matching among input retailers, farmers and buyers.



Figure 3- 40 EC platform “FishWaale”

Source: Aqua Blue Global Aquaculture Solutions Pvt. Ltd.

Aquapartner and Aquabazaar -Digital Platform for Business Matching - ⁹¹

Aquaconnect

Aquaconnect provides full-stack aquaculture tech platform with several services. One of the services, Aquapartner, serves as the last-mile touchpoint for connecting with farmers in the vicinity of farms. These stores, run by our retail partners, help farmers buy high-quality, innovative farm inputs from multiple brands. The company also provide our retail partners with access to formal credit and efficient service delivery to expand their businesses. Another service, Aquabazaar, enables transparency in post-harvest market linkage activity. This helps farmers realize greater value for their produce and helps buyers with reliable sourcing solutions.

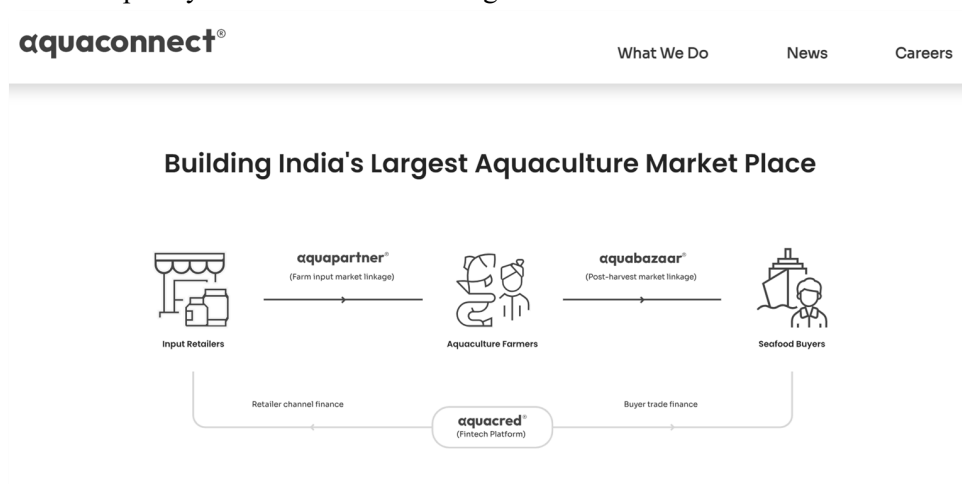


Figure 3- 41 Digital platform for business matching “Aquapartner & Aquabazaar”

⁹⁰ <https://www.fishwaale.com/>

⁹¹ <https://aquaconnect.blue/>

3.8.4 Law, regulation and environment for data utilization and digital transformation in India

There is no dedicated law on data utilization and digital transformation.

Meanwhile, for Intellectual Property Rights (IPR), while not specific to fisheries, copyright laws and IPR protection apply to creative works, including research, publications, and innovations in the fisheries sector. Researchers, authors, and inventors can also seek copyright protection for their original works.

And for data security and privacy, while there isn't a specific law solely for fisheries, general data protection, Digital Personal Data Protection Act (DPDPA) 2023 laws apply, the DPDPA establishes a framework for the processing of personal data in India.

3.8.5 Challenges for data utilization and digital transformation

(1) Challenges for data utilization and digital transformation on governmental functions

1) Challenges of Infrastructure for Digital Technologies in Government of Assam

First, there are some challenges existing in IT infrastructure of governmental organisations, especially DoF. The present condition and challenges can be summarized as follows;

Table 3 - 56 Challenge on IT Infrastructure of DoF for Digitalization

Category	Present Status and Challenges	Necessary Actions to Digitalize
Hardware	- Lack of data server - Insufficient digital devices and network environment	- Introduce data server or utilize outsource server - Procure laptop and network system or substitute some functions with mobile phones
Software	- Limited software introduced (Microsoft office, security software, etc.) - Human resources and budgetary arrangements on O&M - Lack of connection among existing systems - Insufficient service line-ups for fishery business	- Introduce necessary software - Procure annually budget for O&M - Integrate the systems existing - Develop some high-demanded or effective digital service for fishery business - Develop robust data protection policies and cybersecurity measures to build trust among stakeholders.

Source: JICA survey team

2) Challenges on governmental functions

Governmental organizations play important roles in Fishery industry in the state. The major functions of governmental organizations are categorized into; 1) Development Scheme and Project Implementation, 2) Training and Extension Activities, 3) Publication of manuals, statistical data, information, or 4) other public services.

In terms of digitalization, DoF has utilized some digital platforms, especially in the implementation of development projects and schemes for their operation and management purpose. On the other hands, as of Mar. 2024, there are no digital services launched by DoF for private stakeholders in fishery industry in the state (such as online training, etc.). The table 3-58 describes the functions of governmental organization and their challenges/potential for digitalization.

Table 3 - 57 Challenges on governmental functions of DoF for digitalization

Functions and Processes	Present Condition	Challenges and Potential to Digitalize
1. Development Scheme and Project Implementation		
Planning/ Application Process	Extension officers announce project/scheme to farmers. Thereafter, farmers prepare planning report with officers to submit to DoF.	Only the farmers, who have connection to officers, get chance to apply schemes. The announcement and application shall be digitalized for fairness and transparency.
Implementation/ Monitoring Process	Development schemes (PMMSY, GGPGGM, etc.) have individually developed their own system to store data and monitor activities.	Those individual systems have not been connected and utilized each other. The systems should be integrated to combine dataset.
2. Development Scheme and Project Implementation		
Training Arrangement	Some training programs have been organized by various governmental or educational organizations.	The trainings have not been organized in regular basis. The trainings should be managed systematically with utilizing online platform.
Extension Service	Extension services have been provided by field officers.	Lack of human resources makes the coverage of extension activities limited. Digital tools could enhance the impact and effectiveness of extension activities.
3. Publication (Statistics, Guidebook, etc.)		
Data Collection and Storage	Statistical data has been collected manually by field officers and reported to DoF by documents. In DoF, most of those documents are physically stored.	The varieties of available data are limited, and the accuracy of those data is low. There is a potential to utilize digital tools for effective data collection and usage.
Publication	DoF submits statistical data to Directorate of Economics and Statistics (DoES). Then, DoES publishes statistical books.	There are no other publications from DoF than general information on the website. There should have Online publication with on-time update
4. Other Public Services		
- Market Information - Tourism Business, etc.	There are no online services for fish farmers, VC stakeholders or local citizens by DoF.	Introduction of some online services would be beneficial for farmers or citizens. (market price dissemination, EC site, matching support, tourism service, etc.)

Source: JICA survey team

(2) Challenges for data utilization and digital transformation on fishery business

In the present circumstances, the usage of digital technologies in fishery business (both production and VC) is limited only to some advanced startups or diligent stakeholders. Some of the possible causes of such a limitation are considered to be;

- Limited external supports or opportunities to invest new business
- Lack of assets (fund, information, connections, etc.) to be provided by government
- Lack of knowledge and techniques for advanced technologies (even in academic institutions)
- Low profitability or unclear benefit of introduction on digital technologies

Therefore, in order to facilitate the development and extension of digital technologies in fishery business, the governmental interventions or public-private corporation could be effective. The possible ways to enhance utilization of digital technologies would be;

Governmental interventions on startups

- Fundings (such as entrepreneurship program)
- Information and data provision under MoA
- Technical advisory or extension supports
- Establishment of licensing system for new technologies

Public-private partnership

- Implementation of co-research and development
- Binding of MoU to launch co-business

3.9 Fisheries-related projects implemented by the Govt. of India and other donors/international organizations

The major fisheries-related projects of the Government of India and other donors/international organisations being implemented in Assam State as of 2024 are listed below. A summary of each project is given in Table 3-59.

- (1) PMMSY (Pradhan Mantri Matsya Sampda Yojana)
- (2) APART (Assam Agribusiness & Rural Transformation Project)
- (3) RIDF (Rural Infrastructure Development Fund)
- (4) CMSGUY (Chief Ministers' Samagra Grammya Unnayan Yojana)
- (5) SOPD (State Own Priority Development)
- (6) SWIFT (Sustainable Wetlands and Integrated Fisheries Transform action Project (in preparation))

In particular, in order to avoid duplication of project component in considering this project plan, the beel development-related component, which was initially included in the project DPR, will be excluded from the project component as it will be carried out under the SWIFT project.

Table 3 - 58 Summary of fisheries-related projects in Assam State implemented by the Govt. of India and other donors/international organizations

Project	(1)PMMSY	(2)APART	(3)RIDF	(4)CMSGUY	(5)SOPD	(6)SWIFT
Budget	456.00 Cr	131.00 Cr	12,155.00 lakhs	16,636.77 lakhs	1603.69 lakhs	1,767.50 Cr
Period	Since Sep. 2020	2018-24		2021~	2021-2024	
Finance source	Government	World Bank	NABARD	FMS-CMSGUY	Government	ADB
Target area	All district	18 districts	All districts	All districts	All districts	26 districts
Implementation		WorldFish			Contractor	
Activities	6,200 Livelihood support for fishers	Polyculture demonstration	70 Refrigerated 4WD vehicle	38 Cage culture in beel	14ha development of community water body	Restore 8,000ha beel
	1,145ha of Pond and tanks	Freshwater prawn farming with carps	351 3-wheeler vehicle with insulated ice box	2,000 training	9,083 Geotagging	Geo-mapping of beel
	92 Feed mill	150ha of High yielding varieties seed rearing unit	44 Mini fish feed plan	5282 farmers	1 GNB tank	Livelihood generation through beel fishery
	76 Hatcheries	1,000ha of Paddy cum fish farming demonstration	5 Medium fish feed plant		3 fish retail outlet	Capacity building
	39 RAS	1,500ha of Community based beel fisheries demonstration	19 Development of existing fish farm			
	216 Biofloc	5 Fish seed multiplication center				
	210 Pen culture	3 Hygienic fish selling center				
	1,322 small and 15 large Transport vehicle	8 Small scale fish feed mill				
	74 Fish kiosk/Live fish vending center	25 Fishery farmers producers company (FPC)				
	9 Cold storage/ice plant					

Chapter 4 Outline of the Project

4.1 Analysis of core issues

Assam has 2 major water systems, the Brahmaputra and Barak rivers, and is rich in water bodies that form the production base for aquatic products. Specifically, there are 71,843 ha of Beel; 94,693 ha of aquaculture ponds; 83,633 ha of Derelict water bodies/Swamps; 6,102 ha of submerged forests; 3,096 ha of artificial lakes; and 11,304 km of rivers, including main rivers and tributaries (Economic survey, Assam 2023-24). The total fisheries and aquaculture production from the area is 417,000 tons (2021-22). However, it is insufficient to feed the estimated 353,000 inhabitants of the state in 2022, and in fact, 26,430 tons (2022) of fish are imported from neighboring states and countries to make up the shortfall. In this section, the current issues and challenges faced by the fisheries sector in Assam are summarized for each of the major sub-sectors and are presented in Table 4 -1, with explanations provided below.

Table 4 - 1 Issues and challenges of fisheries sector of Assam State

Sub-Sector	Issues and Challenges
Fisheries	• Deterioration of fishing ground • Decrease of fishery resources
Aquaculture	• Productivity is low • Insufficient supply of quality and large size seeds • Diversification of aquaculture species is not enough • Lack of introduction of new aquaculture techniques • Insufficient of feed production and supply
Marketing	• Insufficient hygienic market infrastructure • Insufficient cold chain infrastructure • Immature live fish transportation techniques
Extension	• Insufficient extension infrastructure, staff's capacities and training materials
Organization/Gender	• Ineffective function of producers' organizations (FPO, FPC, etc.) • Insufficient women's participation in fisheries sector
Others	• Difficult access to financial institutions including credit condition • Absence of income source diversification other than fisheries activities • Insufficient administrative system (especially for registration of the pond/tank, statistical data collection and storage, etc.)

Source: JICA survey team

(1) Fisheries

1) Deterioration of fishing ground

Factors contributing to the deterioration of fishing ground include shallower depth of river-bed due to sand siltation, deforestation in the catchment areas and earth cutting in hill slopes for construction purposes, disconnection from the river even during the monsoon season at Beel due to land encroachment, heavy weed infestation in large number of wetlands (beel fisheries) and consequent decomposition resulting in siltation, and water pollution due to urbanization of the surrounding area. None of these can be solved by the fisheries sector alone but require collaboration with relevant ministries and agencies.

2) Decrease of fishery resources

Statistics given by the DoF indicate the decrease of production of river and beel fisheries as shown below.

Table 4 - 2 Change in Production of river & beels production in Assam

year	Total production (River & Beels) in kg
2020-21	88,020.87
2021-22	46,033.23
2022-23	50,907.95
2023-24	48,236.30

Source: DoF

Assam has several fisheries regulations in place for sustainable use of fisheries resources (many of which specify closed seasons), but these are not always respected by fishers. Destruction of breeding grounds, over exploitation, use of banned fishing nets, catching of gravid fish during breeding season, catching of juveniles not permitted under laws have aggravated the situation. Further community approach in management of common property resources is lacking.

(2) Aquaculture

1) Productivity is low

In the first place, the way to increase aquaculture production is to increase the area or volume of aquaculture facilities (e.g. ponds) or increase productivity. The former is a civil engineering development approach, and its feasibility depends on topographical and natural conditions. The latter mainly depends on technological improvements and subsequent improvements in the quality of inputs. Currently, productivity per unit area is estimated to be 2.97 tons/ha⁹² on average in Assam State. No statistical data are available on the number of aquaculture farmer in Assam. There is also no data on the number of ponds. However, with above productivity in mind, we exchanged opinions with experts from the DoF and estimated the breakdown by semi-intensive aquaculture with formulated feed and local feed, and other (extensive aquaculture). The results are shown in the table. The totals in the table are consistent with official aquaculture data of DOF.

Based on the above discussion, it is estimated that 60% of the total pond area, or approximately 56,816 ha, has not yet achieved the target productivity of 4-5 tons. It is necessary to promote productivity improvement in these ponds through this project and other measures.

Table 4 - 3 Estimated pond area breakdown and production breakdown based on the discussion with resource persons.

	Estimated pond area breakdown (%)	Estimated area (ha)	Productivity (ton/ha)	Estimated production breakdown(ton)
Semi-intensive aquaculture with Formulated feed	10	9,469	5.0	47,347
Semi-intensive aquaculture with Local feed	30	28,408	4.0	113,632
Others (Extensive culture)	60	56,816	2.1	120,293
Total	100	94,693	2.97	281,271

Source: Total pond area, production and productivity are taken from the DOF statistics in 2022/23.

Based on the above considerations, it is estimated that at present, the area of ponds not achieving the target productivity of 5 tons (Assam State Fisheries and Aquaculture Policy (draft) 2029-30) amounts to 60% of the total area, or approximately 56,816 ha. It is necessary to promote the sequential improvement of productivity in these areas through this project and other measures.

2) Insufficient supply of quality and large size seeds

Assam is located at a higher latitude than other states in India (e.g. Andhra Pradesh, Orissa and West Bengal) where inland aquaculture is more prevalent and winter temperatures are cooler in Assam. Therefore, although there are 564 hatcheries in the state (Statistical Handbook, Assam, 2022), seed production starts later than in the other states, from April to May onwards. On the other hand, the peak time for seed stocking in pond is around May, at the beginning of the monsoon season. At that time, state produced fingerlings are not fully grown and those from other states have to be used instead. To cope with such situations, production of one-year-old juveniles so called carry over seeds or yearlings are getting popular in recent years. In addition, among progressive fish farmers, there are strong needs for large-size seeds of several 100g in body weight to shorten the culture period and possibly to harvest several times a year (refer to Table 3-14). However, the production capacity of such advanced seeds is insufficient, and their supply chain is not established well.

⁹² Official data on pond area and production are available, which indicate that in 2022/23, the state as a whole will have a pond area of 94,693 ha, a production of 281,271 tons, and a productivity of 2.97 tons/ha (DOF)

3) Diversification of aquaculture species is not enough

The three (3) Indian carp species, Catla, Rofu and Mrigal, collectively known as IMC (Indian Major Carp), account for nearly 70% of the total species farmed in Assam, and are joined by 4 Chinese carp species, including Common Carp, Silver Carp, Big head and Grass Carp. Culture techniques for these fish species have already been established, and there is a need to diversify the species to be farmed to meet the demand for new species. According to our preliminary examination, introduction of freshwater prawn(Scampi) in IMC polyculture ponds can increase crude profit by 4% and intensive mono-culture of Pangasius catfish will be able to achieve more than 10% of crude profit comparing to IMC polyculture when marketing of those species is secured.

4) Lack of introduction of new aquaculture techniques

Aquaculture in Assam is generally extensive farming, where the above-mentioned fish species are stocked in small to hectare-sized earthen ponds and fertilization plus some feeding is applied. The Assam state government is trying to introduce new methods such as cage culture and more modern and intensive RAS and bioflocs in addition to the above pond farming and is developing facilities using funding schemes such as PMMSY, but these are not yet well established.

5) Insufficient of feed production and supply

Currently, floating pellet produced in neighboring states is also distributed in Assam, but the use of that type of commercial feed is not common for carp culture because moderate high growth is achieved with fertilization and input of locally available agricultural by-products (MOC, rice bran, etc.). However, commercial feeds will be needed in the future if the current aquaculture system is consolidated and shifts to semi-intensive and intensive aquaculture with formulated feed so that high productivity (more than 5 ton/ha could be realized) . Currently, there are 41 feed plants in the state producing 16,560 tons approx. per year, but it is estimated that minimum 142,000 tons of feed will be needed in the future if production per unit area is increased to 5 tons/ha.

(3) Marketing

1) Insufficient hygienic market infrastructure

There are 120 wholesale markets and 163 retail fish markets in Assam. Almost all of them are simple markets consisted of only pillars and roof and are not modern and hygienic markets that are closed to birds and insects from the outside. In fact, 5 wholesale markets where the survey team visited are not equipped sales shelf but fish are sold on the ground. As for the aquaculture business unit which provide the aquaculture materials, there are only situated in urban areas.

Because this survey is carried out during the low-temperature winter season, it seemed that the products kept its freshness, even though the fish were not iced over. However, there is room for improvement in the floor and drainage conditions, as well as in the handling of cutting boards and knives in the retail market.

2) Insufficient cold chain infrastructure

Majority of cultured fish were distributed in live condition. On the other hand, fish captured by beel fishery were distributed in fresh with aluminum tubs and nets without ice but with Styrofoam rarely with ice. Decomposition process of fish starts only when they are dead. A few markets have flake ice plants, but most of the market do not have.

3) Immature live fish transportation techniques

Farmed fish that are alive at the time of harvest are transported to the market by truck alive, but because of the system of plastic sheets on the back of the truck, water in there, and aeration by foot flapping, it is said that approx. 10-15% of transported fish die or are dying based on the size of fish and distance for transportation due to rising water temperature and lack of oxygen. It is essential to use live fish transport vehicles equipped with water tanks with heat insulation, water circulation systems powered by engines, and aeration systems to increase the survival rate of fishes while transporting them.

However, from the standpoint of mass supply of fish, it is more efficient to transport fish in ice in Styrofoam/FRP boxes after proper treatment than to transport everything live. This is because more than half of what is transported as live fish is simply “water”.

(4) Insufficient extension infrastructure, staffs' capacities and training materials

As local branch of the DoF, there are district level and under each district, there are development blocks where block level fisheries officers are deployed at each level. However, their offices as their operational base are limited and the infrastructure for training and extension service seldom exists. The capacity of local branch staff (extension workers) is generally low and there are no teaching materials for extension services.

(5) Organization/Gender

There are producer organizations (FPOs, FPCs, etc.) in the state, and the organizations are formed and operated in accordance with the laws governing organizational norms. However, some of these organizations do not function due to low capacity in organizational management and documentation. In addition, women are rarely seen in fisheries and aquaculture, and participation rates are low.

4.2 Development policy of Assam aquaculture

Although the history of modern aquaculture practices in Assam state has a short history comparing to other forgoing states such as Andhra Pradesh, West Bengal and Orissa, the Assam aquaculture has been developing rapidly supported by a series of external aid projects as well as Government programs such as PSMMY etc. Major type of aquaculture is pond polyculture of IMC and Chinese carps using traditional feeding practice with average productivity of 2.97 tons/ha in 2022-23 (Statistics of the Dof Fisheries). Based on the field survey and discussion with resource persons, current farming practices can be reviewed as shown in table 4-4.

Table 4 - 4 Category of farming practices and productivity in ponds/tanks in Assam

Farming practice	Expected productivity/yr	Major practices	Profitability	Remarks
Extensive (Traditional)	Around 1 ton/ha	Only stocking of seeds in ponds	Verified	Not suitable for future livelihood enhancement
Semi-intensive culture with local feed	2.5-3 tons/ha	Fertilizer, probiotics, MOC, rice polish, etc	Verified	Profitability can be improved by application of suitable package of practices and quality input
Organic farming	2.5-3 tons/ha	Use only organic fertilizer, probiotics and feed	Not yet verified	Promotion of organic fish farming and marketing is necessary
Semi-intensive culture with formulated feed	5 tons/ha	Partial feeding with formulated pellets	Verified	Not widely taken-up
Intensive farming	around 8 tons/ha	Complete feeding with formulated pellets	Not yet verified	Study on production and profitability is needed.

Since there are wide variations in the technical level among fish farmers and productivity being achieved by them, most of previous projects focused on uplifting of productivity through adoption of improved farming practices by small- medium scale aquaculture farms.

Government of Assam has implemented numbers of World Bank aided fishery development program, the latest being the Assam Agricultural Competitiveness Project (AACP:2004-2015), and the on-going Assam Agri-business and Rural Transformation Project (APART:2017-24). These are multi-sector projects where fishery was a major component.

Among all the sub-components of fishery activities, enhancement of productivity in pond & tank fisheries was a major activity. Covering farmers under the previous World Bank projects (i) AACP was focused on small-scale farmers (0.14-1ha), and then (ii) APART focused on medium farmers (more than 0.25ha up to 1 ha). Considering the recent development of aquaculture in Assam and high expectation of increasing productivity, the forthcoming Project assisted by JICA is expected to focus more on advanced farmers(individual) as well as traditional farmers. Based on such examinations, The Project shall consider adequate selection criteria of beneficiaries.

In order to increase fish production in the state, there is potential scope to develop derelict water areas and beel fisheries. This task is being carried out by the Fishery Department under ADB assisted SWIFT project. Hence the components of infrastructure development and farming activities in beel and derelict water area will not be included in The Project although they were deemed in early drafting stage of the project.

Thus, sustainable development of carp polyculture is considered as the major theme in line with the slogan of “Grow More Fish” in Assam State, and it sounds quite appropriate for The Project to focus on this central issue. At the same time, there would be a lot of other relevant activities needed to support such aquaculture development. Those are capacity building of implementing agency namely the Department of Fisheries, encouragement of more investment from private sector, introduction of new aquaculture technologies including diversification of target species, and improvement of supply chain, which will also consist of major project components.

4.3 Rational of project

This project is highly appropriate to realize the Vision set forth in the “Assam State Fisheries and Aquaculture Policy”, which is currently being prepared, and to resolve the issues mentioned above. The Vision of the Assam State Fisheries Policy can be summarized as “Maximize sustainable production from the fisheries sector for nutritional security and economic prosperity”. The mission of the Department of Fisheries to fulfill to realize this Vision is as follows.

- Sustainable utilization of fish resources
- Increase of fish production by aquaculture, promotion of high value fishes
- Enhancing fish production and productivity
- Increasing livelihood opportunities
- Strengthening social security and welfare measures for fishers
- Fish resource conservation and management
- Facilitating improved post-harvest practices and value addition with industrial and market linkages

In particular, increasing production is a central issue of the state's fisheries policy, as indicated by the DoF's slogan “Grow more fish,” and the above fisheries policy sets a goal of “doubling” production by FY2029-30. It also sets a numerical target to increase the annual per capita consumption of fishery products from the current 12 kg/person/year to 15 kg/person/year.

From a socioeconomic perspective, there are approximately 2.5 million people working in the fisheries sector, accounting for about 10% of the state's population. The share of fisheries GDP in the state GDP is 3.05%, which is higher than that of other countries in general. The importance of this sector is recognized not only in terms of food security, but also in terms of employment and the state economy.

4.4 Review of PPR

(1) Original PPR

Prior to this study, the DoF formulated the “Assam Fisheries Development and Livelihood Project (December 2022). The project paper was reviewed in this study as a Preliminary Project Report (PPR). A summary of the PPR is as follows.

Table 4 - 5 Proposed project interventions and cost

Intervention / Component		Unit		
1. Project interventions				
1.1 Community-based beel fisheries				
(a) Development of beel fisheries	Ha			
(b) Development of derelict water bodies	Ha			
(c) Eco tourism	No			
1.2 Productivity enhancement through ponds & tanks				
(a) Construction of community ponds for fish farming	Ha			
(b) Construction of individual ponds for fish farming	Ha			
(c) Fish farming enhancement in existing community tank	Ha			
(d) Fish farming enhancement in existing individual pond	Ha			
1.3 Development of fisheries entrepreneurship	No			
1.4 Integrated fish farming for livelihood and income generation				
(a) Integrated pig-fish production	Ha			
(b) Integrated rice-fish farming	Ha			
1.5 Construction of solar based RAS unit	No			
1.6 Construction of solar based biofloc units	No			
1.7 Infrastructure development in fish cooperatives				
(a) Hatchery for high value indigenous species	No			
(b) Seed rearing facility	Ha			
(c) Intensive fish culture in existing pond	Ha			
(d) Cold storage facility	No			
(e) Pick-up vans (modern)	No			
1.8 Fish seed village				
(a) New seed rearing facility with inputs for carps	Ha			
(b) Existing fish seed rearing facility with inputs for carps	Ha			
(c) New seed rearing facility with inputs for HVF	Ha			
(d) Existing fish seed rearing facility with inputs for HVF	Ha			
(e) Carp eco-hatchery with 1.0ha nursery, rearing and stocking tank construction	No			
(f) Renovation of carp hatchery, if available in cluster or village as proposed including one year input	No			
(g) High value fish seed hatchery	No			
1.9 Development of Government fish farms				
(a) Fresh water multi-species finfish hatchery	No			
(b) Magur hatchery	No			
(c) Intensive culture of fish in existing pond	Ha			
(d) Setting up of mini water/soil testing laboratory	No			
(e) Setting up of feed testing laboratory at the existing state laboratory	No			
(f) Central water and soil testing laboratory at existing unit	No			
(g) Construction of indoor and outdoor nursery and rearing unit	No			
(h) Special three phase electricity installation at Gov. farms	No			
(i) Special farm infrastructure	No			
1.10 Establishment of integrated cold chain facilities including packaging, processing and distribution of produces	No			
1.11 Establishment of large feed mills	No			
1.12 Retail outlets along with distribution infrastructure				
(a) Live fish vending center	No			
(b) Three-wheeler with ice box including rickshaw for fish vending	No			
(c) Motorcycle with ice box	No			
(d) Mobile kiosk	No			
(e) Solar dryer system	No			
(f) Terminal market	No			
1.13 Vans for transportation	No			
1.14 Block level aquaculture clinics	No			

	Intervention / Component	Unit		
1.15	Capacity building-Setting up of a major training institution including TCPC office	No		
1.16	DFDO conference hall	No		
1.17	State guest house at Guwahati	No		
1.18	Upgrading of district level training institute	No		
1.19	Upgrading & modernization of RFTI Amranga	No		
2.	Project management			
2.1	Setting up PMU & district level team			
2.2	Monitoring and evaluation			
3.	Physical contingencies (5%)			
4.	Price contingencies (5%)			
	Grand Total			

The review is conducted from 2 perspectives: cost and content.

, this means that the project should be reduced to less than 1/10 of that amount. The DoF presented a second proposal in consideration of the demarcation from some similar projects that are being implemented in parallel. In other words, the DoF made a large-scale adjustment such as removing some sub-components of JICA project and put them in other projects to be undertaken. Many of the sub-components, such as beel fishery, new aquaculture technologies, integrated aquaculture with livestock farming and a part of supply chain development were removed in the second proposal (First Revised PPR).

(2) First revised PPR

The above changes are shown in the table 4-6 as First Revised PPR. In doing so, sub-components were organized considering the categories proposed by Fact Finding (FF) mission of January 2024.

Table 4 - 6 Contents of 1st revised PPR by category

Category	Sub-components (Sub category)	Scale
Improvement of aquaculture productivity	Productivity enhancement through ponds & tanks	
	Fish seed village	
Development of value chain	Infrastructure development in fish cooperatives - Live fish transportation carriers	
	Retail outlets along with distribution infrastructure - Live fish vending centers	
Diversification of fisheries-based livelihood	Blue tourism with beels	
	Development of fisheries entrepreneurship	
Extension and capacity building	Capacity building setting up of a major training institution including TCPC office	
	DFDO conference hall	
	Block level aquaculture extension service center	
	Development of Government fish farms for demonstration purpose	
	Mini water/soil laboratory	

While this preparatory study was relatively supply chain oriented, the sub-components in this category in the First Revise were reduced to live fish transport vehicles and live fish marketing facilities. The category to improve aquaculture productivity was also limited to existing aquaculture ponds and fingerling and excluded sub-components related feed mill development. Instead, a relatively large number of DoF-related institutions remain to be strengthened, and it can be said that the aspect of administrative support has become stronger.

(3) Second revised PPR

The PPR, once modified as of February 2024, was proposed to be changed again in April. A comparative table of the changes is shown in Table 4 - 7

Table 4 - 7 Comparison between first revised and second revised

Category	First Revised PPR		Second Revised PPR	
	Sub-components	Scale	Sub-components	Scale
Improvement of aquaculture productivity	Productivity enhancement through ponds & tanks		Promotion of feed-based aquaculture for fish production enhancement	
	Fish seed village		Development of cluster-based fish seed village	
			Promotion of high yield varieties of Pangasius catfish & Tilapia	
			Promotion of ICAR-GI scampi culture in carp polyculture	
			Need based research studies	
			Credit linkage to fishermen groups for input cost	
Development of supply chain	Infrastructure development in fish cooperatives - Live fish transportation carriers		Deleted	
	Retail outlets along with distribution infrastructure - Live fish vending centers		- Gramin hygienic fish market - Aquaculture business unit - Mobile fish kiosk	
Diversification of fisheries-based livelihood	Blue tourism with beels		Blue tourism with fish farms	
	Development of fisheries entrepreneurship		Same as left	
Extension and capacity building	Capacity building setting up of a major training institution including TCPC office		Same as left	
	DFDO conference hall		DFDO office, conference hall, aquaculture lab.	
	Mini water/soil laboratory			
	Block level aquaculture extension service center		Deleted	
	Development of Government fish farms for demonstration purpose		Deleted	
			Innovative and advance technology adoption for data management	
			Distribution of pond health cards & ID card to fish farmers	

* Cells filled with blue color mean newly added items and with pink color indicate items that content and color have changed.

Pangasius catfish, tilapia, and freshwater shrimp were added to diversify the aquaculture species, while data management and fish farm registration systems were added as new menu items to strengthen the fisheries administration system. The above fish species are not widely cultured even in other states of India, and so the pilot aspect is significant. In addition, the DoF lacks basic administrative systems such as statistics and registration systems, so it is meaningful to incorporate them into this project.

The scale of infrastructure development related to the supply chain and extension has been further reduced, while the scale of sub-components related to aquaculture productivity improvement has been expanded.

4.5 Structure of proposed project

(1) Demarcation of project contents with other on-going projects

As explained earlier, PMMSY (funded by the Government of India), APART (World Bank), are currently implementing projects in Assam in parallel while the SWIFT (Asian Development Bank) is on the way of commissioning soon. Since PMMSY is a scheme that provides large-scale financial support regardless of sub-sectors, sub-components for large-scale infrastructure development related to the supply chain were deleted from this project with the expectation that they would be implemented under PMMSY.

(2) Contents of proposed project and cost

The results of analysis described above in 4.1 to 4.4 can be summarized in a “Problem Tree⁹³” as shown below figure 4-1. The specific issues to be addressed as a result of this analysis (lower card in the figure), which will be implemented as a component of this project, are shown in red, while issues covered by other projects such as APART and PMMSY are shown in blue. The project components, its’ scale and cost are shown in the table 4-8.

⁹³ Problem Tree is a figure to visualize existing problems in the target area by applying the relationship of cause(lower card) and effects(upper card).

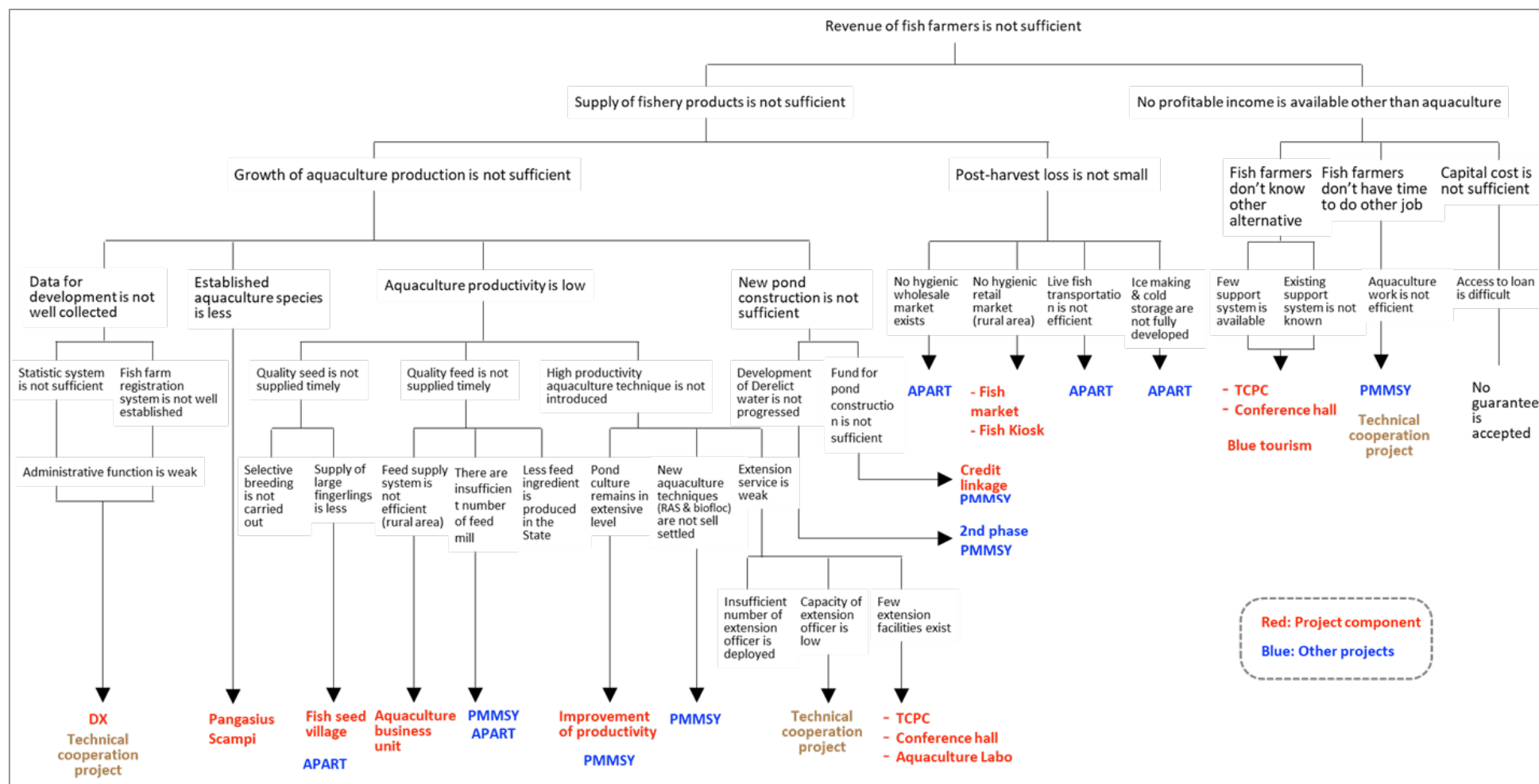


Figure 4 - 1 Result of problem analysis and the corresponding measurements/schemes to solve
Source: JICA survey team

Table 4 - 8 Composition of proposed project, scale and cost

1. **Introduction**

The purpose of this study is to investigate the effects of a new educational program on student performance. The program is designed to improve critical thinking and problem-solving skills through a series of interactive exercises and projects.

2. **Methodology**

The study was conducted using a quasi-experimental design. A group of 50 students was selected from a large public high school. They were divided into two groups: an experimental group and a control group. The experimental group participated in the new educational program, while the control group followed the standard curriculum.

3. **Data Collection**

Data was collected through a series of standardized tests and surveys. The tests were administered at the beginning and end of the semester. The surveys were used to gather information about students' attitudes and perceptions of the program.

4. **Results**

The results of the study show that the experimental group performed significantly better than the control group on the standardized tests. The improvement was most pronounced in the areas of critical thinking and problem-solving. Additionally, the experimental group reported higher levels of engagement and motivation throughout the semester.

5. **Conclusion**

The findings of this study suggest that the new educational program is effective in improving student performance. The program's focus on interactive learning and critical thinking appears to be a key factor in the observed improvements. Further research is needed to explore the long-term effects of the program and to identify ways to implement it more widely.

4.6 Project components and sub-components

4.6.1 Improvement of aquaculture productivity

【1-1】 Promotion of feed-based aquaculture and semi-intensive aquaculture

Sub-component		Unit	Qty	Unit price (Rs. lakh)	Cost covered by JICA loan	Beneficiary	Amount (Rs. Lakh) by JICA loan
(1)	Productivity enhancement of existing community/institutional tanks	ha	■	■	■	■	■
(2)	Productivity enhancement of existing individual ponds of progressive fish farmers	ha	■	■	■	■	■
(3)	Productivity enhancement in existing individual ponds of small fish farmers	ha	■	■	■	■	■

(1) Objective

To increase productivity of pond and tank aquaculture through introduction quality fish seed of large size including genetically improved strain of IMC such as Jayanti *Rohu* and improved *Catla* and provision of formulated feed as well as local feed items. The spawn of the improved IMC strains is now available at the Multiplier Unit (MU)⁹⁴ of the Central Institute of Freshwater Aquaculture (CIFA) such as the Debajit Barman Fish Seed Farm in Nalbari District, Assam and National Freshwater Fish Brood Bank (NFFBB) in Odisha State.

(2) Activity

This component will adopt 2 development approaches for improvement of existing pond culture. One is to encourage semi-intensive culture with formulated feed, and the other is to support semi-intensive culture with local feed. Below table outline of input support and expected productivity increase.

Table 4 - 9 Input supports and expected productivity by approach

	Input supports		Expected productivity increase
	Seed	Feed	
Semi-intensive culture with formulated feed	Large size seeds including genetically improved carp strains	Formulated pellets	From 3ton/ha to 5ton/ha
Semi-intensive culture with local feed	Same as above	Organic feed items such as MOC and rice brain	From 2ton/ha to 4ton/ha

Remarks: As for genetically improved strain, spawn/ early fry of Jayanti *Rohu* and improved *Catla* are planned to be introduced from MU of CIFA, Orissa. These small sized seed will be nursed and grown to be large-size seeds in Fish Seed Village (FSV) of this project. As such, selection of farmers' pond for production of grow-out fish shall be as nearer as possible to FSV. moreover , for the first year , importance will be given for meeting the requirement of seed from the other sources i.e. required seeds as available in the district or near by district and will be procured.



⁹⁴ Multiplier Unit :Seed distribution stations established across India to disseminate quality seed developed by CIFA throughout the country.

(3) Target beneficiaries and selection criteria

Target beneficiaries are not only individual farmers and community (pond/tank) but also institutional ponds such as school/college/university/religious institutions for the approach of formulated feed-based aquaculture. On the other hand, for semi-intensive culture using locally available feed, traditional farmers will be major target group. In both the cases, beneficiaries who have already got assistance during last five years from other external aided projects/state funded schemes shall be unprioritized from the beneficiaries of this project.

Prior to the specific criteria for this component, the beneficiaries should satisfy following conditions.

- 1) Beneficiary farms shall have strong will to participate in the project scheme and understand its implication, namely they are to be selected as demonstration farms/facilities for verification of improved aquaculture techniques and relevant livelihood supporting activities. This means that selected beneficiaries are tasked to open their results for other farmers and extend the knowledge obtained during the project period.
- 2) They shall agree (by an agreement with the DFDO) that they will contribute ■■■ of the project cost as required and abide by all norms/conditions of project implementation as per Guideline of the Department. Financial capacity of beneficiaries will be investigated in the selection process.
- 3) The land ownership shall be inspected in the selection process. The ownership of the ponds should be usually with the farmer himself/his father or mother of family members (taking written authority in the form of NOC them). Ponds/tanks may also be taken on lease, but for a minimum period for 7 years supported by Notary Affidavit with minimum 5 years in hand.

Two criteria namely (a) water area of existing pond/tank and (b) productivity in previous year are set forth for selection of beneficiaries as shown in the below table.

Table 4 - 10 Selection criteria of beneficiaries

Farming system	Beneficiaries	Planned pond area to be supported*	Average production in previous year
Semi-intensive culture with formulated feed	Community (pond/tank)	0.5-2 ha	>2ton/ha/yr
	Institution (ponds)	0.40-2 ha	Around 2ton/ha/yr
	Individual farmer	0.4-1.5 ha	>3ton/ha/yr
Semi-intensive culture with local feed	Individual farmer	0.15-0.4 ha	>1.5ton/ha/yr

*: The Project will support one pond only for each beneficiary.

(4) Implementation system

After beneficiaries are selected, MOU is signed between beneficiaries and DoF represented by DFDO and the activities start according to the following procedures.

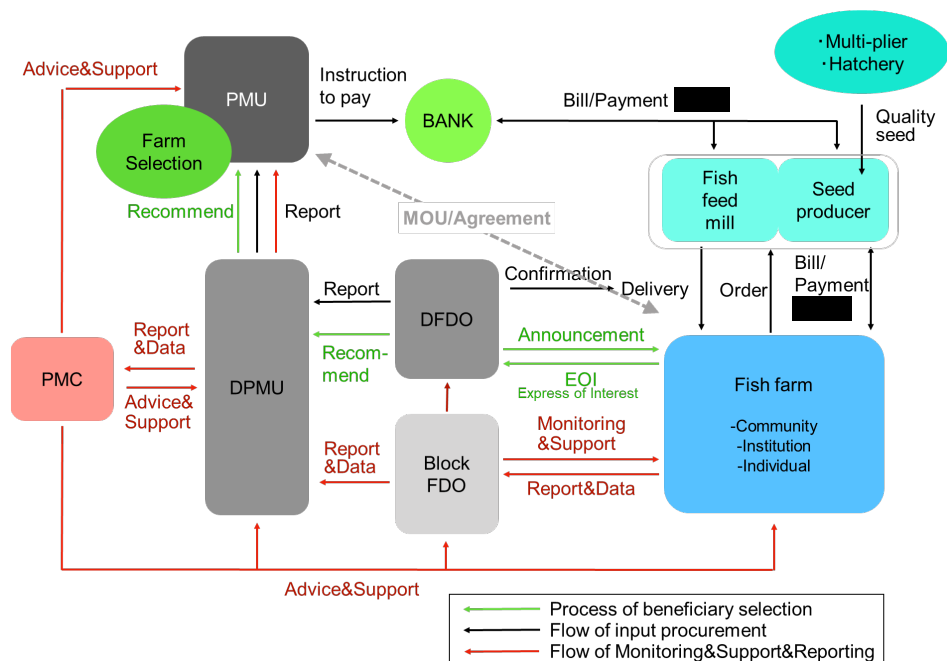


Figure 4 - 2 Implementation structure of the components 1-1 and 1-4

Source: JICA Survey team

【Procurement of input (seed, feed and other input)】

- Fund to procure farming inputs is deposited to the bank.
- Fish farmers order seed feed, and other inputs to their suppliers respectively.
- DFDO confirm the delivery of ordered goods at site and give instructions to the bank.
- Bank pay to input suppliers.

【Preparatory works before arrival of input】

- DFDO holds awareness programs about project and extend field instructions to beneficiaries.
- Beneficiaries will take up pond cleaning etc. and keep the pond ready for liming and manuring.
- Refilling of water into the pond.
- Verification of the above activities by block-level field officers.

【At arrival of input】

- Beneficiaries receive input from suppliers and record it in the logbook.
- Field officers verify proper supply of input and record such information.

【Aquaculture practice】

- Beneficiaries carry out aquaculture using the above input based on the guidelines provided by the project.
- Field officers visit the site time-to-time and carry out monitoring of activities and reporting to DFDO following the format given.
- DFDO will also visit the sites once a month and monitor proper implementation.

【Harvest and reporting】

- Beneficiaries will chalk out detail plan of harvesting in consultation with field officers.
- Beneficiaries harvest fish, record the results in the data sheets and report to the field officers along with the operation plan for the next cycle.
- Field officers submit the above report to DFDO based on the format of the project.
- DFDO checkups them and reports to the PMU.

[1-2] Development of fish seed village

Sub-component		Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State	Benef iciary	Amount (Rs. Lakh) by JICA loan
(1)	Development of fish seed village	ha						
(2)	Fish seed transportation vehicle	No						
(3)	Certification and accreditation of fish hatcheries (20 hatcheries)	LS						

(1) Objective

To realize efficient supply chain of large-size quality seeds or yearling of IMC and other carp species including recommended improved varieties through establishment of seed production clusters called Fish Seed Villages (FSV).

(2) Activity

In Assam state, there are various types of seed producers/growers who produce different size and quality of seeds depending on the needs in the market. However, at present their activities seem to be not adjusted well to the actual demands from grow-out farmers. In recent years there are strong demands for large-size/weight IMC seeds of more than 100g/fish, possibly genetically improved strains, as well as stunted growth carried over fingerlings to increase productivity and to shorten the culture period in grow-out ponds. Therefore, it is needed to establish a sort of strategic and systematic seed production cluster to meet the increasing market demands of such large-size seeds.

Under this component, existing seed growers operating in closed vicinity are to be identified as a cluster, namely as a Fish Seed Village (FSV) and encourage them to produce large-size quality seeds of IMC.

The inputs for upgrading aquaculture facilities are provided to the FSVs and Large-size seeds of more than 100g/seed to be produced at FSVs. Produced large-size seeds will be distributed among beneficiaries of this project, namely IMC grow-out farmers under supervision of the project. Each c

To promote joint purchase of input and joint delivery of fish seed, cooperative societies or FPOs/FPCs composed of fish seed producers will be utilized and be given support. These groups also co-manage the fish seed transportation vehicle which will be provided in the Project.

In addition, to improve the quality of seed production in hatcheries, technical guidance will be provided to meet national certification and accreditation of fish hatcheries.

(3) Target beneficiaries and selection criteria

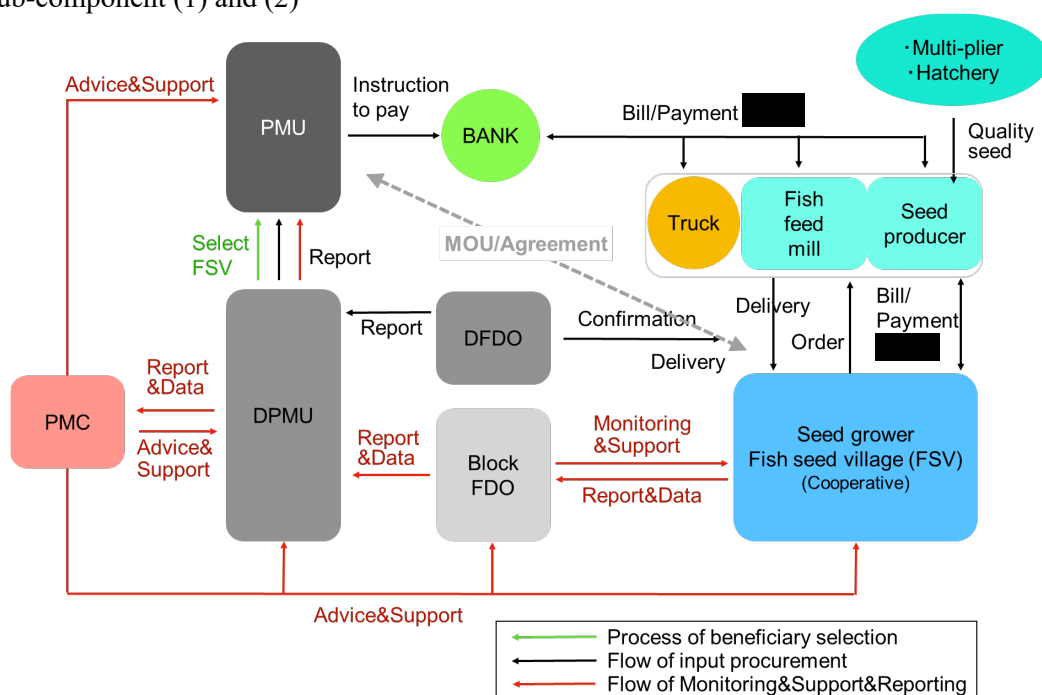
The criteria to select target beneficiaries is as follows.

For sub-component (1) and (2)

- The beneficiaries (not grow-out farms) have sufficient seed raising ponds with size range of 0.2 to 0.4 ha.
- Maximum area of ponds to be supported for one beneficiary will be 1 ha. The pond area shall be utilized primarily for seed production/raising only.
- Water area of One cluster of seed growers or one FSV will be around 20-30 ha, which is located in 1 to 5 contiguous villages.
- In case of supporting the existing cooperative societies and FPOs/FPCs, the society and selected members should agree for being beneficiaries for the Project.
- In case of establishing new cooperative societies, the beneficiaries/members should be agreed to involve in the proposed activities.
- The beneficiaries/ groups/etc. shall comply the norms and regulation for effective management of the fish seed transport vehicle.

- i) Must be a permanent resident of the project target districts preferably in Fish Seed Village (FSV) and must possess identity and residential proof including Aadhaar Card.
- ii) Hatcheries which have registration under the Fishery Department will be only eligible to be as beneficiaries.
- iii) Must have a Bank Account in his/ her/ hatchery/farm name in any nationalized Bank in the districts.
- iv) The applicant must have his/ her own or leased / pond / hatchery/farm. If leased, the lease duration must be for a minimum period of 7 years at the time of submission of the application in hand.
- v) The unit must be in active operational condition and details on annual spawn and fry production (species-wise) achieved during last 3 years must be furnished while submitting the application.

For sub-component (1) and (2)



Source: JICA Survey team

For the formation of the cooperative societies, the implementation procedure is as below.

- i) With the discussion with DoF, the PMC/PMU will identify the potential FSV which matches above selection criteria.
- ii) If there are existing cooperative societies or FPOs/FPCs which have willingness to participate the project, PMC/PMU will discuss with the group regarding the support from the Project, selection of beneficiaries, etc.
- iii) If there are candidate beneficiaries in the potential FSV but they do not participate in cooperative societies nor FPOs/FPCs, PMC/PMU will discuss the establishment of a cooperative society. If they agree for the establishment, PMC/PMU will connect them to FISHFED to proceed establishment.
- iv) The Project will conclude MOU with cooperative societies and/or FPOs/FPCs about the support from the Project, demarcation, etc.
- v) PMC/PMU will provide trainings to the cooperative societies regarding business planning, joint delivery of fish seed to farmers, management of fish seed transportation truck, and other required topics.
- vi) PMC/PMU will connect newly established cooperative societies to FISHFED or other relevant entities for the training of management of cooperative societies, accounting, audit, etc.

For sub-component (3)

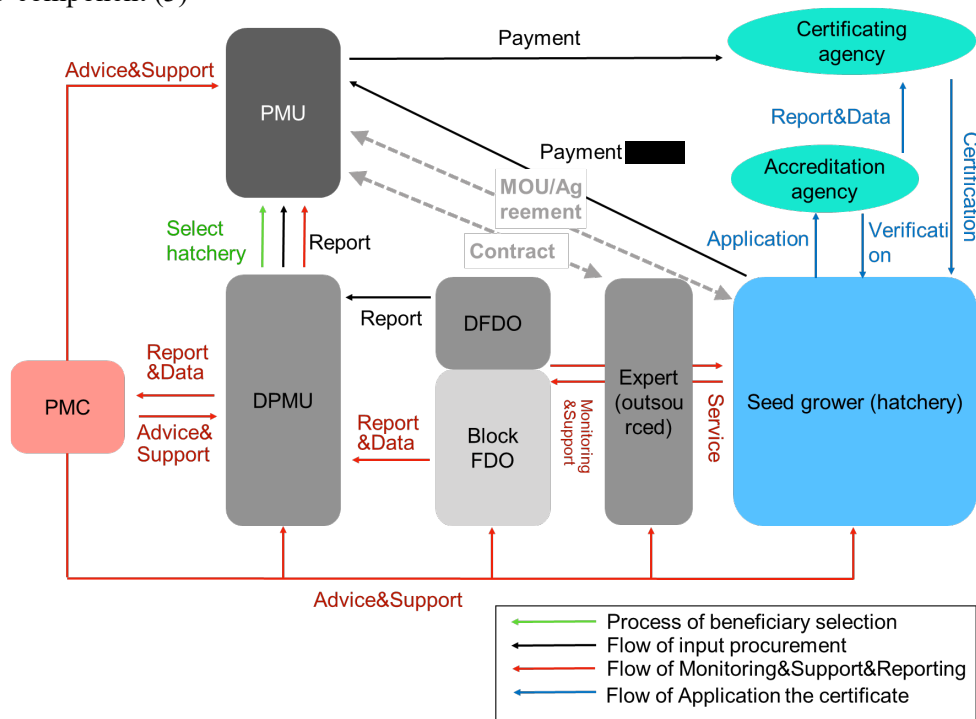


Figure 4 - 4 Implementation structure of sub-component 1-2 (3)

Source: JICA Survey team

【1-3】 Credit linkage to fish farmers

Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	Beneficiary	Amount (Rs. Lakh) by JICA loan
Credit linkage to fish farmers	No					

(1) Objective

This component aims to support the input costs of aquaculture activities and strengthen the local farming economy through the provision of funding to farmer's groups. In particular, it will focus on developing a financial support scheme to facilitate the transition to feed-based aquaculture and to purchase the necessary feed.

(2) Activity

Fish farming communities in Assam are experiencing low aquaculture productivity due to lack of quality material and technology. Currently, much aquaculture is carried out in an extensive manner and little or no feeding is done. This program aims to overcome these challenges and increase aquaculture productivity by providing the necessary funding for feed-based aquaculture.

For the beneficiary portion, loans from banks or Non-Banking Financial Companies (NBFCs) are considered; NBFCs often act as microfinance institutions (MFIs) and provide small loans to rural individuals without access to traditional banking services. While fishponds do not serve as collateral for loans from ordinary banks, NBFCs make it easier for volunteers to obtain loans, as their business plan is the main criterion. Such small loans encourage individuals to set up or expand small businesses, leading to economic independence. In addition, as a track record leads to credibility, building up a track record during project implementation can lead to a continuous source of funding after the project has been completed. In addition, by utilizing loans from NBFCs as a revolving fund, the project aims to support fish farming communities in Assam by ensuring a sustainable source of finance.

(3) Target beneficiaries and selection criteria

The target group will be registered farmer groups within Assam. Selection criteria include relevance of the business plan, no duplication of financial support and track record of activities. The following items are suggested for selection criteria for Credit Linkage Supports.

- I. Successful functioning of the organization during last 5 years fulfilling the following conditions:
 - a. Up-dated Audit Report approved by authorized body (up-dated till 2023-24)
 - b. Holding regular AGM & EC meeting duly documented & signed
 - c. Adequate resource utilization (for example in case of fishponds - minimum productivity achievement 5 tons/ha/year considering all ponds/tanks)
 - d. Profit sharing/ fund utilization with due knowledge of all members as per decision in the AGM
 - e. Women members in both General Body (GB)/ Executive Committee (EC) - min. 30%
 - f. Up-dated Bank Pass Book (month of application)
 - g. Utilization of fund received from Govt/ any funding agency (internal/external)/ financial institutions etc.
 - h. Type of water resource owned by the FPO/SHG/Fy Coop. Society) and number and water area (ha)
 - i. Type of water resource taken on lease by the FPO/SHG/Fy Coop. Society) and number of ponds /community tanks and water area (ha) for 7years of lease with 5 years in hand
- II. Priority for selection will be given to the organization of which all members are women/ led by women
- III. Priority for selection will be given to the organization which have more water area.
- IV. The organization is registered and possesses all relevant documents/ certificates issued by competent authorities.
- V. Ponds of the beneficiary should be perennial.
- VI. If perennial source of water (stream/ rivulet) is available adjacent to the pond systems, the selection will get preference.
- VII. The beneficiaries should agree to contribute [REDACTED] of the total project cost.
- VIII. The selected beneficiaries should agree (by an agreement with the DFDO) that they will abide by all norms/ conditions of project implementation.
- IX. The beneficiaries will inform the DFDO as well as the Departmental Officer(s) of the concerned development block about the date of each harvest in advance.
- X. The beneficiary will agree to maintain records of all activities of pond management/ other management practices as per format provided by the Department.
- XI. The beneficiary group should have maintained regular records of pond management, production data, sales, revenue utilization etc. with document to be shown to the Departmental officers whenever required.

The following items are suggested for inclusion in the application form.

- i. Address details of the farm/FPO/FPC/FCS, etc.
- ii. Annual revenue generation of the organization, profit-loss accounts, profit utilization
- iii. Man-power of the organization.
- iv. Name of the Head of the organization, contact no., and mail id.
- v. All relevant documents as per selection criteria
- vi. Registration number and date/ registration certificate
- vii. Documentary evidence of harvest each time, sale record, entry of sale value amount in the cash book and bank passbook.
- viii. [REDACTED] of the project cost to be contributed by the beneficiary.
- ix. Preference will be given to those community groups as mentioned above ,which are already involved with the welfare activities for the benefit of the society as performed by them for last three years.

(4) Implementation system

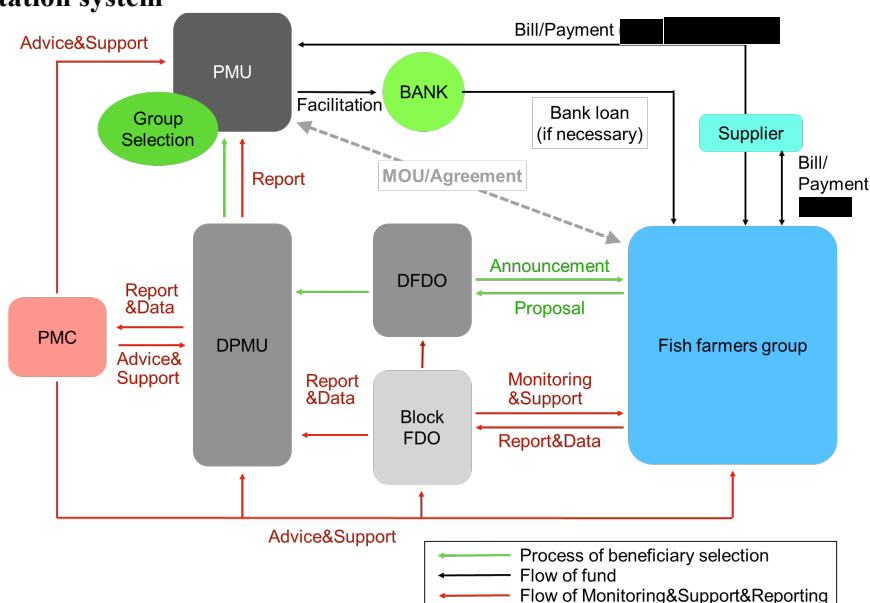


Figure 4 - 5 Implementation structure of component 1-3 (Credit Linkage)

Source: JICA Survey team

【1-4】 Field demonstration (Introduction of new culture species)

Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State contribution	Amount (Rs. Lakh) by JICA loan
(1) Promotion of high yield varieties of Pangasius catfish in existing individual ponds	ha					
(2) Promotion of freshwater prawn (Scampi) culture in polyculture system (semi-intensive culture with formulated feed)	ha					
Promotion of freshwater prawn (Scampi) culture in polyculture system (semi-intensive culture with local feed)	ha					
(3) Promotion of indigenous fish species in polyculture	ha					

Promotion of high yield varieties of Pangasius catfish in existing individual ponds

(1) Objective

Large-scale aquaculture of pangasius catfish, *Pangasianodon hypophthalmus* has been developed in Southeast Asian countries such as Vietnam, Indonesia and Thailand for export commodities as well as for meeting local demand. Although the demand for this species is not very high at present in India as well as Assam, significant number of venture fish farmers have already started aquaculture of this species because intensive culture method can be applied for this species, and they believe there will be a significant market demand for target species diversification. This component aims at demonstration of intensive monoculture of pangasius catfish to examine feasibility of aquaculture of this species in Assam.

(2) Activity

Intensive monoculture of pangasius catfish will be verified at selected individual ponds providing existing seeds that are available in seed market of Assam State. [REDACTED] is proposed to develop in this component with target productivity of 10 tons/ha/year. Selected beneficiary will be provided by the project with subsidy [REDACTED] for

necessary inputs such as seed, feed, materials for pond preparation etc. to launch monoculture of pangasius catfish.

(3) Target beneficiaries and selection criteria

Under this scheme, only progressive fish farmers who have sufficient experience in IMC pond culture and show strong interests for this supportive scheme. Selection criteria are as follows.

- Fish farmers who have achieved pond productivity of more than 3 tons/ha with good record keeping and harvest and are interested in farming pangasius catfish will be considered for selection. Priority will be given to those who are already doing preliminary monoculture of this species.
- Candidate site shall have sufficient number of ponds with water area of more than 0.5 ha (individual ponds). Project will support one of those ponds maximum 1.5 ha.
- Pond readily available for taking up farming practices which does not require any renovation/repair will be considered for selection.
- Pond and tanks which are located under a cluster of radius of 2-3 KM is preferred as the component is proposed to be executed through cluster based development approach.

(4) Implementation system

After beneficiaries are selected, MOU is signed between beneficiaries and DoF represented by DFDO and the activities start according to the following procedures.

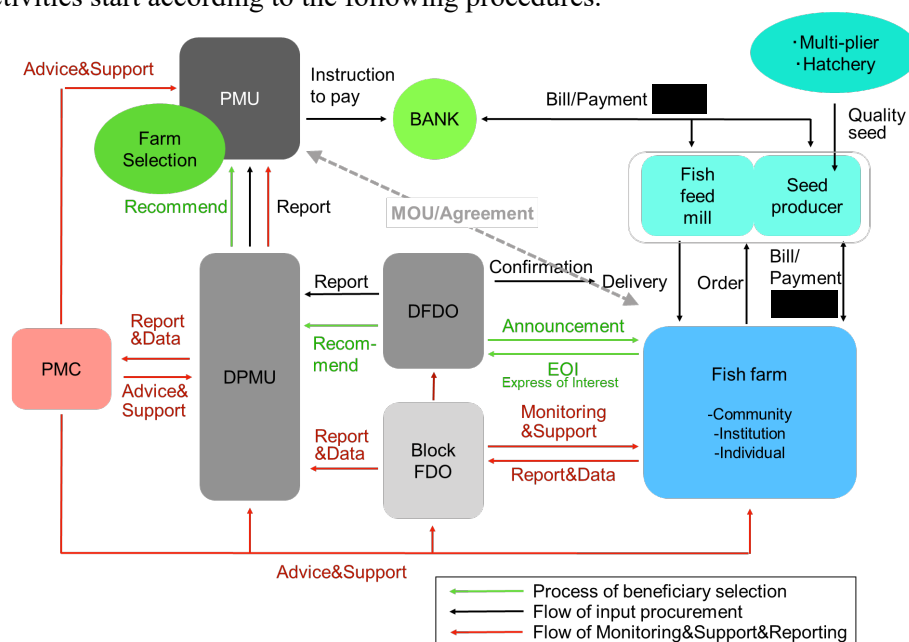


Figure 4 - 6 Implementation structure of the components 1-1 and 1-4

Source: JICA Survey team

【Procurement of input (seed, feed and other input)】

- Fund to procure farming inputs is deposited to the bank.
- Fish farmers order seed feed, and other inputs to their suppliers respectively.
- DFDO confirm the delivery of ordered goods at site and give instructions to the bank.
- Bank pays to input suppliers.

【Preparatory works before arrival of input】

- DFDO holds awareness programs about project and extend field instructions to beneficiaries.
- Beneficiaries will take up pond cleaning etc. and keep the pond ready for liming and manuring.
- Refilling of water into the pond.
- Verification of the above activities by block-level field officers.

【At arrival of input】

- Beneficiaries receive input from suppliers and record it in the logbook.
- Field officers verify proper supply of input and record such information.

【Aquaculture practice】

- Beneficiaries carry out aquaculture using the above input based on the guidelines provided by the project.
- Field officers visit the site time-to-time and carry out monitoring of activities and reporting to DFDO following the format given.
- DFDO will also visit the sites once a month and monitor proper implementation.

【Harvest and reporting】

- Beneficiaries will chalk out detailed plan of harvesting in consultation with field officers.
- Beneficiaries harvest fish, record the results in the data sheets and report to the field officers along with the operation plan for the next cycle.
- Field officers submit the above report to DFDO based on the format of the project.
- DFDO checkups them and reports to the PMU.

Promotion of freshwater prawn (Scampi) culture in polyculture system with carp

(1) Objective

Freshwater prawn (Scampi), *Macrobrachium rosenbergii*, is known as an important aquaculture species in freshwater ponds and cultured popularly in Southeast Asian countries. The early larvae or zoea of this shrimp inhabit in coastal seawaters, and accordingly artificial seed production of this species is carried out at the sites where quality seawater can be taken. In recent years due to high market price of scampi, some progressive farmers in Assam have introduced juvenile shrimp, which were brought from West Bengal and some other coastal states, in carp polyculture ponds and obtained preliminary production results although details are now not defined well.

This sub-component aims to verify feasibility of freshwater prawn (scampi) culture in carp polyculture ponds in Assam.

(2) Activity

Now ICAR-CIFA Orissa continues selective breeding of this species, called genetically improved scampi (GI Scampi). Experiments with 14 generations have already been taken up so far. CIFA as well as NFFBB foster broodstock of GI Scampi and distribute them to the 5 Multiplier Units (MU), which are located in Andra Pradesh for production of juveniles as seeds for aquaculture ponds of private sector. In this project, the seeds of GI Scampi will be able to procure from those MUs in Andra Pradesh.

As for the aquaculture technique, polyculture with IMC will be employed for both semi-intensive culture with formulated feed and local feed. The project plans to introduce juvenile GI scampi to those aquaculture ponds at stocking density of 10,000 ind./ha and expects to harvest them at the size of 40g/ha with survival rate of 60% or 240kg/ha. It shall be noted that carp species of demersal feeding habit such as common carp and mrigal shall be excluded in this polyculture system in order to avoid feeding competition with shrimp in pond.

Selected beneficiary will be provided by the project with subsidy for necessary inputs such as seed, feed, materials for pond preparation etc. to launch polyculture of scampi and carp.

(3) Target beneficiaries and selection criteria

The criteria to select target beneficiaries is as follows.

- i) Fish farmers who have achieved pond productivity of more than 3 tons/ha with good record keeping of pond management and harvest, and who are interested in farming scampi will be

considered for selection. Those who are already doing polyculture of this species will be given priority.

- ii) Candidate site shall have sufficient number of ponds with water area of more than 0.5 ha (individual ponds). Project will support one of those ponds maximum 1.0 ha.
- iii) Pond readily available for taking up farming practices which does not require any renovation/repair will be considered for selection.
- iv) Pond and tanks which are located under a cluster of radius of 2-3 KM is preferred as the component is proposed to be executed through cluster based development approach.

(4) Implementation system

Same as Promotion of high yield varieties of Pangasius catfish.

Promotion of Indigenous fish species in polyculture

(1) Objective

P. sarana (or Ompok, Magur/singi, Mystus spp etc.) is a high market demand fish in Assam as well as in many Indian states. Its presence in natural waters has declined considerably. Its culture in pond contributes both to human consumption and natural resource conservation.

(2) Activity

Activities such as (i) promotion of culture of the species [REDACTED] per project district is proposed under the Project. Additional funds for this activity will not be required as feeding habit of the fish is similar to that of Rohu, a candidate species under polyculture system of carp fishes taken up under the project. In the proposed area [REDACTED] 50% of Rohu seed can be replaced by equal quantity of sarana seed which will be provided by the project with the subsidy [REDACTED] for the cost to purchase, and (ii) As the culture practice of sarana is not widespread, a research/ study on its culture practice under R&D is also proposed.

(3) Target beneficiaries and selection criteria

Target beneficiaries and Selection criteria shall be the same as in the case of other [1-4] Field demonstration programmes indicated above.

(4) Implementation system

Same as Promotion of high yield varieties of Pangasius catfish

【1-5】 Research and Development

Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State contribution	Amount (Rs. Lakh) by JICA loan
Need based research studies (R&D) as per project requirement	LS	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

(1) Objective

This component aims to obtain basic knowledge required for further development and improvement of aquaculture and relevant natural/socio-economic activities (refer to the Activity). These proposed studies are not exhaustive and new research topics may be included.

(2) Activity

The Project will provide budgetary support for various relevant research studies. At present the following studies are thought to be needed and expected although the subjects and contents are to be examined carefully by the PMU.

- Introduction of Biofloc system as an efficient seed production of IMC.
- Identification of existing and previous natural fish breeding grounds in the rivers system of Brahmaputra and Barak
- Study on the production & productivity of aquaculture in ponds/tank and beel fisheries in selected districts

- Study on water resources (ponds, tanks, beels, derelict water bodies and swamps)
- Study on the current problems and issues on FPO, FPC and Farmers' Cooperative societies in Assam
- Study on infrastructural gaps in the whole sale and retail fish markets - from the aspects of hygiene and food safety points of view
- Study on per capita fish consumption
- Study on marketing linkage of indigenous fish including ornamental fish (export & import)
- Study on effect of climate change and its mitigation measure in fisheries sector.
- Study on revival of sick and non-functional fishers' cooperative societies
- Study on increased opportunities for safe and rewarding youth and women's employment and entrepreneurship
- Study on low cost fish feed production technology by using the locally available raw materials

(3) Target beneficiaries and selection criteria

- Institutes/organizations as recognized by the Indian Council of Agriculture Research (ICAR), Government of India
- Government Institute like Indian Institute of Technology, etc.
- Selection criteria shall be appropriateness of research proposal such as subject, study methodology, study period, budget, responsible researchers, expected contribution to the project activities, etc. Concrete criteria will be determined by evaluation committee organized by DoF.

(4) Implementation system

- DoF announces this scheme for relevant organizations and asks submission of proposals.
- At the same time, it organizes the evaluation committee of this scheme.
- The evaluation committee evaluates the proposals and determines the studies that the project budget is provided.
- The selected studies are carried out by the proponents.
- DoF and the Project accept the report presented by the beneficiary
- The results of the studies will be utilized for future planning work of DoF and also disclosed to the public.

4.6.2 Development of aquaculture supply chain

[2-1] Development of fish supply chain and market infrastructure

	Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State contribution	Benef iciary	Amount (Rs. Lakh) by JICA loan
(1)	Aquaculture Business unit (Individual)	No	■	■	■	I	■	■
(2)	Upgradation of Existing semi-urban hygienic fish market	No	■	■	■	■	I	■

(1) Objective

The objective is to promote aquaculture as a whole supply chain by developing various related infrastructures from production to sales of farmed fish.

(2) Activity

Infrastructure related to the supply chain includes fish market, cold chain, etc. Based on the contents of other similar projects underway in parallel, this component plans to develop and construct, i) aquaculture business units (aquaculture material sales outlets) and ii) semi-urban hygienic fish market.

i) Aquaculture business unit

Two (2) types of major inputs required for aquaculture production are seeds and feed. In addition to these 2 items, this sub-component also covers the gear for harvesting fish, nutritional supplements

to be mixed with feed, and pharmaceuticals for aquatic organisms. Seeds are an important input material, but since a simple store and warehouse is planned here, seeds, which require facilities for water supply and drainage, will not be handled at this unit. [REDACTED]

[REDACTED] The store will not only sell goods but will also have staff available for simple technical consultation and on-site instruction to raise the level of technology at the grass-root level. The reference plan is shown in the following figure.

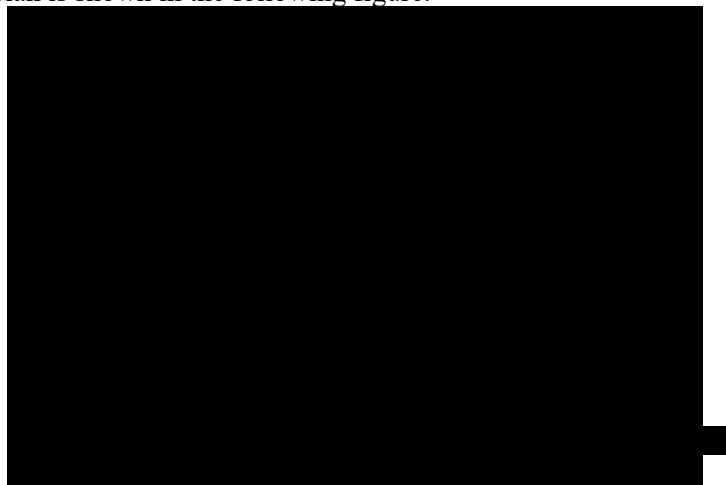


Figure 4 - 7 Layout plan of aquaculture business unit

ii) Semi-urban hygienic fish market

A small retail fish market will be constructed in the village area, following in the footsteps of the 9 retail fish markets already established by APART. [REDACTED]

[REDACTED] It will have sanitary water supply and drainage facilities, an administrative office, equipment storage, and restrooms. Aeration piping for live fish will also be provided. The reference plan is shown in the following figure.

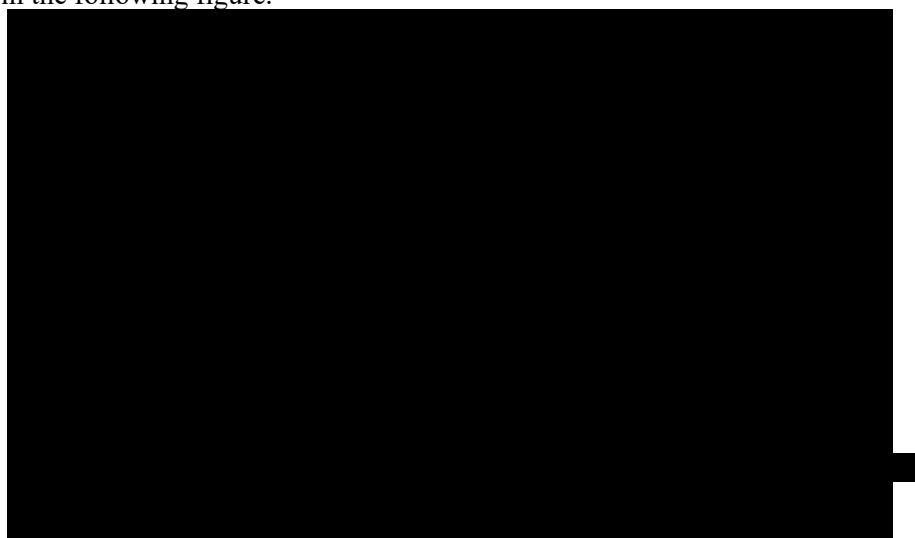


Figure 4 - 8 Layout plan of semi-urban hygienic fish market

(3) Target beneficiaries and selection criteria

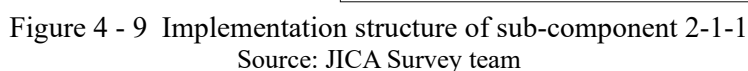
Items i) is targeted at private businesses. Beneficiaries will be selected through public proposal system. Beneficiaries will be provided not only with goods, but also with guidance on handling and general aquaculture techniques. The potential beneficiaries are as follows.

- Businesspersons who have an enthusiasm in developing aquaculture in Assam, a human network with fish farms and input suppliers, minimum knowledge on aquaculture technique, and business skills (accounting and documentation).
- Those who have a bank account and a relevant business authorization issued by the State.
- The unit should be set up preferably in the production cluster area but it is not mandatory.
- Those who have technical and financial soundness to maintain the facility.
- Preference will be given to the professional graduates like fisheries/agriculture/animal husbandry. In absence of such professional graduates, science graduates may also apply.
- They shall agree (by an agreement with the DFDO) that they will contribute [REDACTED] of the project cost as required and abide by all norms/conditions of project implementation as per Guideline of the Department.

- Area where no hygienic retail fish market exist.
- The proposed market area shall be in Government land /local bodies etc.
- Appropriate site where access of road, electricity and water (supply and drainage) is assured, is available near by the proposed market area.
- Village council who will manage this market is well organized and has a capacity to manage fish market (collecting fish stall fees, cleaning market in a daily basis, paying operation cost (salary, electricity and water), maintaining facilities in mid-term basis.

i) Aquaculture business unit, it is implemented as follows.

- The beneficiaries are selected by a proposal basis. In said proposal, the specification of relevant equipment and facility, cost and business plan should be clearly explained.
- Beneficiaries order proposed equipment and facility.
- When those equipment and facility are delivered to the beneficiaries, the concerned DFDO confirms the items ordered.
- DFDO advises time to time beneficiaries to make their business successful.
- Beneficiaries prepare an annual activity report and DFDO check it.



ii) Semi-urban hygienic fish market will be implemented as follows.

- Target village and site is selected through PMU.
- Drawings and tender document are prepared by PMU.
- Constructor is selected by tender procedure.
- Construction.
- Market management committee is organized in the village and necessary stuffs are recruited by the committee.
- The management committee is responsible for daily operations, check and mid-term maintenance as well as preparation of operation report.
- PMU inspects proper management of the market.

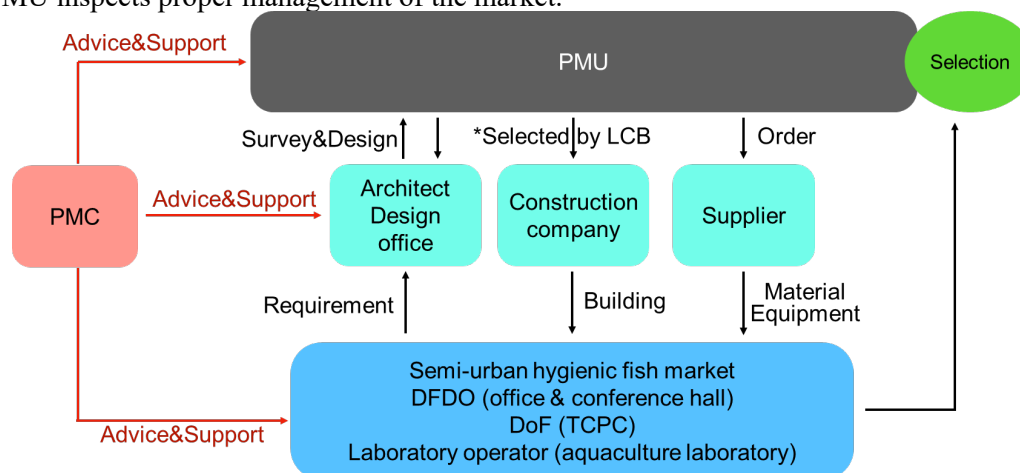


Figure 4 - 10 Implementation structure of infrastructure development sub-components 2-1-2 and 3-1
Source: JICA Survey team

【2-2】 Assam-Japan business investment exploration

Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	Amount (Rs. Lakh) by JICA loan
Assam-Japan business investment exploration	No				

(1) Objective

To promote investment in fisheries sector in Assam.

(2) Activity

The project will hold the seminar and site-visit tour [REDACTED] during the project implementation. Participants are presented not only the project outline but also the information related to the fisheries sector and business environment in Assam.

(3) Target beneficiaries and selection criteria

Indian and Japanese private companies who may have concern or interest in the business in fisheries sector in Assam.

(4) Implementation system

- PMU will gather information on the private companies which may have an interest in investing in the fisheries sector in Assam. Especially for Japanese company, the information will be provided by the JICA office, Embassy of Japan and JETRO (Japan External Trade Organization) office in India in consultation with PMC.
- PMU will hold the web-seminar to the companies and invite the on-site seminar and site visit.
- PMU will conduct the seminar and site visit.

4.6.3 Diversification of aquaculture-based livelihood

[3-1] Development of Blue Tourism for livelihood enhancement of target group

Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	Beneficiary	Amount (Rs. Lakh) by JICA loan
Development of Blue Tourism for livelihood enhancement of target group	No	1	1	1	1	1

(1) Objective

The main objective of this component is to improve the livelihoods of fish farmers in Assam through blue tourism (pond-related tourism activities). It aims to utilize the natural resources of the state to promote sustainable tourism and increase the economic benefits for the fishing communities. It also aims to supplement the livelihoods of fish farmers and stabilize their income through tourism activities.

(2) Activity

Assam has abundant water resources and high untapped tourism potential. This component will use these resources and attract tourists from in and out of the state, thereby stimulating the local economy and diversifying income sources for communities dependent on fishing. Potential components are as follows.

- Restaurants
- Amusement boats
- Angling sets
- Aquarium
- Infrastructure development (access roads, electricity supply, water supply, etc.)
- Administrative facilities

(3) Target beneficiaries and selection criteria

The target beneficiaries are mainly community groups such as functional cooperative society/FPC/FPO/individual. Government fish farm can also be utilized as demonstration unit for blue tourism. As selection criteria, the following are suggested.

i) Presence of water bodies as tourism asset

Beneficiaries shall have well established fish farm/large water body of minimum 2.0 ha water area.. Preference will be given to beneficiary having larger water body.

ii) Accessibility:

Distance from cities and other major points of interest determines the accessibility of a tourist destination. If it is too far away or there is a lack of transport, visitor numbers may decrease.

iii) Transport infrastructure:

The condition of roads and transport links can affect the time and cost of reaching a destination for tourists. Good road infrastructure improves the tourism experience and attracts more visitors.

iv) Regional development:

The state of road development is closely linked to the overall level of development in the state. Easy access to tourist attractions can have a positive impact on other economic activities in the area and promote long-term economic growth.

v) Environmental impact:

Road development and improved access to tourist destinations can have an impact on the environment. Sustainable tourism development requires planning that balances environmental protection.

vi) Level of engagement:

Criteria for selecting people who are likely to contribute to the program, such as their willingness to actively participate in targeted activities and their past participation. For example, their contribution to the community and their participation in relevant activities may be assessed.

vii) Specific attributes:

Individuals with specific attributes that are relevant to the program objectives, such as age, gender, disability status, ethnic minorities or individuals from a particular social background, may be targeted.

(4) Implementation system

This component is implemented through partnerships with local government, state development agencies, private company and non-governmental organizations (NGOs). These organizations will provide technical support, project management and monitoring, and local communities will be actively involved in the management of the business.

As part of the operation and maintenance management system, it is envisaged that the PMU provide technical support for business support, including the start-up and operation of new businesses in consultation with PMC.

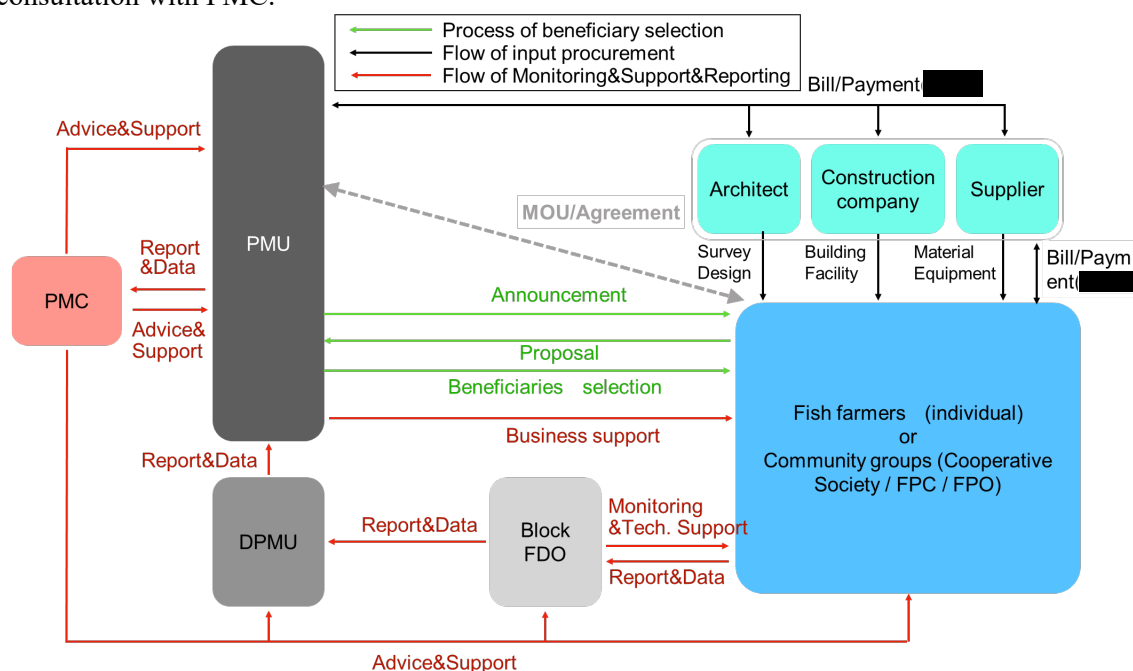


Figure 4 - 11 Implementation structure of components 3-1 and 3-2
Source: JICA Survey team

【3-2】 Entrepreneurship Development

Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	Beneficiary	Amount (Rs. Lakh) by JICA loan
Entrepreneurship Development	No					

(1) Objectives

To meet new challenges of enterprises, cooperatives and other institutions to strengthen technology adoption of Assam aquaculture sector.

(2) Activities

For the entrepreneurs, the Project provide seed funding and business trainings (financial access, basic accounting, business planning, etc.). The seed funding will cover up to of the project cost for local companies.

(3) Target beneficiaries and selection criteria

The beneficiaries will be selected by the following criteria.

- Assamese companies / cooperatives / organizations/institutions
- Business operation in Assam at least for last 3-5 years

Proposal-based approaches will be taken. Some of the target areas would include:

- To establish hatchery & production process of new varieties - local indigenous varieties / non-native species (shrimp, tilapia, etc.)
- To improve seed transportation (transportation truck with mechanical water circulation and aeration system)
- To establish organic / naturally-grown aquaculture farms
- To process value-added products (fish powder and flake as a nutrition supplement for children and pregnant women)
- To create and manage online sales channel
- To establish feed processing focusing on locally available ingredients

Selection criteria shall include degree of conformity to objectives, magnitude of impact on the Assam industry, capacity and credibility of the team, feasibility of the plan, etc.

(4) Implementation structure

Implementation structure is the same as the one in component 3-1. This component also envisages the PMU as an advisor of operation and maintenance management system, providing technical support for business support, including the start-up and operation of new businesses in consultation with PMC.

This component will be implemented in following steps:

- Promotion: Promote the program through publicity events in more than one year, SNS, etc.
- Selection: The selection committee shall be constituted. The selection steps shall include: i) qualification screening, ii) document screening and iii) interview
- Contract with beneficiaries: Agreements shall be formed between beneficiaries, DoF and implementing organization.
- Training: Provide the necessary business training
 - A. Client Sourcing
 - Overview: Refers to the activities of finding and building relationships with clients. The goal is to acquire new clients or strengthen relationships with existing ones.
 - Examples: Finding potential clients through sales activities or marketing efforts, engaging in networking or attending exhibitions, and approaching the target market.
 - B. Project Identification
 - Overview: The stage where market needs and opportunities are analyzed to identify new project opportunities. It's important to determine which projects are feasible and have high profitability.
 - Examples: Conducting market analysis to assess needs and opportunities, and identifying promising projects, such as recognizing the demand in the energy sector and pinpointing potential renewable energy projects.
 - C. Bankable Project Preparation
 - Overview: The process of preparing a project so that it can receive funding or investment from financial institutions. This involves creating business plans, risk analysis, and profitability forecasts to prove that the project is feasible and has expected returns on investment.
 - Examples: Developing a detailed business plan, evaluating profitability and risks, analyzing financial plans, cash flow forecasts, and the investment recovery period, and submitting these to financial institutions.
 - D. Scheme Conversance
 - Overview: Refers to becoming familiar with public grants, loan schemes, tax incentives, and other support programs related to the project or business. Understanding these schemes helps ensure that the project receives the appropriate support.
 - Examples: Researching available loan schemes or grant programs from governments or international organizations and understanding which schemes can be applied to the project. For instance, utilizing government grants or tax incentives for renewable energy projects.

E. Liaison with the Financial Institution

- Overview: The activities of collaborating with financial institutions or investors to secure funding or loans. Effective communication with financial institutions is key to ensuring the necessary funds for the project.
- Examples: Negotiating with banks or investment companies, organizing financing conditions, providing progress reports and financial data, and maintaining relationships with financial institutions until funding is secured.

F. Legal and Statutory Compliance

- Overview: The process of ensuring that the project or business complies with domestic and international laws and regulations. This is a critical step to avoid legal issues.
 - Examples: Preparing contracts, obtaining permits, complying with environmental regulations, and managing procedures in accordance with labor laws and tax laws. Collaborating with legal teams to confirm that all legal and regulatory requirements are met and adhered to.
- Seed funding: Grants will be provided over several implementation periods.
 - Review: On-site review shall be taken up during and after the implementation and annual audit shall be conducted for 7 years after the completion of the project.

4.6.4 Infrastructure Development for Training, Extension and Capacity Building

【4-1】 Infrastructure development for aquaculture extension, training & capacity building

	Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State contribution	Beneficiary	Amount (Rs. Lakh) by JICA loan
(1)	Aquaculture Laboratory	No	1	1.0	1.0		1	1.0
(2)	Strengthening of training cum production centre (TCPC)	No	1	1.0	1.0	1.0		1.0
(3)	Upgradation of DFDO Office & conference hall	No	1	1.0	1.0	1.0		1.0

(1) Objective

The objective is to expand education, training and field-level technology extension services for DoF staff, fisheries & aquaculture producers, distributors and processors.

(2) Activity

Considering the demarcation with other similar projects underway in parallel, this component plans i) Aquaculture laboratory, ii) Strengthening of Training cum Production Center (TCPC), and iii) Upgradation of DFDO office & conference hall.

i) Aquaculture laboratory

A simple laboratory for analyzing pond water and bottom sediment will be established at district level for the purpose of assisting in the management of in-pond culture environment. Once a month, a fish farmer will bring in water and bottom sediment samples from their farms for analysis with payment of fee to be decided by PMU. The analyzing parameters are, pH, dissolved oxygen, phosphate, nitrate and nitrite etc. for pond water and soil. The lab will analyze the samples and advise on countermeasures to be taken if any abnormalities are found.

In addition to the essential function defined for the laboratory above, the group operator can also take up need-based additional function in the building.

ii) TCPC

This is an education and training facility for DoF staff, fishery & aquaculture producers, distributors and processors in Assam, and will be constructed on a site adjacent to the DoF headquarters. Although there is an existing facility, it has essentially lost its functionality due to the age of the facility. The main training courses include a 12-month Aquaculture Course, Fisheries Biology & Resource Management Course, Fish Physiology & Environmental Management Course, Fish Processing, Harvesting & Marketing Course, and Basic Science & Extension Education Course. The

reference plan is shown in following figure. Note that the practical training is conducted at the government pond adjacent to the DoF headquarter.

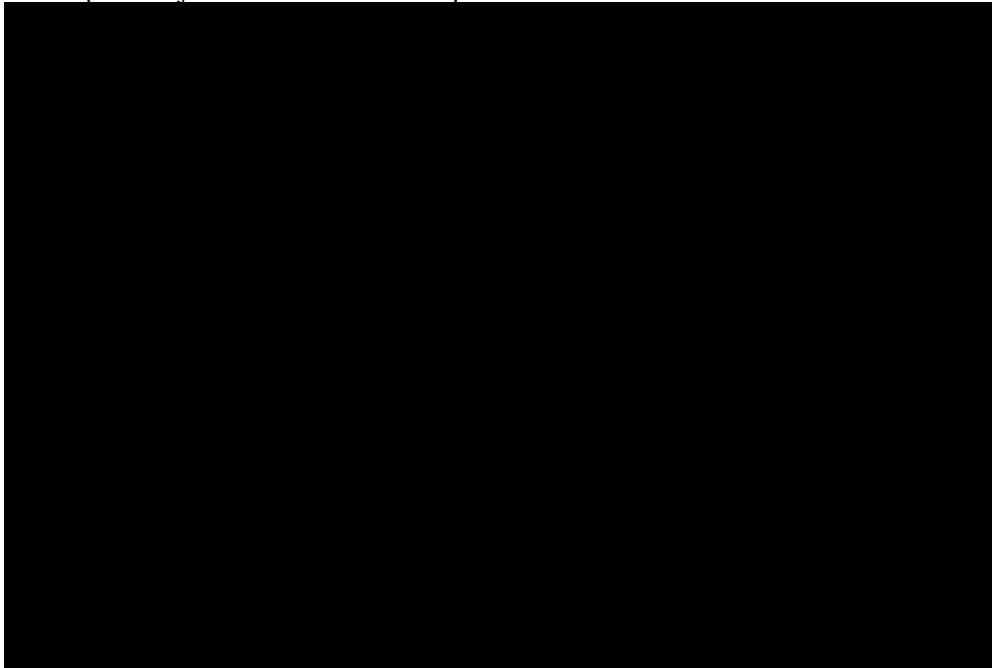


Figure 4 - 12 Layout plan of TCPC
Source: DoF

iii) DFDO office & conference hall

This is the DFDO's district Office & conference hall. In principle, the facility will target districts that do not have existing facilities and will be equipped with ICT facilities, providing a place and facilities where meetings and training sessions can be held to bring together fish farmers in the district.

(3) Target beneficiaries and selection criteria

- i) Beneficiary (laboratory operator) may be a group of farmers such as FPC/FPO/Cooperative society/SHG. Progressive fish farmers/local individual can be the beneficiaries depending on the local situation.
- ii) Location of the laboratory operator should be in the production cluster of the district or nearby the area.
- iii) Laboratory operator should be willing to contribute minimum [REDACTED] of the project cost of the lab

The items ii) and iii) are the district facilities. Basically, the target districts should be ones where no facilities of the same function exist. TCPC is a state owned only one facility.

(4) Implementation system

Implementation structure is the same as the one in sub-component 2-1-2.

- The facility and equipment are designed, and tender document is prepared by PMU.
- Constructor and equipment supplier is selected by tender procedure.
- The facilities are constructed at designated places and handed over to respective level of DoF.
- DFDO office with conference hall are operated by district officer.
- TCPC is operated by Superintendent of Fisheries (Training) under the guidance of DoF headquarters by an annual calendar of training, prepared in advance before end of each financial year for the next year, for different batches of participants.
- The operation guidance will be done by the supplier of equipment if necessary.

[4-2] Innovative and advance technology adoption for data management in fishery sector in Assam (DX)

Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State contribution	Amount (Rs. Lakh) by JICA loan
Innovative and advance technology adoption for data management in fishery sector in Assam	LS	1	1.00	1.00	0.00	1.00

(1) Objective

Through digital transformation (DX), DoF and fishery stakeholders enhance their capacity and create value to foster development of fishery sector in Assam state.

(2) Outline

Under this component, SaaS⁹⁵ (software as a service) platform will be developed under administration of DoF to digitalize its functionalities and provide digital services to fish farmers, department officers as well as stakeholders (like business entities etc.). This platform will adopt a single sign on (SSO⁹⁶) system for all the users. See the Attachment 1 for detail.

(3) Activity

The major services in this platform will be-

- User management, farmers' ID and pond health card: Provide functionality to register for farmers ID card and pond health card, avail all the department related service and self-services digitally.
- Project management system: Department officers can use this platform for performing office work, to manage program / projects activities and reporting (communication) and preparation of MIS.
- Training and extension services: Online training, online publication of training and extension materials, online technical consultation counter, etc.
- Statistics and Publication services: data collection app for statistics, online publication of statistical data, integration of outsource statistical data, etc.
- Other supplemental modules: e-accounting and payment module, e-Procurement, e-Document, e-Booking, e-Insurance, etc.
- The DX system will cover the data relating to this project and as per requirements to be decided by the DoF without any duplicity with other existing or upcoming governmental MIS system.

This platform will be built on the government hosted cloud with connecting existing external systems. The users can access this system with any devices (web or app based). With software development, the support center will be also established under DoF.

The following table summarizes the functionalities and the timeline to implement and manage the DX system for the DoF.

Table 4 - 11 Functionalities and the timeline of DX system

Functionality	Description	Timeline
Setup for implementation of DX system	Administrative arrangement and mobilization of Vendor' s team	1.00
Requirement Gathering	Understanding the requirements coordinated with the existing infra and proposed functionality for the proposed system.	1.00
Designing and Submission of required document	Submission of System document (including system design document (SDD), System Resource Specifications (SRS), Data flow diagram document	1.00

⁹⁵ Software as a service (SaaS) is application software hosted on the cloud and used over an internet connection by way of a web browser, mobile app or thin client.

⁹⁶ Single sign-on (SSO) is a technology which combines several different application login screens into one. With SSO, a user only has to enter their login credentials (username, password, etc.) one time on a single page to access all of their SaaS applications.

Functionality	Description	Timeline
	(DFD) etc.) to start development / customization and implementation of the DX system	
Development / Customization and Implementation of the system (with Pilot Testing)	Development, Customization and go-live of the system at production for UAT	
Workflow Automation	Process and workflow will be identified and configure as per the existing department working and hierarchy for implementation, in the system.	
Data Digitization & Migration	The data will be digitized and optimized for migration from the existing system to the new DX system with data quality and integrity.	
Data Analytics	The Dashboard and MIS will be designed based on identified KPI and other information heads for DoF Authorities w.r.t. the Department activities as well as program/ project activities for decision making and performance monitoring.	
Portal Development	The Web Interface will be developed and integrated with the existing Department site and maintaining the web portal and mobile app for the DoF, which will provide online access and information to the stakeholders, such as citizens, businesses, and department officials.	
Policy Formulation for Farmers' ID	The policy for Farmers' ID registration will be formulated in parallel with system development.	
Training and Capacity Building	The training and capacity building activities will be conducted to the DoF staff and users on how to use the DX system effectively and efficiently.	
Maintenance and Support	All technical support will be provided to manage and maintain the system for error free efficient operations of DX.	
Exit Management and Handover	The DX system will be handed over to the DoF with proper documentation and knowledge transfer and ensuring the sustainability and scalability of the system.	

(4) Implementation Structure

Implementation structure is shown in the following figure.

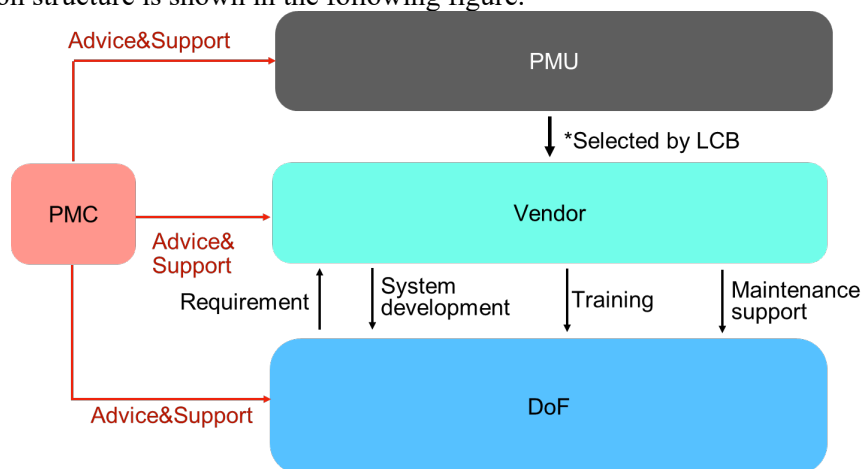


Figure 4 - 13 Implementation structure of sub-component 4-2 and 5-1-4

Source: JICA Survey team

- PMU: Ownership, Administration and Management
- PMC: DPR Preparation, Contract Management, Monitoring and Supervision
- Vendor: System Design, Development, Integration, Data Digitization and Training

【4-3】 Capacity building of farmers and stakeholders

Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State contribution	Amount (Rs. Lakh) by JICA loan
Capacity building of farmers and stakeholders	LS	■	■	■	■	■

(1) Objective

This component aims at capacity building of farmers, which will be beneficiaries of the Project, in order to enhance the efficiency of the Project and to achieve the overall goal. The training subjects will cover not only technical topics but also management guidance to strengthen the sustainability of activities, promotion of gender equality and women's empowerment, and awareness raising of nutrition.

(2) Activity

The direct beneficiaries of the Project are mainly individual fish farmers and FPOs about fish farming technologies and record keeping. The Project provides them with necessary trainings and guidance at the start of activities and as per necessity during the project period.

Technical trainings shall be carried out by participatory way adopting the concept of Farmer-to-Farmer extension approach, which has been developed in various JICA's technical cooperation projects in recent years. In short, the trainers shall not be restricted to the government officers only but utilize the technical skill of progressive fish farmers as well. Also, the sites of training shall not be restricted to the DFDO office and public facilities but utilize the fish farms of progressive fish farmers as well and /or nearest school adjacent to beneficiaries' farm sites,

Table 4 - 12 Capacity building for farmers and stakeholders

i) Explanatory session for FPOs at the beginning stage

Duration	■
Venue	FPO office/ FRO's farm sites
Participants	■
Trainers	Block level field officers (FDOs & FDs) and DFDO, and resource persons of specific technical subjects such as progressive fish farmers and local consultants
Contents of training	• Outline of the Project and objectives of relevant components • Package of practices relevant to the project and the beneficiary • Refinement of current aquaculture practices (how to procure quality seeds, feeds and other farm inputs, stocking density and daily feeding, daily management of fish farm, aquaculture calendar, etc), marketing and post-harvest management. • How to improve management capacity of FPO including record keeping and sustainability of activities. • Q&A about current aquaculture practices • Discussion of needs from men and women in the activities of FPO and how to reflect those needs in the future activities of FPO.

ii) Explanatory session for individual fish farmers at the beginning

Duration	■
Venue	Conference rooms of DFDO and/or site of progressive fish farmer ■
Participants	■
Trainers	Block level field officers (FDOs & FDs) /DFDO and resource persons of specific technical subject/ progressive fish farmers
Contents of training	• Outline of the Project and objectives of relevant components • Outline of the Project and objectives of components • Package of practices relevant to the project and the beneficiary

	• Refinement of current aquaculture practices (how to procure quality seeds, feeds and other farm input, stocking density and daily feeding, daily management of fish farm, aquaculture calendar, etc), marketing, post-harvest management. • Pond design & usefulness of inlet/ outlet of ponds • Record keeping and sustainability of activities. • Q&A about current aquaculture practices
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iii) Need-based technical trainings by district

Duration	
Venue	
Participants	Individual fish farmers and FPOs
Trainers	Block level field officers/DFDO and resource persons to be engaged
Contents of training	During the project period, district level training sessions will be held in order to cope with local training needs such as countermeasures for outbreak of fish disease, control of demand and supply of fish seeds, marketing strategy of cultured fishes, aquaculture techniques on newly introduced species, etc.

iv) Knowledge exchange program (farmer to farmer)

The project will organize short-term visit/ tour to the site of progressive aquaculture farmers between clusters and seed grower farms to brush-up the technical knowledge. It will provide the transportation cost and per diem for beneficiaries. The site of the visit/ tour may be within district/ other districts of the state or outside state within country .

v) Online technical guidance

It is expected to establish a supporting system using the web network under the above mentioned components 4-1 and 4-2 .

vi) Gender training for individual farmers

To increase the production of fish, it is crucial that both male and female fish farmers actively participate in the project activities. Hence, the Project provides beneficiaries with a gender training to promote equal participation of men and women and eventually women's empowerment in fishery.

Duration	
Venue	Conference rooms of DFDO and/or site of fish farmer
Participants	
Trainers	DFDO supported by DPMU
Contents of training	Refer "Gender Action Plan" for more details. • Explanation of the basic concepts of gender • Visualization of participation of men and women in aquaculture activities • Visualization of workload and burdens in household • Visualization of decision making in household • Creation of an action plan by each farmer for identified issues through the above activities

vii) Gender training for farmers groups

To encourage active participation of both male and female members in group activities, it is important for group management to understand the needs of members from a gender perspective, plan activities, and provide services accordingly. To realize such a situation, gender training will be provided to the management of the groups targeted in this project.

Duration	
Venue	FPO office/ FPO's farm sites
Participants	
Trainers	DFDO supported by DPMU
Contents of training	Refer "Gender Action Plan" for more details.

	• Explanation of the basic concepts of gender • Visualization of participation of men and women in group activities • Visualization of decision making in group activities • Discussion with group members and understand their issues and needs • Creation of an action plan for promoting gender equality in the group.
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viii) Nutritional awareness training for farmers

To tackle issues of health and nutrition in Assam and promote healthy consumption of fish, the Project will provide training to raise awareness of nutrition for farmers.

Duration	
Venue	FPO office/ FPO's farm sites/ Conference rooms of DFDO/ site of fish farmer
Participants	
Trainers	PMC in charge of nutrition
Contents of training	• Nutritional information about fish and its benefits to human's health • Methods of consumption of fish (cooked and dried). • Introduction of mola fish and fish powder. • Mola fish powder and its benefits to the nutrition improvement • Method of consumption of fish powder (cooking demonstration)

(3) Target area and selection criteria

All beneficiaries, either FPO or individual farmers, and stakeholders of all components of the Project will be targeted.

(4) Implementation structure

Training programs including major topics, target groups, venue, budget, etc., will be prepared and implemented by PMU in consultation with PMC.

4.6.5 Institutional Development for Project Management

【5-1】 Establishment and management of PMU/ DPMU

	Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State contribution	Amount (Rs. Lakh) by JICA loan
(1)	PMU	No					
(2)	DPMUs	No					
(3)	Project management information system	LS					

(1) Establishment of PMU/DPMU

The project is implemented by two (2) levels of PMU (Project Management Unit), State Project Management Unit (PMU) and District Project Management Units (DPMU).

Immediately after the start of the project, the DoF will set up the PMU and DPMU; the envisaged members of the PMU and DPMU and Terms of Reference are as described in 5.2.2(5) and (6) below.

(2) Project management including planning and implementation

Upon creation of PMU as a society, the Project Operation Manual as a guiding document of project implementation will be prepared by PMU. This Manual will be reviewed by PMC in due course. In the document, roles and responsibilities of project personnel, budgeting, accounting and reporting system of the project, internal control, external audit, procurement modalities and etc. shall be depicted. To establish common understanding on project implementation modalities, the project staffs of various levels will be given training as described in 【5-2】.

(3) Preparation, monitoring, and updating of annual action plan

The project requires action plan implementation, monitoring and evaluation for project activities, and the action plan shall be updated annually from assessment of the progress and review of present action

plan. The schedule for preparation, monitoring, and updating of annual action plan is shown in the table below.

Table 4 - 13 Action to be taken and schedule

Steps	Action to be Taken and Schedule
Preparation	Preparation of first annual action plan before the Project
Monitoring	Submission of monthly and quarterly reports including physical and financial progress
Review	Review of annual action plan based on monitoring in September
Updating	Updating annual action plan for next year based on review in December
Planning	Finalizing next-year annual action plan with budgeting

Source: JICA Survey team

(4) Procurement of necessary equipment

The equipment will be procured for PMU and DPMU function. Examples of equipment is summarized in the following table. At the implementation stage, equipment other than these will be procured as necessary.

Table 4 - 14 Example of equipment procured for PMU and DPMU offices

No.	Item	Unit	Qty.	Description	Remarks
1	PC (Laptop/Desktop)	■	■	■	■
2	Printer	■	■	■	
3	UPS	■	■	■	
5	Internet (Wide Area Network)	■	■	■	■
6	Ethernet (Local Area Network)	■	■	■	■
7	PDF Software - Adobe Acrobat	■	■	■	■
8	Documentation Software (Office)	■	■	■	■
9	GPS (Hand held)	■	■	■	■
10	CAD Application	■	■	■	■
11	Vehicle	■	■	■	
12	Rental vehicle/ fuel	■	■	■	

(5) Project Management Information System (PMIS)

The project management information system (PMIS), which will cater to all the functional requirements (including reporting) to manage, monitor and evaluate the process and activities under the project. This PMIS adheres to the external funded agencies PMIS or personal property management system (PPMS) framework and prescribed indicators (based of DMF) for project Implementation and management activities in a collaborative and an integrated environment as per project requirements. PMIS Flow consists of five key elements which are detailed below:

- 1) Project Framework (PF), which specifies performance targets and indicators ex ante, along with assumptions & risks, provides a common basis for all subsequent evaluation.
- 2) Project Performance Report (PPR), which is a system for reporting on project progress (Contract Awards, Disbursement and Financial Management) and the likelihood of achieving development objectives—it generates a project performance rating for implementation progress and development objectives, and it incorporates an early warning system to identify potential projects risks.
- 3) Project Execution & Monitoring –Project activities start with necessary surveys, supervision, and monitoring for efficient project management. Civil work with quality monitoring, S-Curve, Fiscal Planning and monitoring, Engineering document management, team collaboration and management, Realtime Dashboard and MIS with Reporting.

- 4) Project Completion Report -Details achievements against Project Framework (PF) targets if any.
- 5) Project Performance Audit (post evaluation) Report, which also evaluates achievements against PF targets with historical data for impact study and Audits.

The PMIS solution will support saving time in project execution like construction, cost effective project delivery, increase productivity, increase speed of work, increase document quality, speeding up of response time, and simpler working methods.

- Online & Offline for application usage with mobile notification and multi device support
- Document Management with data repository.
- Workflow Management with various documents and submittals.
- Cloud Based - Digital Construction Management (Including Building Information Modelling)
- Site activities Management with incident reporting & management
- Contract Management
- Automated Realtime Reports & Dashboard with Data Classification, Data Trends
- Resource Management (like Asset & Inventory).
- Preparation and Management of Quality Assurance Plan (QAP), Safety aspects (Safeguards) and other key statutory compliances.
- Communication and Collaboration through dedicated mobile Applications (Android and IOS) as well as browser-based applications hosted at cloud server.



Figure 4 - 14 Graphic Image of PMIS (Main System Screen, Realtime Dashboard)
Source: Ahmedabad Peri Urban Livability Improvement Project

Implementation structure is the same as component 4-2

(6) Monitoring/Evaluation

The daily monitoring and advisory service to beneficiaries of the project will be done by district and block level officers. The officers accompany beneficiaries in the following work.

- Preparation of proposal to apply to the project.
- Daily communication between DPMU and beneficiaries.
- Technical advice at site.
- Promote beneficiaries to make a record keeping.
- Taking record of activity monitoring.
- Confirmation of quality and quantity of aquaculture input ordered by the beneficiaries.

【5-2】 Capacity building of management units' officers

Sub-component	Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State contribution	Amount (Rs. Lakh) by JICA loan
(1) Technical training for officers	LS					
(2) Exposure visit	LS					

(1) Objective

This component aims at capacity building of officers involved in project management and implementation at both PMU and DPMU in order to enhance the efficiency of the Project and to achieve the overall goal. The training subjects will cover not only on the technical topics but also on the management guidance for sustainability of production activities and strengthen community groups (FPO/FPC/CS etc.) in overall resource management.

(2) Activity

The direct beneficiaries of the training under the Project are mainly the project management officers at both PMU & DPMU. The Project provides them with necessary trainings and guidance at the start of activities and as per necessity during the project period

Table 4 - 15 Capacity building for officers

i) Explanatory session at the beginning

Duration	
Venue	Conference Room of Directorate of Fisheries, Meen Bhawan, Guwahati
Participants	
Trainers	Project Officer & other Senior Officers of PMU
Contents of training	• Outline of the Project and objectives of relevant components • Procurement related issues • Improvement of management capacity of FPO and management of community assets by groups • Implementation of components and sustainability management • DX matters • Gender and Fishery (explanation of Gender Action Plan) • Project management, record keeping and accounts maintenance • Monitoring & reporting • Question & answer session

ii) Technical Improvement

【In India】

a) Breeding and seed production

Duration	
Venue	ICAR-Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar
Participants	
Trainers	Resource persons from CIFA
Contents of training	• Breeding and seed production of genetically improved rohu (Jayanti Rohu), and genetically improved Catla • Feed management and productivity • Sustainable aquaculture • Freshwater prawn seed production & farming • Water use efficiency and farm income • Eco-friendly and economically viable fish production systems for livelihood and nutritional security • Climate change impacts and mitigation measures

b) Recent advances in fisheries management

Duration	
Venue	ICAR-Central Institute of Fisheries Education (CIFE), Mumbai
Participants	
Trainers	Resource persons from CIFE
Contents of training	• Recent advances in Fisheries management and aquaculture

c) Fish Supply chain

Duration	
Venue	ICAR-Central Institute of Fisheries Technology (CIFT), Kochi
Participants	
Trainers	Resource persons from CIFT
Contents of training	• Fish processing • Post-harvest management & cold chain • Efficient fish market designs and market management • Quality assurance and management • Agri-business incubation

d) Assessment and conservation of fish genetic resources

Duration	
Venue	ICAR-National Bureau of Fish Genetic Resources, Lucknow (NBFGR)
Participants	
Trainers	Resource persons from NBFGR
Contents of training	• Assessment and conservation of fish genetic resources • Collection, cataloguing and documentation of fish genetic resources • Management of fish genetic resources.

e) Aquaculture Engineering

Duration	
Venue	Indian Institute of Technology, Kharagpur (West Bengal)
Participants	
Trainers	Resource persons from Aquaculture Engineering Division of the institute
Contents of training	• Hygienic fish market design & estimation of civil work • Designing of modern Fisheries Training Centre, requirement of essential equipment, estimation of civil works etc • Designing of modern Fisheries Laboratory, requirement of essential equipment, estimation of civil works etc

f) Engineering, Account, Project management

Duration	
Venue	Directorate of Fisheries (Meen Bhawan)
Group-I	
Participants	
Trainers	Two Seniormost Engineers of the DoF
Contents of training	• Suitable design and shape with provision of inlet & outlets and selection of beneficiary ponds under the project • Fish market design, civil work estimation, implementation of work and reporting • Criteria for selection of good performing fish seed hatcheries, hatchery design, estimation of civil work, implementation of work and reporting • Mobile fish kiosk design, modelling and fund estimation
Group-II	
Participants	
Trainers	Registrar and Accounts Superintendent of the DoF
Contents of training	• Maintenance of project accounts- fund release & expenditure etc. • Timely report preparation and submission • Regular day-to-day up-dating of all financial records, registers
Group-III	
Participants	
Trainers	PMC (Project Management Consultant)
Contents of training	Basic rules about project management in the Project, DX matters

g) Gender and nutrition training

Duration	
Venue	Directorate of Fisheries (Meen Bhawan)
Participants	
Trainers	PMC in charge of gender mainstreaming
Contents of training	<Gender> Refer “Gender Action Plan” for more details. • Explanation of the basic concepts of gender • Visualization of participation of men and women in aquaculture activities • Visualization of workload and burdens in household • Visualization of decision making in household • Discussion how FDOs can support fishers in the front line with the perspective of gender <Nutrition> • Health and nutrition status in Assam • Fish and its benefits to human health • Introduction of small fish and its nutrition

h) Exposure visit to Progressive fish farms inside state (knowledge exchange programme)

Duration	
Venue	Karimganj/Nalbari/others
Participants	
Interaction	With progressive farmer
Contents of training	Package of practices for table fish production/ yearling production & post-harvest issues

i) Exposure visit to SHEP project (knowledge exchange programme)

Duration	
Venue	Uttarakhand
Participants	
Interaction	With progressive farmer
Contents of training	Case study of SHEP approach

j) Progressive fish farms inside state (knowledge exchange programme)

Duration	
Venue	Karimganj/Nalbari/others
Participants	
Interaction	With progressive farmer
Contents of training	Package of practices for table fish production/ yearling production & post-harvest issues

k) Need-based technical trainings

Duration	
Venue	To be decided as per requirement
Participants	
Trainers	To be decided as per requirement
Contents of training	Need-based During the project period, field training/ exposure visits of officers will be held in order to cope with training needs on issues as and when required, inside state, outside state and outside country.

iii) Online technical guidance

It is expected to establish supporting system using the web network under the component 4-2(1 day).

【Overseas training】

a) Bangladesh

Duration	
Venue	Bangladesh Fisheries Research Institute (BFRI), Mymensingh
Participants	
Trainers	Resource person of BFRI
Contents of training	• Practical training on breeding and seed raising of indigenous fish species (Pabda/ Pavo, Murrels etc) • Culture practices of Pabda/ Pavo, Murrels etc, • Marketing & post-harvest mgt etc. • Advanced aquaculture practice for pond and tank fisheries

b) Thailand

Duration	
Venue	Asian Institute of Technology, Bangkok
Participants	
Trainers	Resource person of Asian Institute of Technology
Contents of training	• Breeding and seed rearing of high yielding fish species • Commercial intensive farming practices • Marketing & post-harvest mgt etc.

c) Japan

Duration	
Venue	To be decided by PMU, advised by PMC
Participants	
Trainers	To be decided by PMU, advised by PMC
Contents of training	• Hygienic market • Infrastructure and management of Blue tourism (ig Hayashi Trout Farm) • Fish processing, packaging • Value addition, post harvest & cold chain • Marketing • Case study on good practice of project management

(3) Target area and selection criteria

Member of PMU & DPMUs

(4) Implementation structure

Training programs including major topics, target groups, venue, budget, etc., will be prepared and implemented by PMU and DPMU in consultation with PMC.

【5-3】 Monitoring & evaluation

Sub-component		Unit	Qty	Unit cost (Rs. lakh)	Cost covered by JICA loan	State contribution	Amount (Rs. Lakh) by JICA loan
(1)	Baseline survey	LS					
(2)	Mid-term survey	LS					
(3)	Endline survey	LS					

Concerning the evaluation of the project, baseline survey, midline survey and endline survey will be carried out by out-sourcing to local consultant (by LCB) under the responsibility of DPMU and PMU. Details of the survey, such as survey contents, responsible organization, data source and timing of data collection, are shown in 7.2 in this report.

4.7 Selection of target districts

Although there are 35 districts in the whole of Assam, it is not easy to cover them all with a limited budget. From a medium to long term perspective, it is important to limit the target district if the project is to achieve success and then move on to the next stage. The following criteria were used to select target districts as shown in the following tables.

Table 4 - 16 Criteria to select target districts

Parameter	Value
a) Aquaculture production	More than 10,000 tons
b) Seed production	More than 500 million fish seed
c) FDO (district and block)	More than 7 officials
d) Population	More than 950,000
e) Cooperative	More than 10 coop.

The result of district evaluation based on the above criteria is shown in the following table.

Table 4 - 17 Evaluation of districts based on the criteria

				Criteria					Total Score
Division	Divisional office	No.	District	a) Aquaculture Production (ton)	b) Seed Production (Million Fish)	c) Total FDO (district + block)	d) Population (Nos)	e) Cooperative society (Nos)	
Addition of points				3 points	2 points	1 point			
Criteria for scoring points				more than 10,000	More than 500	More than 7	More than 950,000	More than 10	
Barak Valley	Silchar	1	Cachar	25,141	123	10	1,736,617	10	6
		2	Hailakandi	17,812	177	4	659,296	3	3
		3	Karimganj	11,655	20,977	7	1,228,686	15	8
Central Assam	Nagaon	4	Dima Hasao	485		3	214,102		0
		5	Hojai	10,243		3	931,218		3
		6	East Karbi Anglong	5,799	12	11	660,955	1	2
		7	West Karbi Anglong	838		0	295,358		0
		8	Morigaon	12,174	547	4	957,423	29	7
		9	Nagaon	26,475	15,285	10	1,892,550	33	8
Lower Assam	Guwahati	10	Baksa	9,265	635	3	950,075		1
		11	Barpeta	12,410	39,792	6	1,693,622	21	7
		12	Bajali	2,710		2			0
		13	Bongaigaon	7,476	246	4	738,804	7	0
		14	Chirang	1,087	60	1	482,162	2	0
		15	Dhubri	6,890	319	8	1,394,144	10	3
		16	Goalpara	6,193	560	6	1,008,183	10	4
		17	Nalbari	19,198	10,952	7	771,639	16	7
		18	Kamrup Metropolitan	2,086		3	1,253,938		0
		19	Kamrup	12,641	407	12	1,517,542	33	6
		20	Kokrajhar	6,761	500	5	887,142	4	2
		21	South Salmara-Mankachar	5,094		2	555,114		0
North Assam	Tezpur	22	Tamulpur			0			0
		23	Biswanath	2,463		3	612,491		0
		24	Darrang	13,410	100	6	928,500	12	4
		25	Sonitpur	6,391	1,890	6	1,311,619	24	4
Upper Assam	Jorhat	26	Udalguri	7,033	197	3	831,668	1	0
		27	Charaideo	1,459		2	458,615		0
		28	Dhemaji	2,784	96	4	686,133	10	1
		29	Dibrugarh	8,776	54	8	1,326,335	6	2
		30	Golaghat	3,822	708	7	1,066,888	10	5
		31	Jorhat	5,254	250	9	924,952	14	2
		32	Lakhimpur	16,652	210	8	1,042,137	14	6
		33	Majuli	2,243		1	167,304	6	0
		34	Sivasagar	4,144	516	6	692,435	10	3
		35	Tinsukia	13,405	470	6	1,327,929	2	4
Data source:									
a) Aquaculture production		2022-23 Interim report							
b) Seed production		2019-20 DPR							
c) Nos. of FDO		2024 Dof							
d) Population		2011 Statistical Handbook, Assam 2022							
e) Nos. of Cooperative		2024 Dof							
Selection Method:									
Each Criteria from a) to e) is scored according to the "Addition of points" and 8 provinces are selected as target districts based on the Total Score.									

The target districts selected in this way are Cachar, Karimganj, Morigaon, Nagaon, Barpeta, Nalbari, Kamrup and Lakhimpur (see the following figure).

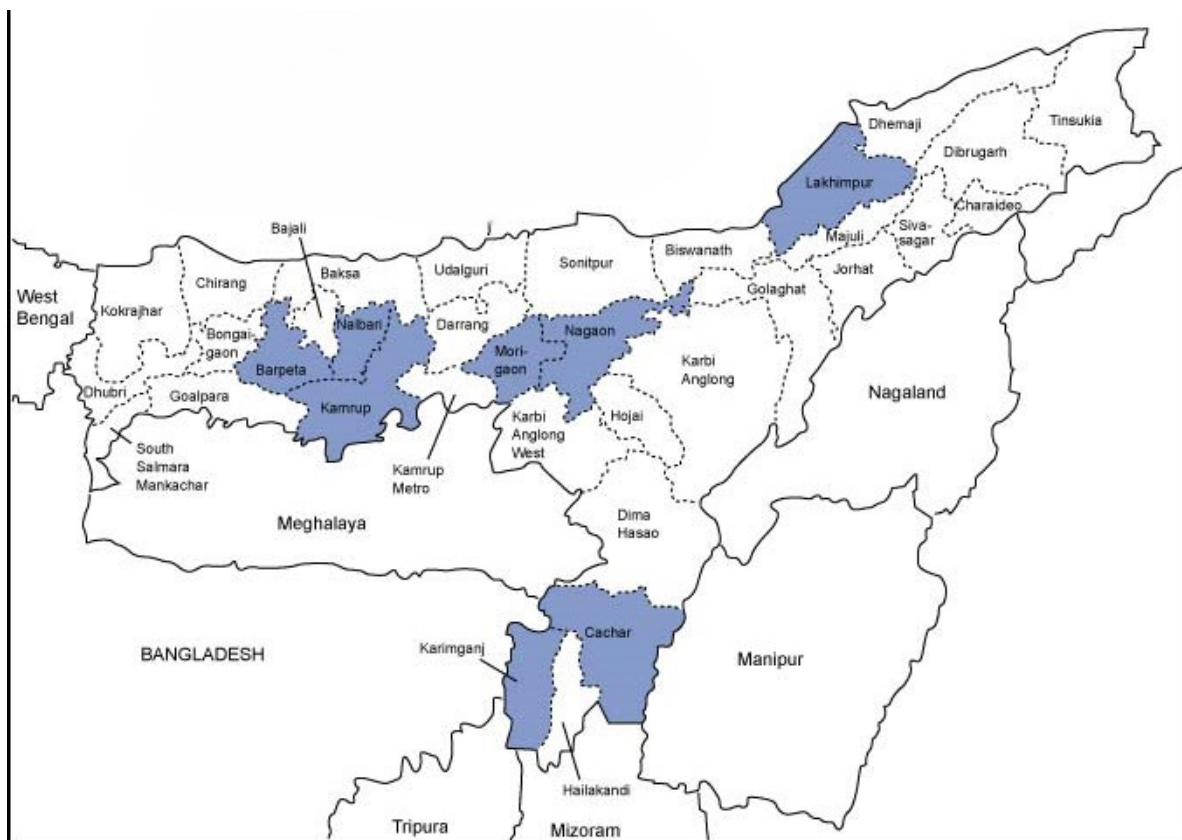


Figure 4 - 15 Target districts

Source: JICA Survey team by tracing https://d-maps.com/carte.php?num_car=31175&lang=en Maps

Chapter 5 Implementation Plan

5.1 General

This chapter describes the implementation plan of the Project, which consists of the project organizational structure, implementation schedule, procurement plan, operation and maintenance.

5.2 Overall Project Organizational Structure

The overall project organization structure is proposed as shown below.

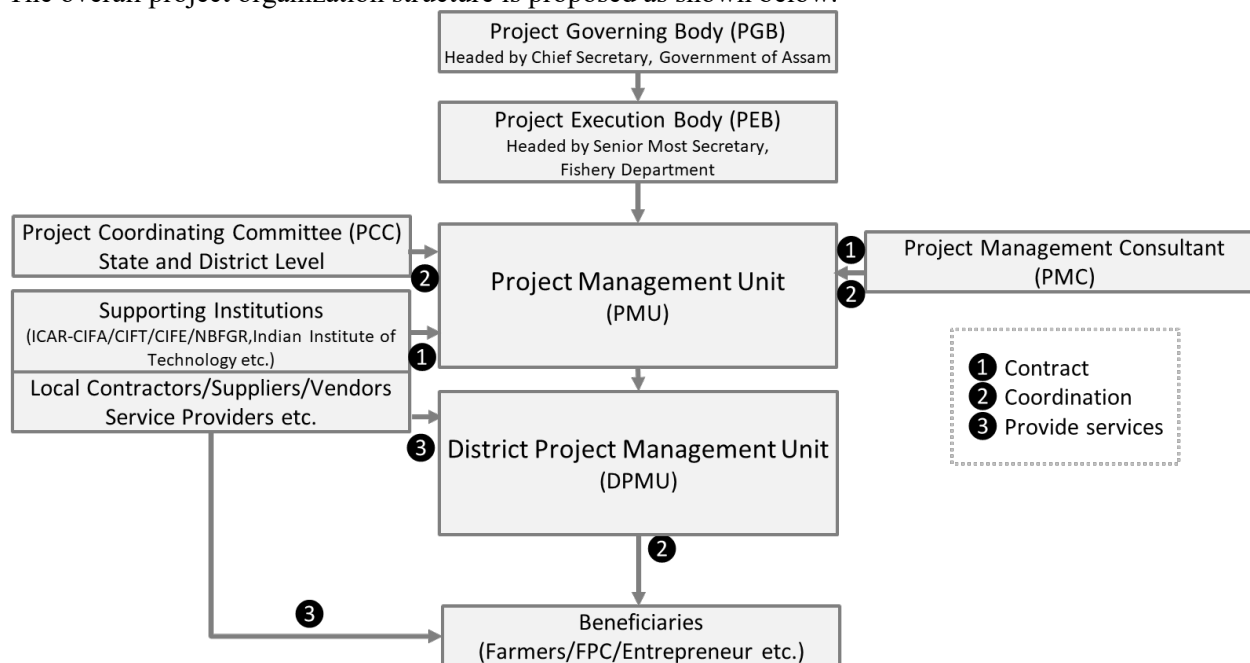


Figure 5 - 1 Overall Organization Structure for Project Implementation

Source: JICA survey team edited based on DPR prepared by DoF

(1) Project Governing Body (PGB)

This structure will be headed by the Project Governing Body (PGB) chaired by the Chief Secretary, Government of Assam. The PGB will consist of senior most secretaries to the Government of Assam, in the respective Departments of - (1) Finance (2) Cooperation (3) Revenue & Disaster Management (4) Tourism (5) Forest & Environment (6) Industry & Commerce. Senior Most Secretary to the Fishery Department shall be Deputy Chairman of the PGB. Project Director will be the Member Secretary of PGB and the Deputy Project Director will be one of the members of the PGB.

The progress of the PMU will be reviewed every 6 months, or more frequently if the situation arises by PGB based on the report from PEB. PGB shall ensure effective inter-departmental coordination for the smooth project implementation.

(2) Project Executive Body (PEB)

The Project Executive Body (PEB) will be headed by the Senior Most Secretary to Fishery Department to the Government of Assam. Other members of the body consist of representative of the Department of (1) Finance (2) Cooperation (3) Revenue & Disaster Management (4) Tourism (5) Forest & Environment (6) Industry & Commerce not below the rank of Joint Secretary of the concerned Departments. The Project Director will be the Member Secretary of the PEB and Deputy Project Director will be one of the members of the PEB.

The progress of the PMU will be reviewed every 3 months, or more frequently if the situation arises based on the report from PD. Role and Responsibility of the PGB & PEB shall be fixed by the Administrative Department as per the norms.

(3) Project Coordinating Committee (PCC)

The Project Coordination Committee (PCC) will be headed by the Project Director. The PCC meeting will be held every month on the fixed day or more frequently if the situation arises. PCC will be responsible for monitoring and coordination of project activities. The PCC will consist of the following members.

- All technical officers of the Directorate of Fisheries not below the rank of DFDO & allied cadre
- All engineers of the Directorate of Fisheries not below the rank of Assistant Engineer
- All DFDOs of the project districts
- All PMU officials (contractual and non-contractual)
- Any expert(s) recommended by the Project Director

(4) Project Management Unit (PMU)

The organization chart of PMU at state level is shown in below figure. PMU is headed by the Project Director and assisted by the Deputy Project Director and others as detailed below.

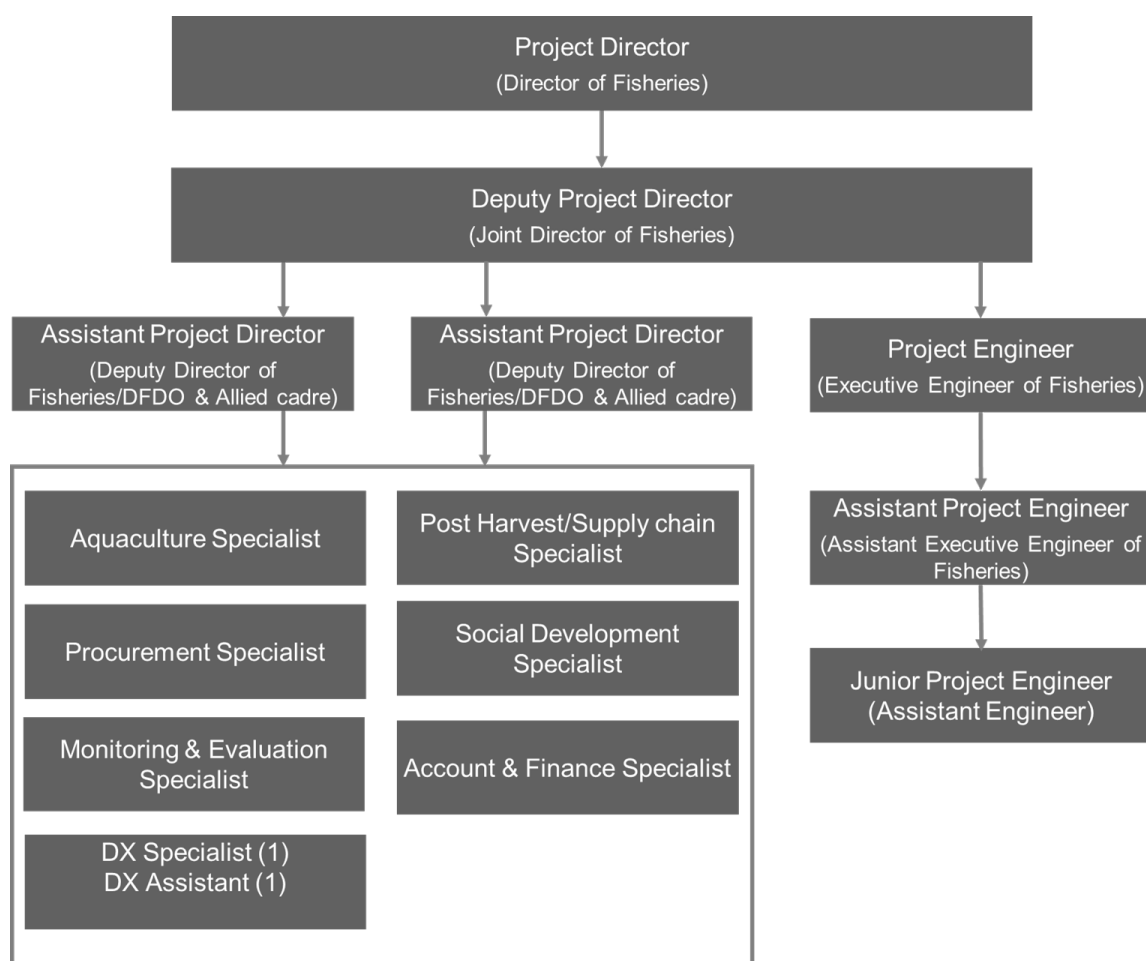


Figure 5 - 2 Organization chart of PMU

Source: JICA survey team edited based on DPR prepared by DoF

Terms of Reference of PMU are as follow.

- Project Director:
 - Maintaining coordination and linkages with state upper level (Senior Secretary level of the Ministry)
 - Ensuring that there is no conflict in implementation modalities of other similar schemes with regard to that of JICA

- Deputy Project Director:
 - Supervise the progress and fund release and report to the Project Director in timely basis
 - Directs the relevant agencies to respond and take action when problems or issues affecting the progress of the project become apparent.
 - Ensure that there is no duplicity with other schemes based on the report from Project Engineer and specialist in charge
- Assistant Project Director:
 - Preparation of Annual Work Plan (AWP) and coordinating with concerned department for timely release of fund from Government and implementation
 - Coordinating with district level team on regular basis
 - Reviewing the progress of project implementation (including Physical & financial aspects) on monthly
- Project Engineer and specialist in charge
 - Implementing corrective measures for removal of impediments and for expediting progress
 - Validating the physical progress reports prepared by PMU and report to Assistant Project Director on monthly basis.

It is noted that PMU should be supported by a team of Project Management Consultants (PMC), having technical knowledge/expertise and experience as well as general administrative procedure of JICA loan project.

In addition to the above, approx. 4 numbers of technical officers of DoF (not below the rank of fisheries development officer) shall be engaged under the Project as Assistant Project Officer (APO) depending upon the necessity for execution of the project components.

(5) District Project Management Unit (DPMU)

The organization chart of DPMU is shown in figure 5-15. DPMU is headed by DFDO of selected district. As of PMU, the necessary stuffs are nominated or recruited for operation of this structure. The staffing resource of DPMU is given in Attachment 2

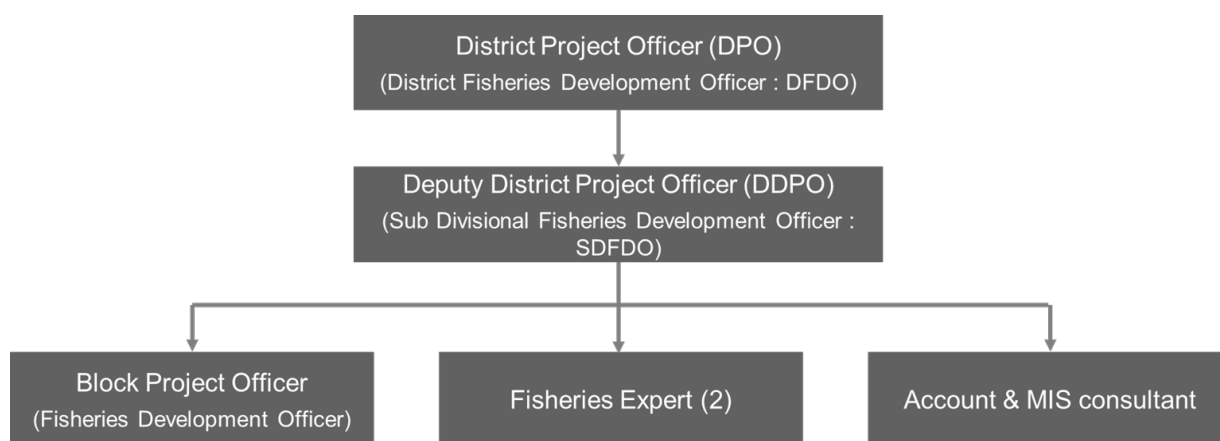


Figure 5 - 3 Organization chart of DPMU

Source: JICA survey team edited based on DPR prepared by DoF

Terms of Reference of DPMU are as follows.

- DPO
 - Work closely with producer communities and entrepreneurs to achieve the project development objectives
 - Report the project progress to PMU on monthly basis

- DDPO:
 - Verify the monthly report submitted by the person in charge (Block Project Officer, Fisheries Expert and Accountant & MIS consultant)
 - Supervise the implementation and progress of the activities conducted by the person in charge
- Accountant:
 - Ensure quality assurance of input procured and instruct bank to pay input suppliers
- Person in charge:
 - Ensure timely report submission
 - Implement assigned project activities at ground level

(6) Project Management Consultant (PMC)

The Project Management Consultant (PMC) will be procured by the PMU utilizing the Japanese ODA loan to reinforce their implementation capacity, particularly to ensure technical and management support for the Project. The PMC will assist the PMU in the improvement of process and procedures for project implementation at the state, district, and block levels. A sample Terms of Reference (TOR) for the PMC and required man-month (MM) are shown in following table.

Table 5 - 1 Sample TOR of the PMC and MM

No.	Position	MM	TOR
International expert			
1	Team Leader	■	● Assist overall project management (time/schedule management, quality control, budget management, safety management) ● Assist establishment of aquaculture administration procedure and legislation ● Overview current situation of fishery sector in and out of the State ● Assist in supervision of bidding procedure ● Hold a sensitization program for project officials and government officials such as DoF, DFDO, etc. ● Assist coordination among government organizations and other donor agencies for entire project ● Assist necessary public relations activities related to project contents and results ● Prepare required documents / reports ● Manage national consultant works and outputs
2	Aquaculture expert	■	● Assist project management (time/schedule management, quality control, budget management, safety management) of aquaculture component ● Assist selection of beneficiary farms (private, community and institution) ● Assist discussion and coordination with relevant institutions such as CIFA, University, etc. ● Assist examine the R&D proposal ● Prepare and conduct foreign and domestic trainings and study tours
3	Supply chain expert	■	● Assist project management (time/schedule management, quality control, budget management, safety management) of supply chain component ● Assist selection of beneficiaries ● Assist design and supervision of construction ● Assist bidding procedure ● Assist business planning and management ● Assist preparation of operation and maintenance scheme ● Assist relevant training program
Sub-total of IE		■	

No.	Position	MM	TOR
Local expert			
1	Co-Team Leader	■	● Assist overall project management as the Co-Team Leader of the Consultant Team. ● Assist overall project management (time/schedule management, quality control, budget management, safety management) ● Support a sensitization program for project officials and government officials such as DOA ● Assist progress and result monitoring and conduct necessary progress meetings ● Assist coordination among government organizations and other donor agencies ● Assist necessary public relations activities related to project contents and results ● Prepare required documents / reports ● Manage national consultant works and outputs
2	Aquaculture expert	■	● Assist international aquaculture expert and PMU in charge of aquaculture ● Assist procurement of necessary input for aquaculture ● Assist preparation and conduct of domestic trainings and study tours ● Assist discussion and coordination with relevant institutions such as CIFA, University, etc.
3	Fish marketing / Entrepreneurship expert	■	● Assist international supply chain expert and PMU in charge ● Assist selection of beneficiaries ● Assist and monitor PMU on capacity building and business planning and support of beneficiaries including blue tourism development ● Assist official registration procedure of coop. & company
4	Infrastructure & procurement expert	■	● Conduct the natural condition survey and prepare the drawings ● Assist PMU in design, bidding, pre-construction procedure and supervision of building construction and procurement ● Assist operation and maintenance of relevant infrastructure and equipment
5	Institutional and capacity development expert	■	● Survey of state and central government fishery policies and development plans, current government and donor schemes and update of contents ● Assist PMU in formulating and organizing training program and exposure visit for farmers and officers ● Assist to formulate action plan for organizational capacity development of DoF HQ, District and block level ● Monitoring of aquaculture extension activities and necessary technical guidance during project implementation
6	Gender & nutrition expert	■	● Assist PMU (social development specialist) for gender action plan ● Assist organizing gender related training and awareness programs
7	Environmental management expert	■	● Screening and Selection of Sub-components ● Conduct planning and implement of environmental monitoring plan ● Organize public audience if necessary ● Implementation and Monitoring of Sub-components ● Prepare environmental management report
8	Monitoring and evaluation expert	■	● Conduct Monitoring & Evaluation(M&E) training for DFDO ● Compile activity record and data collected at beneficiary level ● Monitoring of project indicators ● Prepare M&E report periodically ● Assist in bidding procedure, arrangement and implementation of baseline, mid-term and endline survey
9	Financial management expert	■	● Supervision of accounting work of PMU ● Monitoring of project expenses disbursement ● Prepare financial report and plan

No.	Position	MM	TOR
10	DX expert (MIS)	■	● Assist in bidding procedure ● Conduct discussion and coordination with vendor ● Conduct collection and analysis of user requirement of information system ● Prepare of system concept and specification ● Supervision of system development and trial ● Conduct user training and maintenance with vendor
Sub-total of LE		■	

5.3 Monitoring/Evaluation

Daily monitoring, advisory service to beneficiaries of the project will be done by Block Project Officers. The officers will accompany with beneficiaries in following work and then report to DPMU and DFDO.

- Preparation of proposal to apply to the project.
- Daily communication with beneficiaries.
- Technical advice at site.
- Promote beneficiaries to make a record keeping.
- Taking record of activity monitoring.
- Confirmation of quality and quantity of aquaculture input ordered by the beneficiaries.

5.4 Implementation plan and Procurement method

Table 5 - 2 Implementation plan and Procurement method

1. *Introduction*

2. *Background*

3. *Methodology*

4. *Results*

5. *Discussion*

6. *Conclusion*

7. *References*

8. *Appendix*

9. *Index*

10. *Table of Contents*

11. *Abstract*

12. *Summary*

13. *Key Words*

14. *Keywords*

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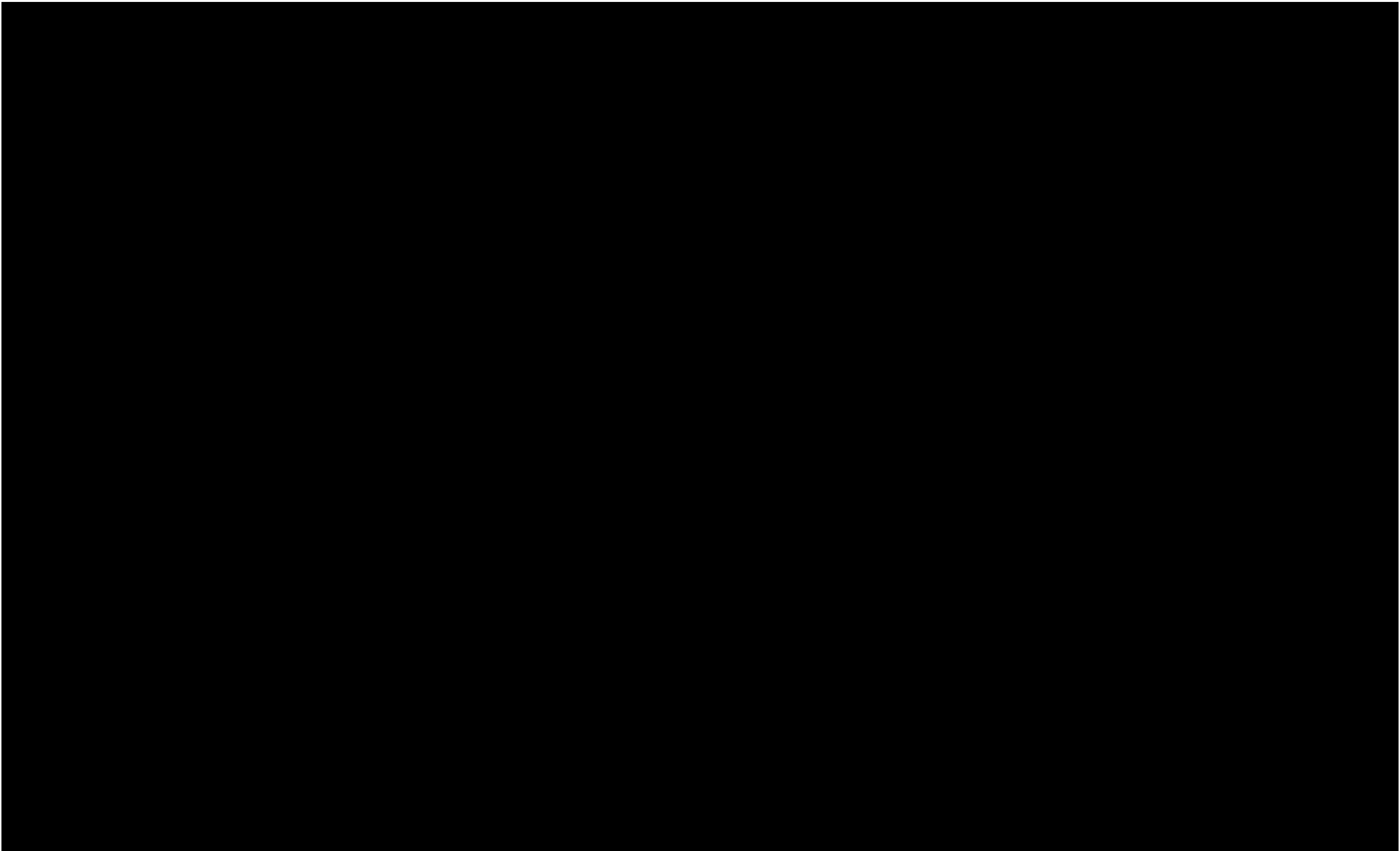
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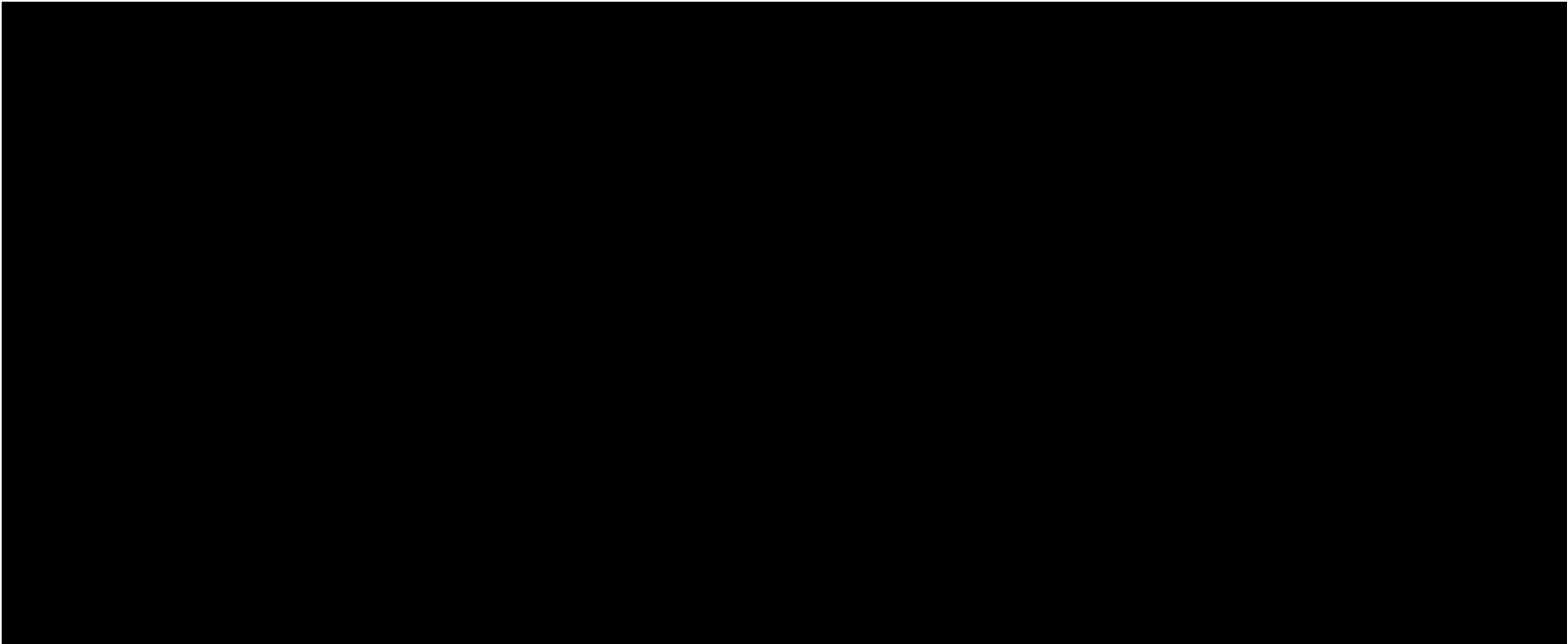
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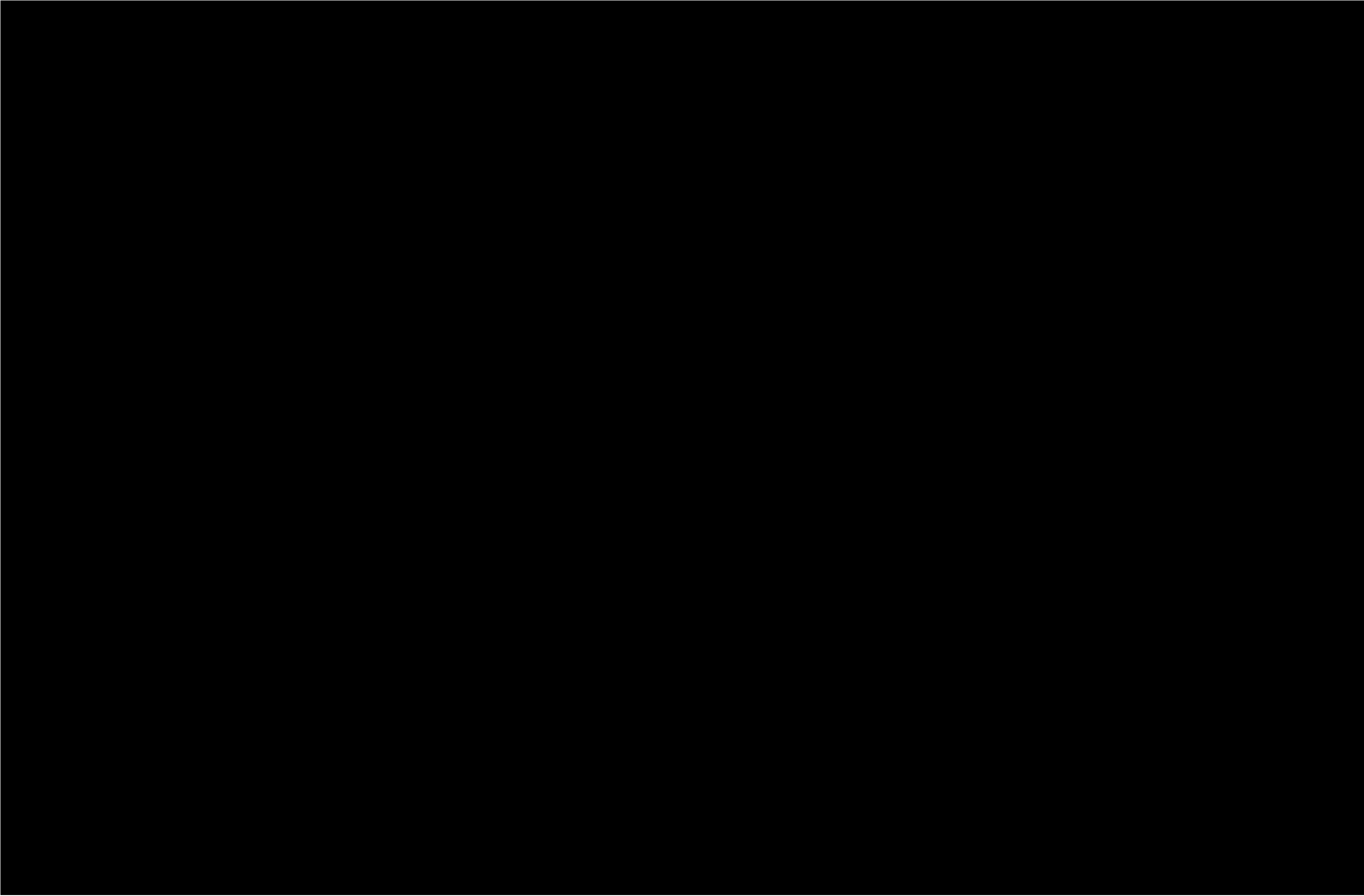
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5.5 Procedure and executor of the construction works

In this project, construction works are included as shown in the below table.

Table 5 - 3 List of construction works in the project

Component	Contents related to construction works
2-1(1)	Aquaculture business unit () * Direct undertaking by beneficiaries
2-1(2)	Gramin hygienic fish market ()
3-1	- Supportive infrastructure for blue tourism (Restaurants, toilet, accommodation facilities, angling platform etc.) - Exterior works (parking, access roads, outside wall etc.)
4-1(1)	Aquaculture laboratory
4-1(2)	TCPC - Training & office building (class room/training hall, library, office, conference hall, canteen, toilets, storage etc.) - Trainee's hostel (), storage, dining hall and kitchen, guest rooms toilets, etc. - Exterior works (parking, access roads, outside wall etc.)
4-1(3)	DFDO office & conference hall

Source: JICA survey team edited based on the DPR prepared by DoF

Tender of the construction works will proceed in accordance with the Assam Public Procurement Act, 2017 (Assam Act No.XXIV of 2017) and Assam Public Procurement Rules 2020 (Registered No. 768/97).

Note:

- 1) Procurement above Rs.20 lakh is mandatory of e-procurement
- 2) Notice Inviting Tender (NIT)/Notice Inviting Quotation(NIQ) must be published in SPPP (State Public Procurement Portal)
- 3) Procurement of all goods and services that are available in GeM (Government e-Marketplace) is mandatory for all procuring entities for procurement of all Goods & Services.

Where necessary, DoF will apply for building permission namely “No Objection Certificate” through the verification by Guwahati Metropolitan Development Authority (GMDA) according to the designated procedure⁹⁷. The whole procedure usually takes 45 days for issuing above mentioned Certificate.

5.6 Operation and Maintenance (O&M) of Project Facilities

Aquaculture business unit and Aquaculture laboratory will be provided to private businesspersons who are selected through official procedure so that those infrastructures will be owned by them, operated and maintained by them. Same above, fish seed transportation truck will be provided to fish seed producer groups (cooperative), owned, operated and maintained by said cooperative.

On the other hand, TCPC, DFDO office & conference hall and data management system are relevant public infrastructure of regional and district of level of fisheries administration. They are owned, operated and maintained by DoF

Table 5 - 4 Owner and O&M responsibility of each infrastructure

Component	Item	Owner	O&M responsibility
Improvement of aquaculture productivity	Fish seed transportation truck	Cooperative	Cooperative
Development of aquaculture supply chain	Aquaculture business unit	Private businessperson	Private businessperson
	Semi-urban hygienic fish market	Panchayat	Market committee
Extension and capacity building	Aquaculture laboratory	Private businessperson	Private businessperson
	Training cum production center (TCPC)	DoF	DoF
	DFDO office & conference hall	DoF	DoF
	Data management system on fishery sector	DoF	DoF

Source: JICA survey team

⁹⁷ Reffer to the website <https://gmc.assam.gov.in/how-to/apply-for-building-permission-1>.

Chapter 6 Project Cost

6.1 Basic conditions of the project cost estimate

The project costs are estimated based on the latest data and information obtained from the Department of Fisheries (DoF), Assam related to the target eight districts during the survey period. The details of the project cost estimate applied by DoF are shown below.

(1) Contents of cost estimate

- (a) Direct cost for project components:
 - 1. Improvement of aquaculture productivity
 - 2. Development of aquaculture supply chain
 - 3. Diversification of aquaculture-based livelihood
 - 4. Extension and capacity building
 - 5. Institutional development for project management
- (b) Consulting services
- (c) Administration expenses during the construction period
- (d) Price escalation and physical contingencies
- (e) Tax, interest during construction and commitment charge

(2) Conditions of assumption

6.2 Summary of the project cost

(unit: million)

[illegible]

6.3 Annual Disbursement Schedule

Table 6 - 2 Summary of Annual Disbursement Schedule

(Unit: Million INR)

[illegible]

6.4 Appropriate Bidding Method

6.5 Formulation of Optimal Construction Plan

6-2

Chapter 7 Project Evaluation

7.1 Economic evaluation methodology and assumptions

(1) Method of economic evaluation

Economic evaluation is carried out to assess the economic viability of the pilot site cascade systems. In order to evaluate the cascade systems, indicators such as economic internal rate of return (EIRR), cost-benefit ratio (B/C), and net present value (B-C) are calculated by estimating the cash outflow (costs) and inflow (benefits) on annual basis over the project life with a certain discount rate by discount cash flow method (DCF method). The EIRR is a discount rate at which the present value of the in and out cash flows become equal. This rate shows the return to be expected from the Project as expressed in the following equation:

$$\sum_{t=0}^n B_t / (1 + r)^t - \sum_{t=0}^n C_t / (1 + r)^t = 0$$

Where, C_t is Cost, B is Benefit, t is Year, n is Project Life (year), and r is the Discount Rate (EIRR).

The sensitivity analysis is also carried out to evaluate the viability of the cascade systems against possible adverse change in the future.

The financial internal rate of return (FIRR) is not calculated because FIRR is an indicator to assess the financial sustainability of the implementation agency with direct return from project activities such as airport and water supply project.



Table 7 - 1 Calculation of standard conversion factors

Category	Sub-category	Conversion Factor									
		1	2	3	4	5	6	7	8	9	10
Construction	General										
	Structure										
	Equipment										
	Installation										
Operation and Maintenance	General										
	Structure										
	Equipment										
	Installation										
Replacement	General										
	Structure										
	Equipment										
	Installation										

(3) Project economic cost

Based on the financial cost described in Chapter 6, the economic project cost is estimated using the abovementioned conversion method to the economic price. The economic cost is shown in the following table.

Table 7 - 2 Economic cost of the project

Category	Sub-category	Economic Cost									
		1	2	3	4	5	6	7	8	9	10
Construction	General										
	Structure										
	Equipment										
	Installation										
Operation and Maintenance	General										
	Structure										
	Equipment										
	Installation										
Replacement	General										
	Structure										
	Equipment										
	Installation										

Source: JICA Survey Team

(4) Operation and Maintenance (O&M) and replacement cost

O&M Cost

O&M cost is estimated as shown in the following table. The annual O&M cost is assumed to be needed for the DX system and the infrastructure for supply chain development and capacity building components. The O&M cost will be required every year according to the component schedules. Details of the annual incremental O&M cost are shown in Attachment 3.

[illegible]

Replacement cost

Table 7 - 4 Economic cost of replacement (every 10 years)

Country	Replacement Cost	Replacement Cost as % of GDP
China	1.00	0.00%
USA	0.50	0.00%
Japan	0.40	0.00%
Germany	0.30	0.00%
France	0.20	0.00%
UK	0.10	0.00%
Italy	0.05	0.00%
Spain	0.02	0.00%
Sweden	0.01	0.00%
Norway	0.00	0.00%
Denmark	0.00	0.00%
Finland	0.00	0.00%
South Korea	0.00	0.00%
India	0.00	0.00%
Brazil	0.00	0.00%
Argentina	0.00	0.00%
Colombia	0.00	0.00%
Venezuela	0.00	0.00%
Russia	0.00	0.00%
Ukraine	0.00	0.00%
Poland	0.00	0.00%
Czech Republic	0.00	0.00%
Slovakia	0.00	0.00%
Hungary	0.00	0.00%
Slovenia	0.00	0.00%
Croatia	0.00	0.00%
Bulgaria	0.00	0.00%
Romania	0.00	0.00%
Greece	0.00	0.00%
Portugal	0.00	0.00%
Ireland	0.00	0.00%
Netherlands	0.00	0.00%
Belgium	0.00	0.00%
Luxembourg	0.00	0.00%
Austria	0.00	0.00%
Switzerland	0.00	0.00%
Liechtenstein	0.00	0.00%
Monaco	0.00	0.00%
San Marino	0.00	0.00%
Vatican City	0.00	0.00%
Andorra	0.00	0.00%
Malta	0.00	0.00%
Cyprus	0.00	0.00%
Maldives	0.00	0.00%
Bahrain	0.00	0.00%
Qatar	0.00	0.00%
UAE	0.00	0.00%
Saudi Arabia	0.00	0.00%
Oman	0.00	0.00%
Yemen	0.00	0.00%
Somalia	0.00	0.00%
Ethiopia	0.00	0.00%
Kenya	0.00	0.00%
Tanzania	0.00	0.00%
Uganda	0.00	0.00%
Rwanda	0.00	0.00%
Burundi	0.00	0.00%
DRC	0.00	0.00%
Congo	0.00	0.00%
Angola	0.00	0.00%
Nigeria	0.00	0.00%
Ghana	0.00	0.00%
Senegal	0.00	0.00%
Gambia	0.00	0.00%
Sierra Leone	0.00	0.00%
Liberia	0.00	0.00%
Ivory Coast	0.00	0.00%
Ghana	0.00	0.00%
Benin	0.00	0.00%
Niger	0.00	0.00%
Chad	0.00	0.00%
Sudan	0.00	0.00%
Egypt	0.00	0.00%
Libya	0.00	0.00%
Tunisia	0.00	0.00%
Algeria	0.00	0.00%
Morocco	0.00	0.00%
Mali	0.00	0.00%
Niger	0.00	0.00%
Chad	0.00	0.00%
Sudan	0.00	0.00%
Egypt	0.00	0.00%
Libya	0.00	0.00%
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Libya	0.00	0.00%
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Algeria	0.00	0.00%
Morocco	0.00	0.00%
Mali	0.00	0.00%
Niger	0.00	0.00%
Chad	0.00	0.00%

(5) Project economic benefit

[REDACTED]

Economic production cost with and without project conditions have been prepared for estimation of the project benefits under the following conditions:

- Details of budgets are presented in Attachment 3.

(7) Project benefit

As mentioned above, the project benefits are calculated from the improvement of fish productivity from the advanced farmer level to small-scale farmer level, including the seed production at FSVs. The economic benefits are summarized in the table below, and the detailed calculation is shown in Attachment 3.

Table 7 - 5 Summary of economic benefit

Economic sector	Code	Subsector			Total	Subsector	Total
		Subsector	Subsector	Subsector			
Manufacturing	1	1.1	1.2	1.3	1.4	1.5	1.6
Services	2	2.1	2.2	2.3	2.4	2.5	2.6
Construction	3	3.1	3.2	3.3	3.4	3.5	3.6
Agriculture	4	4.1	4.2	4.3	4.4	4.5	4.6
Energy	5	5.1	5.2	5.3	5.4	5.5	5.6
Transport	6	6.1	6.2	6.3	6.4	6.5	6.6
Health	7	7.1	7.2	7.3	7.4	7.5	7.6
Education	8	8.1	8.2	8.3	8.4	8.5	8.6
Other	9	9.1	9.2	9.3	9.4	9.5	9.6

Source: JICA Survey Team

Source: JICA Survey Team

(8) Results of economic evaluation

Based on the assumptions and conditions described so far, the indicators for economic evaluation are calculated as shown in the following table. The cash flow table for the calculation is shown in Attachment 3.

Table 7 - 6 Calculation results of the indicators for economic evaluation

Indicator	2019				2020				2021
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
1. Economic growth	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
2. Employment	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
3. Inflation	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
4. Fiscal balance	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
5. External balance	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9

Source: JICA Survey Team

A sensitivity analysis is also carried out tentatively to evaluate the soundness against unexpected adverse changes such as cost overrun and decrease of benefit in the future. The result of analysis is shown in the following table.

[illegible]

(9) Farm economic analysis

7.2 Operation and effect indicators

The operation and effect indicators of the project are shown in the table below.

Type	Indicator	Unit	Present (2024)	Target(2031)
Operation indicators	1) Aquaculture productivity	ton/ha	2.9	5.0
	2) Number of large size fish seed (over 100g/indi.) produced and delivered to grow out fish farms	nos.	To be confirmed by BLS	20% more than BLS data
	3) Number of certified hatchery	nos.	0	20
	4) Number of farms who grow high yield varieties	nos.	10 (estimation)	50
	5) Number of aquaculture administration systems digitalized and maintained	nos.	1	4
	6) Number of aquaculture supporting infrastructure			
	- Aquaculture business unit	nos.	0	16
	- Semi-urban hygienic fish market	nos.	0	16
	- Blue tourism facility	nos.	To be confirmed by BLS	8
	- Aquaculture laboratory	nos.	0	8
	- DFDO conference hall	nos.	0	8
Effect indicators	1) Annual aquaculture production	ton	118,994	198,720
	2) Employment in aquaculture sector	nos.	Male: XX Femal : XX Confirmed by BLS	5% more than BLS data respectively
	3) Household income/year of aquaculture farmers	Rs.	437,130* ¹	740,000

*1: Calculation based on the questionnaire data of supply chain survey conducted by JICA survey team

(2) Monitoring method and system for project indicators

7-5

Table 7 - 9 Monitoring method and system for project indicators

Type	Indicator	Monitoring target	Responsible organization	Timing of data collection after BLS	Data source
Operation indicators	1) Aquaculture productivity	Component 1 Fish farmers	DPMU	Once a year	Interview survey
	2) Number of large size fingerlings produced and delivered to grow out fish farms	Component 1 Seed growers	DPMU	Once a year	Interview survey
	3) Number of farms who grow new species	Component 1 Fish farmers	DPMU	Once a year	Interview survey
	4) Number of aquaculture administration systems digitalized and maintained	Component 4-2	PMU	Once a year	Interview survey
	5) Number of aquaculture groups (cooperative, FPO, FPC)	Component 1&3	PMU	Once a year	Annual report ⁹⁸
Effect indicators	1) Aquaculture production	All components	PMU	Once a year	Annual report
	2) Employment in aquaculture sector	All components	PMU	Baseline & Endline	Interview survey
	3) Livelihood of fish farmers	All components	PMU	Baseline & Endline	Interview survey

Source: JICA Survey Team

The monitoring method and system will be finalized as soon as project activity starts by PMU. The system will be reviewed and updated with support of PMC.

7.3 Risk management

(1) Approach to risk management

“Risk” is defined as the possibility that an event will occur and adversely affect the achievement of an objective. According to the concept of risk management, risk is generally classified as the probability of occurrence and the impact (magnitude) of loss when it occurs. Based on the classification, treatments for risks shall be considered, such as avoidance, reduction (optimize, mitigation), sharing, retention, etc. The purpose of risk management is to identify potential problems before they occur.

In the Project, “loss” is considered to be a “decrease of development effect”. Factors to reduce the development effect are called risks, such as decrease of the project benefit, increase of project cost, unachieved development target of the project, project cancellation or suspension, and their multiple occurrences.

Treatment for risks is generally classified as follows:

⁹⁸ Annual report: DoF will compile the report on yearly bases based on the monthly report prepared by BMU

Table 7 - 10 Treatment for risks

Impact	Probability	
	High	Low
High	Avoidance of the risk (to avoid activity itself with the risk)	Sharing of the risk (to transfer the risk to others, e.g., insurance)
Low	Reduction of the risk (to reduce probability and impact of risk before occurring)	Retention of the risk (not to take action for the risk)

Source: JICA Survey Team

As mentioned above, the concept of risk management aims to treat critical and major risks based on the above categories, considering the costs associated with the treatment of risks. Risk identification and assessment shown below is done based on the concept of risk management.

(2) Identification and assessment of risks

According to JICA's Risk Management Framework, risks of the project are identified and assessed in the following categories. The JICA's Risk Management Framework classifies the risks into 1) stakeholder risk, 2) executing agency risk, and 3) project risk. The identified major risks in each risk category and the assessment results are shown in the following table.

Table 7 - 11 Identification and Assessment of Major Risks of the Project

Major Risks	Risk Assessment	Risk Treatment
1. Stakeholder risk		
Risk of the project cancellation or suspension resulting from the low commitment of the state of Assam ☒ Appraisal stage ☒ Implementation stage	Probability: M Impact: H	1) To hold regular high-level policy meeting, Project RGB to review and approve annual plan of operation and budgetary allocations at the timing of the next fiscal year's budget request. 2) To hold regular financial sanction meeting, RGB to monitor and guide all the financial matters. 3) To monitor the policy trends of the central government of India and the position of the Project in the annual plan of the state of Assam.
2. Executing agency risks		
2.1 Capacity risk		
1) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from the lack of technical capacity of DoF and PMU ☒ Appraisal stage ☒ Implementation stage	Probability: L Impact: M	1) To support PMU by PMC experts and supporting institutions for project implementation. 2) To plan appropriate implementation structure and training for all of the components. Especially for 1-4 Field demonstration, 3-1 Development of Blue Tourism and 4-2 Innovative and advance technology adoption components, quality PMC expert and proper executers will be required in consideration of the lack of technical skill of PMU.
2) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from low project management capacity of DoF and PMU ☐ Appraisal stage ☒ Implementation stage	Probability: L Impact: M	1) To hold regular meetings between PMU and DPMU to monitor, evaluate and approve financial management and procurement. 2) To support PMU by PMC for application of the guideline and manuals on financial management and procurement.

Major Risks	Risk Assessment	Risk Treatment
3) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from low financial capacity and delay of payment to contractor of DoF ☐ Appraisal stage ☒ Implementation stage	Probability: L Impact: M	1) To hold Project Execution Body (RGB) meeting regularly to monitor, evaluate and approve financial management and procurement. 2) To support PMU by PMC for financial management
2.2 Governance risk		
1) Risk of delay of the project resulting from the improper communication of related organizations and the implementation structure. ☐ Appraisal stage ☒ Implementation stage	Probability: L Impact: M	1) To clarify role, responsibility and relationship of each organization before starting the Project. 2) To hold Executive Committee regularly to share and discuss on the progress of the project activities with related organizations. 3) To implement institutional development component for DoA staff with support of PMC.
2) Risk of delay of the project implementation schedule from delay of procedure of L/A by the government ☒ Appraisal stage ☐ Implementation stage	Probability: L Impact: M	1) To support the state by JICA to arrange meetings and documents to achieve necessary procedure and approval punctually before project implementation.
2.3 Fraud & corruption risk		
Risk of increase of cost and unachieved development target, delay of the project resulting from fraud of procurement of the Project.	Probability: L Impact: M	1) To adopt procurement system prepared by PMU with addition of necessary revision. 2) To monitor proper procurement work through DoF.
3. Project risk		
3.1 Design risk		
1) Risk of delay in the implementation of the Project from the design with too advanced techniques. ☐ Appraisal stage ☒ Implementation stage	Probability: M Impact: M	1) To appoint PMC to support PMU to conduct project components especially for 4-2 Innovative and advance technology adoption components.
2) Risk of unachieved development component in the project implementation from improper project scope and project monitoring system. ☐ Appraisal stage ☒ Implementation stage	Probability: L Impact: M	1) To plan proper project components before the Project 2) To hold monthly progress meeting by PMU, DPMU to monitor and share the progress of activities 3) To hold Project Execution Body (RGB) meeting to monitor the progress of project components.
3) Risk of unachieved development component and delay of the project implementation schedule caused by the gap between the timings of commencement of the project and optimal season for aquaculture ☐ Appraisal stage ☒ Implementation stage	Probability: M Impact: M	1) To adjust the appropriate time to commence the project by proceeding the appraisal stage by the DoF. 2) To flexibly modify the procedure, scale and duration of the components 1 as necessary.

Major Risks	Risk Assessment	Risk Treatment
4) Risk of cancellation or suspension of the project implementation from increase of project cost ☐ Appraisal stage ☒ Implementation stage	Probability: L Impact: M	1) To consider the project cost based on economic situation of country and target area before the Project.
5) Risk of decrease of benefit of the project implementation from sudden decrease of market demand of target fish due to external factors. ☐ Appraisal stage ☒ Implementation stage	Probability: L Impact: L	1) To conduct the project economic analysis and confirm the resiliency against demand (benefit) decrease before the Project.
3.2 Program/donor risk		
Risk of decrease of benefit/effect and delay of the project resulting from overlap of the components by other schemes, other donors' projects or departments conducted in Assam state. ☐ Appraisal stage ☒ Implementation stage	Probability: M Impact: L	1) To hold information exchange meeting and project coordination meeting with relevant organizations such as ADB periodically by PMU supported by PMC
3.3 Delivery quality risk		
1) Risk of impossibility to monitor and measure development effect due to lack of the way of data collection. ☐ Appraisal stage ☒ Implementation stage	Probability: M Impact: L	1) To support officers of DoF by PMC to collect and manage the data properly. 2) To establish DX system and provide technical support including O&M to PMUs, DFDO and DoF with support of PMC
2) Risk of unsecured sustainability for O&M of project resulting of replacement of the officers trained in the project ☐ Appraisal stage ☒ Implementation stage	Probability: M Impact: L	1) To conduct O&M training to the multiple officers and develop the training manuals. 2) To consider implementation to further strengthen the capacity of DoF by the other scheme like Technical Assistance program
3) Risk of decrease of benefit, increase of cost, unachieved development target and delay of the project resulting from natural disaster ☐ Appraisal stage ☒ Implementation stage	Probability: L Impact: M	1) To plan construction work schedule to be conducted in non-monsoon season. 2) To monitor climate condition especially for flood with support of PMC and taking necessary measures (i.g. harvest the fish when the alert is announced)

Remark: H :High, M :Middle, L:Low

Source: JICA Survey Team

Chapter 8 Environmental and Social Considerations

8.1 Environmental Administrative System in India

In India, there are a number of ministries, departments, institutions, autonomous bodies and agencies that are involved in environmental management, monitoring and surveillance. The Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India (GoI) is the apex body and central ministry in the country, in charge of regulating and ensuring environmental protection including planning, promotion, coordination, and supervision of environmental policy/program for implementation. The Central Pollution Control Board (CPCB) under MoEF&CC at the union level and the State Pollution Control Board (SPCB) at the state level together form the regulatory and administrative core of this sector, which are mainly responsible to periodically monitor pollution levels. Table 8-1 provides an overview of the major institutions involved in ESC in the country.

Table 8 - 1 Major Institutions Involved in Environmental and Social Considerations

Key Union Government	
Ministry of environment, forest and climate change	MoEF&CC is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes. The broad objectives of the Ministry are: • Conservation and survey of flora, fauna, forests and wildlife • Prevention and control of pollution • Afforestation and regeneration of degraded areas • Protection of the environment and • Ensuring the welfare of animals <u>Regional office</u> At 19 location; Bangalore, Bhopal, Bhubaneswar, Chandigarh, Chennai, Raipur, Dehradun, GandhiNagar, Guwahati, Hyderabad, Jaipur, Jammu, Kolkata, Lucknow, Nagpur, Shimla, Shillong, Vijayawada, Ranchi
Central Pollution Control Board	CPCB serves as a field formation and also provides technical services to the Ministry of Environment and Forests of the provisions of the Environment (Protection) Act, 1986. Principal Functions of the CPCB, as spelt out in the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981, (i) to promote cleanliness of streams and wells in different areas of the States by prevention, control and abatement of water pollution, and (ii) to improve the quality of air and to prevent, control or abate air pollution in the country.
Ministry of tribal affairs	The Ministry was set up in 1999 after the bifurcation of Ministry of Social Justice and Empowerment with the objective of providing a more focused approach towards the integrated socio-economic development of the Scheduled Tribes (the most underprivileged section of the Indian Society) in a coordinated and planned manner
Ministry of rural development	Being the nodal Ministry for most of the development and welfare activities in the rural areas, the Ministry of Rural Development plays a pivotal role in the overall development strategy of the country. The vision and mission of the Ministry is sustainable and inclusive growth of rural India through a multipronged strategy for eradication of poverty by increasing livelihoods opportunities, providing social safety net and developing infrastructure for growth.
Ministry of fisheries, animal husbandry and dairying	<u>Department of fisheries</u> The Department is responsible for matters relating to formulation of policy and schemes relating to Development of Inland, Marine and Coastal Fisheries and Fishery Institutes.
Key State Departments (Government of Assam)	
Department of Environment & Forest	<u>Principal chief conservator of forest & Head of forest force</u> The Mission of the Department of Environment and Forests, Assam is to protect and improve the environment, to safeguard the forests and wildlife of the State, to preserve and add new dimensions to the rich heritage of our composite culture, to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures. <u>Pollution control board</u>

	State Pollution Control Board, Assam was an autonomous statutory organization constituted on 2nd June, 1975 under the provision of section 4 of the Water (Prevention & Control of Pollution) Act 1974 with a view to protecting the environment and preventing and controlling the pollution of water and air in the State of Assam <u>Assam state biodiversity board</u> Government of India has enacted the Biological Diversity Act, 2002. The Act provides for conservation of Biological Diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources and knowledge. At the national level, National Biodiversity Authority (NBA) has been established to implement the Act with headquarters in Chennai (Tamil Nadu) under Sec. 8 of the Act. SBBs are formed at state level and Biodiversity Management committees (BMC) are constituted by the local bodies to decentralize the implementation of the Act.
Department of Tribal Affairs	<u>Directorate of welfare of plain tribes & backward classes</u> The Directorate facilitates as a mediator of the requirements of the people belonging to the backward sector to the Govt. and simultaneously delivers/ implements any such grants sanctioned by the Govt. with the help of its various sub-ordinate offices, Councils, agencies, etc.
Guwahati development department	<u>Guwahati municipal corporation (GMC)</u> GMC is the urban local body responsible for governing, developing and managing Guwahati. GMC works under Guwahati Development Department, Assam. <u>Guwahati metropolitan development authority (GMDA)</u> In order to ensure planned development of the Metropolitan area, the GMDA was established in 1992 as per Guwahati Metropolitan Development Authority Act 1985 (amended). It replaced the erstwhile Guwahati Development Authority constituted in 1962 under the Town and Country Planning Act, 1959 (amended).
Other Agencies	
• Department of revenue & disaster management • Assam Remote sensing Application Center(ARSAC) • Assam project Forest and Biodiversity Society(APFBCS) • Department of science & technology, Assam	

Source : <https://moef.gov.in/>, <https://cpcb.nic.in/index.php>, <https://tribal.nic.in/Home.aspx>, <https://rural.gov.in/en#>, <https://minfahd.gov.in/>, <https://forest.assam.gov.in/>, <https://directorwptbc.assam.gov.in/>, <https://gmc.assam.gov.in/>, <https://gmda.assam.gov.in/>

8.2 Environmental Laws, Regulations and Policies in India and the State of Assam

The need for protection and conservation of environment and sustainable use of natural resources is reflected in the constitutional framework of India and also in the international commitments of India. Over the years, these guiding principles have resulted in the development of strong legal policies and operative framework for the protection of environment and conservation of ecological resources in the country.

Article 48A-Directive Principles of State Policies of the Constitution of India 1949 stipulates that “The State shall endeavor to protect and improve the environment and safeguard the forests and wildlife of the country”. Further, the Constitution of India under Article 51A-Fundamental Duties, defines the fundamental duties of every citizen of India “to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures”.

With the focus on achieving the sustainable development goal in developing countries, as mandated in the Guidelines for Environmental and Social Considerations (January 2022) of Japan International Cooperation Agency (JICA), this chapter deals with a review and analysis of the national and state level policies, laws and regulations of relevant environmental and social considerations (ESC), primarily to ensure that the Project and its activities are in compliance with the JICA Guidelines as well as The World Bank’s Safeguard Policies.

In India, apart from the various national level laws/policies, the state governments formulate their own laws, rules, regulations, guidelines, policies and standards covering different aspects of ESC, consistent with key relevant national laws and regulations. The important and relevant national and state level legal

frameworks which are applicable for ESC in relation to the proposed Project and its activities are outlined in Table 8-2.

Table 8 - 2 National/State Level Legal Framework for Environmental and Social Considerations

Law/Policy	Description / Outline	Competent authorities
A. Environment Protection and EIA		
National Forest Policy, 1988	Envisages 33% of the area of India should be under forest/tree cover through involvement of local communities in joint forest management programs	MoEF&CC, State Forest Department, VPs
Wildlife Protection Act, 1972	The Act prohibits killing/trapping of wild animals, control of collection, protection, and sale of specified plants, defines restrictions on access and use of protected areas	MoEF&CC, State Forest Department, State Wildlife Board
Biological diversity Act, 2002	An Act to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.	Acts of the Parliament of India
Assam biodiversity rules, 2010	The Government of Assam constituted the “Assam State Biodiversity Board” on 29 September 2010 to promote biodiversity conservation in the state, sustainable use of its components and equitable sharing of benefits arising out of the use of biological resources and traditional knowledge associated with these resources. At the same time, this Assam Biodiversity Rules were notified in 2010.	Department of environment & forest, Government of Assam
Threatened species of Assam Notification, 2018	In exercise of the powers conferred by section 38 of the Biological Diversity Act 2002, the central government, in consultation with the government of Assam, hereby notifies the species of plants and animals which are on the verge of extinction, and prohibit or regulate the collection, for the State of Assam.	MoEF&CC
Environmental Regulations	The state of Assam has adopted the following union level regulations and laws pertaining to environment protection and control of pollution: – The Water (Prevention & Control of Pollution) Act, 1974 and rules framed thereunder. – The Air (Prevention & Control of Pollution) Act 1981 and rules framed thereunder. – The Water (Prevention & Control of Pollution) Cess Act, 1977, as amended by Amendment Act, 1991, 2003, and rules framed thereunder – Environment (Protection) Act, 1986 and the rules/notifications framed thereunder: – Environmental Protection Rules, 1986. – Environmental Impact Assessment Notification, 1994, 1997, 2002, 2004, 2006, 2020 as amended. – Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016. Manufacture, Storage and Import of Hazardous Chemical Rules, 1989; – Plastics Manufacture, Sale and Usage Rules, 1999 and 2003; – Bio-Medical Waste (Management and Handling) Rules, 1998 and Amendment Rules 2000, 2003, 2016; – The Noise Pollution (Regulation and Control) Rules, 2000; – Municipal Solid Wastes (Management and Handling) Rules, 2000;	Central Pollution Control Board,

Law/Policy	Description / Outline	Competent authorities
	- Ozone Depleting Substances (Regulation) Rules, 2000; - Batteries (Management and Handling) Rules, 2001; - The Manufacture, Use, Import, Export, and Storage of Hazardous Micro Organisms, Genetically Engineered Organisms or Cells Rules, 1989. - Chemical Accident (Emergency Planning, Preparedness, and Response) Rules, 1996. - There are additional rules that are notified considering the need for the betterment of the health of the society in general as well as their bearing on the environment. Apart from Uttarakhand State Pollution Control Board, there are other agencies as well that are responsible for the implementation of these rules: - Public Liability Insurance Act, 1991. - Motor Vehicle Act, 1988.	
B. Pollution Control and Waste Management		
Plastic Waste Management, Rules, 2015	Plastic Waste (Management and Handling) Rules, 2011 rules more effectively and to give thrust on plastic waste minimization, source segregation, recycling, involving waste pickers, recyclers and waste processors in collection of plastic waste fraction either from households or any other source of its generation or intermediate material recovery facility and adopt polluter's pay principle for the sustainability of the waste management system, the Central Government reviewed the existing rules.	MoEF&CC
The Guwahati waterbodies (Preservation and Conservation) Act, 2008	An act to provide for preservations, protection conservation, regulation and maintenance of waterbodies and to develop the waterbodies into natural water reservoir and convert into eco-tourism recreation center to suit the ecological balance within the jurisdiction of Guwahati Metropolitan Development Authority and to protect the waterbodies from the encroachers and damages.	Legislative department Government of Assam
C. Land Acquisition/ Involuntarily Resettlement		
Right to Fare Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	An Act to ensure a humane, participative, informed and transparent process for land acquisition for industrialization, development of essential infrastructural facilities and urbanization with the least disturbance to the owners of the land and other affected families. The Act notifies to provide fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition and make adequate provisions for such affected persons for their rehabilitation and resettlement, and for ensuring that the cumulative outcome of compulsory acquisition should be that affected persons become partners in development leading to an improvement in their post-acquisition social and economic status and for matters connected therewith or incidental thereto.	Acts of the Parliament of India
Assam Right to Fare Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2015	These rules were published as required by section 112 of Right to Fare Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013,	Department of revenue & disaster management
Notification land acquisition rehabilitation and resettlement amended rules, 2022	This notification was addendum to the Assam Right to Fare Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2015	Department of revenue & disaster management

Law/Policy	Description / Outline	Competent authorities
The Assam Land (Requisition and Acquisition) Act, 1964, amended up to 1985	This Act was brought to consolidate the law of requisition and speedy acquisition of premises and land obtain public purposes mainly centering round requisition and acquisition on account of flood control and associated activities with the enactment of the Assam Land Act, 1964 that was amended in 1985	Directorate of land requisition, acquisition and reforms

Source: Compiled by JICA Study Team

8.3 Environmental Clearance

Environmental clearance (EC) of new projects in India is subject to the EIA Notification, 2006 that became effective from 14th September 2006. This notification is applicable to all states. MoEF&CC has published the draft EIA Notification 2020, with the intention of replacing the existing EIA Notification, 2006 under the Environment (Protection) Act, 1986.

Initially all the process was manual and used to take years in the grant of environmental clearance. But now the process has been made online and time bound. A separate website (www.environmentclearance.nic.in) has been launched by Ministry of Environment, Forest and Climate Change, Government of India for online submission & monitoring of environmental & costal reserve zone (CRZ) clearances mandating online submission of applications for Terms of Reference (TOR) and Environmental Clearance from 4th July 2014 in the Ministry and 2nd July 2015 in the SEIAA, with a view to bring more transparency in the system and expediting the decision making.

8.3.1 Environmental Impact Assessment

In 1994, for the first time, the EIA Notification, under the Environmental (Protection) Act (1986), was formulated, which made the process of EIA a “statutory requirement” rather than an “administrative requirement” for a number of projects/activities that are likely to have significant environmental impacts and health implications. Thereafter, the EIA Notification has undergone several amendments, whereby, the provisions for conducting public hearing has been incorporated, and several important projects/activities have been brought into the ambit of EIA, thus requiring an “Environmental Clearance” from the MoEF&CC. The EIA Notification 2006, and subsequently the draft EIA Notification 2020, were issued with further improvements in the EIA procedure. Further, an effort has also been made to make the EIA procedure more transparent and to provide societal vigil of projects affecting the environment through public hearing/consultation by moving the environment protection agenda into public domain. In the draft notification (2020), revised threshold criteria were introduced for different categories of projects. In this section, the processes adopted in India and the requirement for EC is described, although as per the review of the proposed project activities, it is unlikely that the Project will require any environmental clearances.

Anticipated projects are classified as Category C according to the JICA guidelines for Environmental and Social Considerations. These are likely to have minimal or little adverse impacts on the environment and society. However, at present, the sub-component is not yet decided, it will be Category FI under the JICA Guidelines.

8.3.2 EIA System and Requirements

As per EIA Notification, 2006, the projects/ developmental activities have been broadly divided into eight major categories and thirty-nine subcategories that require EC either from the central government (MoEF&CC) or at the state level from the State Environmental Impact Assessment Authority (SEIAA). In the draft EIA Notification 2020 however, the list is modified into 43 categories. As per draft EIA 2020 notification, the categories along with thresholds for the related project components and activities that require prior EC, are described in Attachment 4-1.

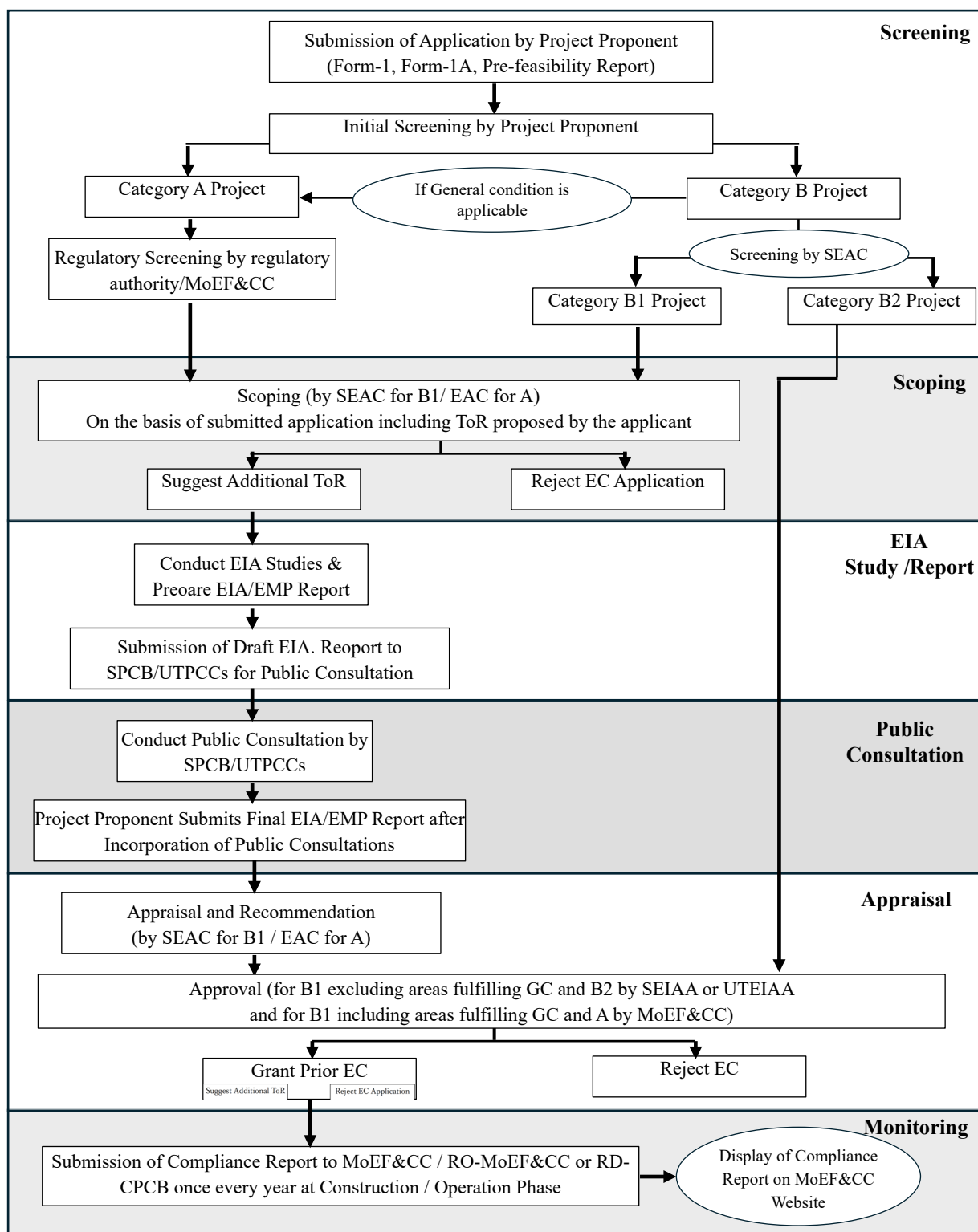
All projects and activities are broadly categorized into two types, namely: Category A and Category B, where Category B is further subdivided into B1 and B2, based on the size/scale of the concerned projects as well as spatial extent of potential impacts on human health and natural/ man-made resources. The detailed stages prior to EC are highlighted below.

- 1) Category 'A' projects or development activities are mandated to conduct EIA studies along with conducting public consultation as per the procedure stipulated in the notification and EC is required from the central government or MoEF&CC.
- 2) For Category 'B' projects, screening is under the purview of the State Expert Appraisal Committee (SEAC) and the State Level Environmental Impact Assessment Authority (SEIAA) committee for decentralized procedure of EC. Further Category 'B' projects are divided into Category 'B1' and 'B2'. Under Category 'B1', there are two sub-types of projects:
 - (a) 'B1' projects that exclude areas defined under 'General Conditions' shall require prior-EC from SEIAA, as the case may be.
 - (b) 'B1' projects that include areas defined under 'General Conditions' shall require prior-EC from the MoEF&CC without any changes in the category of the project.

Category 'B2' projects fall under the purview of the SEIAA and do not require EIA. For 'B2' projects that are required to be placed before the Appraisal Committee shall require prior-Environmental Clearance (EC) from SEIAA whereas, the rest of B2' category projects shall require prior-Environmental Permission (EP) from SEIAA and shall not be placed before the Appraisal Committee.

8.3.3 Stages and Procedure to Obtain Environmental Clearance

As per EIA notification 2006 four stages of EC procedures were defined. On the other hand, as per draft EIA Notification 2020, broadly six stages of EC procedures were defined. In order to maintain sanctity of both the notifications and for practicality and ease, the EIA has been divided into six stages in this report, i.e.; 1) Screening, 2) Scoping, 3) EIA Study, 4) Public Consultation, 5) Appraisal, and 6) Monitoring (Refer Figure 8-1).



Note: EAC: Environmental Appraisal Committee
EIA: Environmental Impact Assessment
EMP: Environmental Management Plan
GC: General Conditions
MoEF&CC: Ministry of Environment and Forest
and Climate Change

RO: Regional Office RD: Regional Directorate
SPCB: State Pollution Control Board
SEAC: State Level Expert Appraisal Committee
SEIAA: State Level Environment Impact Assessment Authority
UTEIAA: Union Territory Level Environment Impact Assessment
Authority
UTPCC: Union Territory Pollution Control Committee

Figure 8 - 1 Stages in the Environmental Clearance Procedure as per Draft EIA Notification 2020
Source: EIA Notification 2006 and draft 2020

The process of application for EC is given in Table 10.3.1. As part of transparency, all state-wise details of EC application, public hearing details for upcoming and approved Terms of Reference (ToR) are updated on the dedicated website of MoEF&CC.

Table 8 - 3 Process of Application for Prior EC as per the Draft EIA Notification 2020

Stage	Forms	Supplemented with	Applicability	Regulatory Authority
Scoping	Form-1	Pre-feasibility Report	All projects under Category 'A' and Category 'B1'.	Ministry: For the projects under Category 'A' and Category 'B1' (those which attracts the General Conditions); and SEIAA or UTEIAA, as the case may be: For the projects under Category 'B1' (those which do not attract the General Conditions) and Category 'B2'.
Public consultation	Simple letter addressed	(i) At least 10 hard copies and a soft (electronic) copy of the Draft EIA Report prepared in English; and (ii) At least 10 hard copies of summary of EIA Report in English and in the official language of the State or Union Territory or Regional language.	All projects as given in subclause (1) of clause 14 of this notification	Member Secretary of SPCB / UTPCC concerned.
Appraisal	Form-1	(i) Form-1A; and (ii) Conceptual plan	All projects mentioned at column (5) under item 42 and 43 of the schedule.	SEIAA or UTEIAA, as the case may be
	Form-1	(i) Form-1B2; (ii) EMP; (iii) Final Layout plan; (iv) Feasibility Report or Mining plan in case of mining projects; (v) District Survey Report in case of mining of minor minerals; and (vi) Cluster certificate in case of cluster situation.	All projects falling under Category 'B2'.	SEIAA or UTEIAA, as the case may be.
	Form-2	(i) Final EIA Report; (ii) Copy of Feasibility Report or Approved Mining Plan in case of mining projects; (iii) Copy of final layout plan; (iv) Public consultation proceedings; (v) District Survey Report in case of mining of minor minerals; and (vi) Cluster certificate in case of cluster situation; and (vii) Certificate of compliance of conditions earlier prior-EC or prior-EP, as the case may be, issued by the Component Authority in case of expansion or modernization proposals; and (viii) Other prerequisites as specified at subparagraph (5) of paragraph 17 of this notification.	All projects falling under Category 'A' or Category 'B1'.	Ministry: For the projects under Category 'A' and Category 'B1' (those which attracts the General Conditions); SEIAA or UTEIAA, as the case may be: For the projects under Category 'B1' (those which do not attract the General Conditions) and Category 'B2'

Source: Draft EIA Notification (No. S.O.750(E) dated 17th February 2020 of MoEF&CC

8.3.4 Building Construction and Area Development Projects Requiring Prior Environmental Clearance

Based on the review of the DPR and further discussion with the Department of fishery regarding the planned activities in the project, the details of similar project types like building construction/ area development projects, along with details of category and threshold limits as mentioned in the draft EIA Notification 2020 for requiring prior-environmental clearance, are listed in Table 8-4.

Table 8 - 4 List of Projects Related to Development of land water areas and Building Construction Requiring Prior-Environment Clearance

Project		Category with Threshold Limit			Remarks
		A	B1	B2	
4	Irrigation	$\geq 50,000$ hectares of culturable command area	$>10,000$ hectares and	$> 2,000$ hectares and $< 10,000$ hectares of culturable command area.	
42	Building construction and area development projects		$>1,50,000$ m ² of built-up area and/or total land area of > 50 hectares	(i) $>20,000$ m ² and $50,000$ m ² of built-up area (ii) $> 50,000$ m ² and $< 1,50,000$ m ² of built-up area projects having provisional 'certificate of green building' or relating to industrial sheds, educational institutions, hospitals and hostels for educational institutions	Note 1. Projects under (i) and (ii) of Column (5) shall not be referred to the Appraisal Committee. 2. Any change in the intended use, prior permission from the regulatory authority for amendment in the prior- EP shall be obtained. All such cases shall be referred to the Appraisal Committee.
				$> 50,000$ m ² and $< 1, 50,000$ m ² of built-up area	Note: Projects under Column (5) shall be referred to the Appraisal Committee

Source: Based on the Draft EIA Notification (No. S.O.750(E) dated 17th February 2020) of MoEF&CC

As part of the draft EIA 2020, In the project, the building infrastructure like fish market, whose threshold limit in the draft EIA 2020 is set as $>20,000$ m² and $50,000$ m² of built-up area, thus no EC is required.

8.3.5 Land Acquisition, Rehabilitation and Settlement

Until 2013, GoI and the states were following the Land Acquisition Act, 1894. In the year 2007, GoI introduced the National Rehabilitation and Resettlement Policy. In November 2013, 'The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act' was passed by the Parliament. This objective behind the formulation of the Act was to bring in a transparent process of land acquisition through consultative and participatory approach for land acquisition with the least disturbance to the owners/families of the land with fair compensation and appropriate rehabilitation and resettlement of the families.

The 2013 Act brought in several key changes to the process of land acquisition in the country.

- It increased the compensation provided to landowners, from 1.3 times the price of land to two times the price of land in urban areas, and two to four times the price of land in rural areas.
- Unlike the earlier act, which did not provide rehabilitation and resettlement (R&R), the 2013 Act provided R&R to landowners as well as to those families which did not own land but were dependent on the land for their livelihood. The act permits states to provide higher compensation and R&R.
- It mandated that a Social Impact Assessment (SIA) be conducted for all projects, except for those land that are required urgently. An SIA assesses certain aspects of the acquisition such as whether the project serves a public purpose, whether the minimum area that is required is being acquired and the social impact of the acquisition.
- It mandated that the consent of 80% of landowners be obtained for private projects and the consent of 70% of landowners be obtained for public-private partnership projects. However, consent of

landowners is not required for government projects.

On the 3rd of April 2015, the bill exempted five categories of projects, namely: (i) defense, (ii) rural infrastructure, (iii) affordable housing, (iv) industrial corridors (set up by the government/government undertakings, up to 1 km on either side of the road/railway), and (v) infrastructure projects, from this provision of the 2013 Act including the requirement of a social impact assessment and the limits that apply for acquisition of irrigated multi-cropped land, through issuing a notification.

The processes involved in land acquisition and involuntary resettlement are described in below;

However, under the project, no anticipated resettlement and rehabilitation due to project activities would be required because the construction of the project will take place on government properties.

Process of Land Acquisition

- Preparation of Social Impact Assessment study, a public hearing on the assessment made and publication of the study.
- Appointment of an expert group to assess the Social Impact Assessment and further the government's examination of proposals for land acquisition.
- Publication of preliminary notification and appointment of officers.
- Preliminary survey of land.
- Hearing of objections.
- Preparation of Rehabilitation and Resettlement Scheme by the Administrator and its review thereafter.
- Approval and publication of the above scheme.
- Intimating the interested parties through notification.
- A meeting of the interested parties with the collector at a time, date and place fixed by the collector.
- Enquiry to objections of the interested parties by the collector.
- Land Acquisition.

Process of Resettlement and Rehabilitation

- Government intends to acquire land for public purposes
- Consultation with concerned assam municipality or municipal cooperation
- Social Impact Assessment Study
- Public Hearing for SIA: Report on SIA made in public in local Language
- Appraisal on SIA report by independent multi-disciplinary expert group
- Preliminary Notification is published
- Survey and Census of Affected Families and Prepare R&R Scheme by Administrator (R&R)
- Collector reviews the R&R Scheme, and Submits to Commissioner (R&R) for approval
- Approved R&R Scheme is made public
- Secretary issues a Declaration indicating 'need of land for public purpose', 'settlement area identified', and summary of R&R scheme to the Government
- Requiring body deposits amount towards cost of land acquisition
- Collector provides the R&R awards to each affected family

8.4 Environmental and Social Conditions

Baseline information pertaining to social and environmental conditions is very important to understand the perceived impact that the project activities might have on the local environment. The importance attached to baseline information does not depend on whether there will be any negative impact on the environment due to project and its activities and/or whether EIA is required or not. Thus, some key baseline data pertaining to the social and natural environment are represented in the subsequent sections.

8.4.1 Social Environment

This section describes the details of the socio-economic conditions and cultural perspectives of scheduled tribes (STs) in the state. See Chapter 2.

8.4.2 Natural Environment

(1) Protected Areas

The Protected Area Network (PAN) of Assam includes 7 National parks and 17 wildlife sanctuaries covering an area about 5,195.42 km². constituting approximate 6.62 percent of the total geographical area of the state. The wildlife sanctuaries in Assam are a heterogeneous mixture of a variety of landscapes, plants, birds and animals. Suitable climatic conditions, geographical location and vast forest reserves have made Assam a favourable habitat for birds, animals and natural vegetation. The wildlife sanctuaries and national parks of the state are the breeding ground for some of the rarest global species. Many wildlife sanctuaries of Assam are home to large number of precious wildlife species from the golden languor to the one horned rhinoceros. Two national parks of the state are designated as world heritage sites by the UNESCO in 1985. Category wise wildlife protected areas of the state is presented in the following tables.

Table 8 - 5 National park, sanctuary, reserves

National Park

No.	Name of the National Park	Location (District)	Area in km ²
1	Kaziranga National Park	Golaghat, Nagaon, Sonitpur	430.00
	Kaziranga National Park-1 st addition	Nagaon	43.78
	Kaziranga National Park-2 nd addition	Golaghat	6.47
	Kaziranga National Park-3 rd addition	Golaghat	0.069
	Kaziranga National Park-4 th addition	Nagaon	0.89
	Kaziranga National Park-5 th addition	Golaghat	1.15
	Kaziranga National Park-6 th addition	Sonitpur, Biswanath	376.00
2	Manas National Park	Chirang, Baksa	500.00
3	Dibru-Saikhowa National Park	Dibrugarh, Tinsukia	340.00
4	Nameri National Park	Sonitpur	200.00
5	Orang National Park	Udalguri, Sonitpur	78.81
6	Paimona National Park	Kokrajhar	422.00
7	Dehing Patkai National Park	Dibrugarh, Tinsukia	231.65

Wildlife Sanctuary

No.	Name of the Wildlife Sanctuary	Location (District)	Area in km ²
1	Garampari WLS	Karibi Anglong	6.05
2	Laokhowa WLS	Nagaon	70.13
3	Bornadi WLS	Udalguri	26.22
4	Chakrasila WLS	Kokrajhar	45.56
5	Burachapari WLS	Sonitpur	44.06
6	Panidihing Bird Sanctuary	Sibsagar	33.93
7	Hollongapar Gibbon WLS	Jorhat	20.98
8	Pobitora WLS	Morigaon	38.31
9	Sonai Rupai WLS	Sonitpur	220.00
10	Bherjan-Borajan-Podumai WLS	Tinsukia	7.22
11	East Karbi Anglong WLS	Karibi Anglong	221.81
12	Nambor WLS	Karibi Anglong	37.00
13	Morat Longri WLS	Karibi Anglong	451.00
14	Nambor Doigurung WLS	Golaghat	97.15
15	Amchang WLS	Kamrup (M)	71.64
16	Borial WLS	Cachar & Karimganj	326.245
17	Deepar Beel WLS	Kamruo (M)	4.10

Tiger Reserves (TR)

No.	Name of TR	Location (District)	Area in km ²
1	Manas TR	Kokrajhar, Chirang, Baksa, Udalguri	2,837.12
2	Nameri TR	Sonitpur	344.00
3	Kaziranga TR	Nagaon, Golaghat, Sonitpur	858.98

Elephant Reserve (ER)

No.	Name of ER	Location (District)	Area in km ²
1	Chirang-Ripu ER	Kokrajhar, Chirang, Baksa, Udalguri	2,600.00
2	Sontipur ER	Sonipur	1,420.00
3	Dining Patkai ER	Dibrugarh, Tinsukia	937.00
4	Kaziranga-Karibi Angling ER	Sonitpur, Nagoan, Golaghat, Karbi Anglong	3,270.00
5	Dhansiri-Lungding ER	Karibi Anglong, Nagoan, N.C.Hills	2,740.00

Biosphere Reserves (BR)

No.	Name of BR	Location (District)	Area in km ²
1	Manas BR	Kokrajhar, Chirang, Baksa, Udalguri	2,837.00
2	Dibru-Saikhowa BR	Dibrugarh, Tinsukai	765.00

Source (Table: Government of Assam, Environment & Forest, Principal chief conservator of forest & Head of forest force.

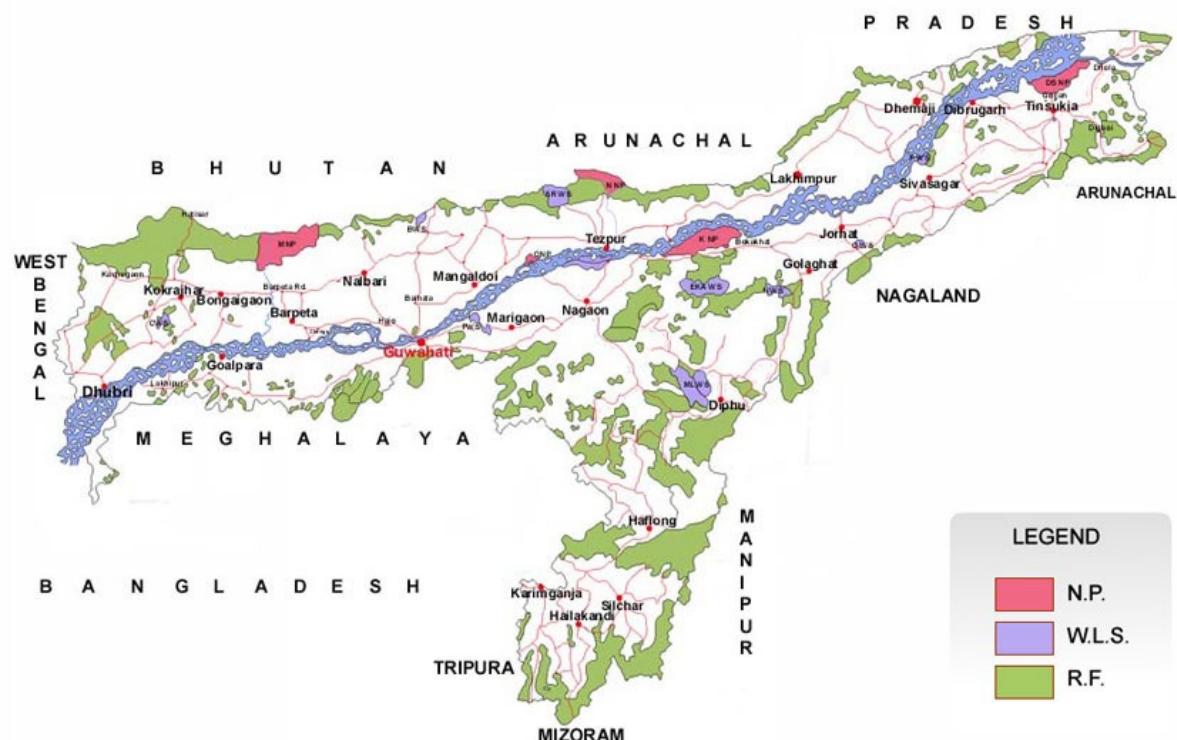


Figure 8 - 2 Geographical location of Seven National Parks in Assam

Source: Government of Assam, Environment & Forest, Principal chief conservator of forest & Head of forest force.

(2) Ambient Air Quality

In Assam State, ambient air quality is being monitored in seven towns/cities, namely: Dibrugarh, Dispur, Gauripur, Guwahati, Jorhat, Silchar and Tezpur. As per the notification dated 18 November 2009 on the National Ambient Air Quality Standards by the Central Pollution Control Board, the air quality standards have been fixed for a 24-hour average including 100 µg/m³ for Respirable Suspended Particulate Matter (RSPM), 80 µg/m³ for SO₂, and 80 µg/m³ for NO₂, while the annual average standard fixed is 60 µg/m³ for RSPM, 50 µg/m³ for SO₂, and 40 µg/m³ for NO₂ (Table10.4.7).

Table 8 - 6 National Ambient Air Quality Standards

Pollutants	Time weighted average	Concentration in ambient air		
		Industrial Area	Residential, Rural & other Areas	Sensitive Area
Sulphur Dioxide (SO ₂)	Annual Average*	80 µg/m ³	60 µg/m ³	15 µg/m ³
	24 hours****	120 µg/m ³	80 µg/m ³	30 µg/m ³
Oxides of Nitrogen as NO ₂	Annual Average*	80 µg/m ³	60 µg/m ³	15 µg/m ³
	24 hours****	120 µg/m ³	80 µg/m ³	30 µg/m ³
Suspended Particulate Matter (SPM)	Annual Average*	360 µg/m ³	140 µg/m ³	70 µg/m ³
	24 hours****	500 µg/m ³	200 µg/m ³	100 µg/m ³
Respirable Particulate Matter (RPM) (size less than 10 microns)	Annual Average*	120 µg/m ³	60 µg/m ³	50 µg/m ³
	24 hours****	150 µg/m ³	100 µg/m ³	75 µg/m ³
Lead	Annual Average*	1.0 µg/m ³	0.75 µg/m ³	0.50 µg/m ³
	24 hours****	1.5 µg/m ³	1.0 µg/m ³	0.75 µg/m ³
Ammonia	Annual Average*	0.1 mg/m ³	0.1 mg/m ³	0.1 mg/m ³
	24 hours****	0.4 mg/m ³	0.4 mg/m ³	0.4mg/m ³
Carbon Monoxides	8 hours**	5.0 mg/m ³	2.0 mg/m ³	1.0 mg/m ³
	1 hours	10.0 mg/m ³	4.0 mg/m ³	2.0 mg/m ³
*	Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval			
**	24 hourly/ 8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days. Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week at uniform interval.			
NOTE:				
1. National Ambient Air Quality Standard: The levels of air quality with an adequate margin of safety, to protect the public health, vegetation and property.				
2. Whenever and wherever two consecutive values exceed the limit specified above for the respective category, it would be considered adequate reason to institute regular/ continuous monitoring and further investigation. S.O. 384(E), Air (Prevention & Control of Pollution) Act, 1981, dated April 11, 1994] [EPA Notification: GSR 176(E), April 02, 1996].				
1. Include vide Notification SO.955(E), Air (Prevention & Control of Pollution) Act, 1981, dated October 14, 1998]				

Source: National Ambient Air Quality Standard https://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf

(3) Ambient Noise Level

Noise pollution is often misunderstood as sound pollution. Sound is pure tune, harmonic, with fixed frequencies and amplitudes, occurring at regular intervals, producing meaningful communication and pleasure in hearing. “Unwanted sound” is noise, having a complex mix of pure tones of various frequencies and amplitudes. These sound waves fluctuate and repeat themselves in highly haphazard manner. Folks from cities, towns, and even villages are increasingly exposed to various sources of noise pollution, namely, loudspeakers, public address system, amplified music especially during social functions, movement of vehicles, blowing of horns, and in factories and industries.

The state board regularly conducts ambient noise monitoring for 8 (Silchar, Dibrugarh, Sivasagar, Tezpur, Golaghat, Nagaon, Bongaigaon and Guwahati) areas/zones spread over the entire state.

Table 8 - 7 Noise Level Standards

Zone code	Zone	LIMITS IN dB(A)	
		Day time 6AM to 9PM	Night time 9PM to 6AM
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence	50	40

Source: The Noise Pollution (Regulation and Control) Rules, 2000. <https://cpcb.nic.in/noise-pollution-rules/>

(4) Water Quality

The water quality data reflects level of impacts on water quality and helps in ascertaining the nature and extent of pollution control measures that are required. The Central Pollution Control Board is sponsoring the water quality monitoring of major rivers of the state through its national programme, namely, “National Water quality Monitoring Programme (NWMP). The Objective of NWMP is to standardized measurement of identified parameters in order to define status and trends of water quality. Under NWMP systematic procedures of collection, preservation and transportation, storage, analysis of water samples and dissemination of data are followed for sample locations from natural waterbodies (surface and ground water). The State Pollution Control Board in collaboration with the Central Pollution Control Board is carrying out water quality monitoring at 29 locations in the state. Regular monitoring of water quality is being carried out and data are being forwarded to CPCB. Table 8-8 depicts the criteria for primary water quality.

Table 8 - 8 Primary Water Quality Criteria

Designated Best Use	Class of Water	Criteria
Drinking Water Source Without Conventional Treatment but After Disinfection.	A	1. Total coliform organism MPN/100 ml shall be 50 or less. 2. pH between 6.5 and 8.5. 3. Dissolved oxygen 6 mg/l or more. 4. Biochemical oxygen demand 5 days 20 oC 2 mg/l or less.
Outdoor Bathing (Organized)	B	1. Total coliform organism MPN/100 ml shall be 500 or less. 2. pH between 6.5 and 8.5. 3. Dissolved oxygen 5 mg/l or more. 4. Biochemical oxygen demand 5 days 20 oC 3 mg/l or less.
Drinking Water Source After Conventional Treatment and Disinfection	C	1. Total coliform organism MPN/100 ml shall be 5,000 or less 2. pH between 6 and 9. 3. Dissolved oxygen 4 mg/l or more. 4. Biochemical oxygen demand 5 days 20 oC 3 mg/l or less.
Propagation of Wildlife and Fisheries	D	1. pH between 6.5 and 8.5. 2. Dissolved oxygen 4 mg/l or more. 3. Free ammonia (as N) 1.2 mg/l or less.
Irrigation, Industrial Cooling Controlled Waste Disposal	E	1. pH between 6.5 and 8.5. 2. Electrical conductivity at 25 0C micro mhos/cm max. 2,250 3. Sodium absorption ratio max. 26. 4. Boron max 2 mg/l.

Source: Web site of central pollution control board. <https://cpcb.nic.in/wqstandards/>

Table 8 - 9 Water quality standard

Pollutants	India	Japan River	Japan Lakes
pH	6.5- 8.5	6.7-7.5	6.7-7.5
BOD	-	3mg/l or less: nature	-
COD	-	-	4mg/l or less: nature
DO	4 mg/l or more.	6mg.l or more.	6mg/l or more.
Total nitrogen	1.2 mg/l or less.	-	1.0mg/l or less : Carp
Total phosphorus	-	-	0.1mg/l or less : Carp
Total suspended solids	-	25mg/l or less	3.0mg/l or less
Total coliform bacteria	2,500MPN/100 ml. or less	1,000MPN/100mL or less	1,000MPN/100mL or less

Source: Ministry of environment and forest notification, September 2000.

Japan Fisheries Water Standards, Japan Fisheries Resource Conservation Association

In Assam, water quality surveys have been conducted by the NWMP at 66 groundwater sites and 47 ponds and beer sites. The following table shows the results of groundwater surveys at major sites in Assam (target districts) for the year 2022. Although E.coli etc. are missing, pH, BOD, and other parameters are within Indian and international standards. During subcomponent operation, the groundwater will be managed so that it does not deteriorate below these values.

Table 8 - 10 Groundwater quality survey results in Assam by NWMP (extract)

Name of Monitoring Location	Temperature (°C)		pH		Conductivity (µmhos/cm)		BOD (mg/L)		Nitrate-N + Nitrite-N (mg/L)		Total Dissolved Solids (mg/L)		Fluoride (mg/L)		Arsenic (mg/L)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
LAKHIMPUR TOWN	22	26	7.6	7.7	258	262	2.4	2.6	0.7	0.9	146	172	0.28	0.33	0.01	0.01
NAGAON (PANIGAON),	24	24	6.9	7.1	320	324	2.5	2.6	0.9	1	180	206	0.29	0.31	0.01	0.02
KARIMGANJ (COLLEGE)	22	24	6.8	6.9	126	132	2.5	2.6	1	1.1	80	96	0.31	0.32	0.01	0.01
PANCHGRAM MARKET	22	23	6.8	7.2	152	156	2.4	2.7	0.8	0.9	96	106	0.26	0.3	0.01	0.02
NAGABALI MUNICIPALITY DUMPING SITE, GOLAGHAT	27	27	7.2	7.2	242	242	2.5	2.5	1	1	166	166	0.31	0.31	0.01	0.01
MEHEPUR TRENCHING GROUND, CACHAR	23	24	6.8	6.9	201	212	2.4	2.5	0.9	1	118	132	0.28	0.31	0.01	0.01
MEHERPUR, CACHAR	23	24	7	7.2	206	216	2.3	2.5	0.8	0.9	120	138	0.29	0.31	0.01	0.01
BADARPUR GHAT, KARIMGANJ	23	24	6.8	7.2	158	162	2.3	2.4	1	1.1	98	112	0.3	0.31	0.01	0.01
NAGAON TOWN PIPE WATER SUPPLY SCHEME, NAGAON	21	21	6.9	6.9	186	186	2.5	2.5	1.4	1.4	126	126	0.34	0.34	-	-
NAGAON COLLEGE, NAGAON	21	21	6.8	6.8	196	196	2.6	2.6	1.2	1.2	134	134	0.33	0.33	0.01	0.01

Source; Water quality data of ground water under NWMP 2022,

8.4.3 Man-Animal Conflict

(1) Human – Elephant Conflict

In India, human-elephant conflict has been on the rise for the last few decades. The situation is worse in the state of Assam, where 5,719 elephants are present, and the density of elephants is greater than that of other areas. Most of the elephant habitats in the state are fragmented or intermingled with human-used lands. As a result, human-elephant conflict (HEC) has been increasing in the state. Each year, an average of 30 elephants and 70 humans dies in the state because of HEC. Most of these conflicts occur during the paddy harvesting season. At that time of year, the elephants come out from their habitats and take refuge in forest patches and tea gardens near agricultural fields and raid crops at night.

Table 8 - 11 Elephant Conflict

Species	Year		
No. of Elephant died in Human - Elephant Conflict	2021	2022	2023
	20	23	21
No. of person died in Human - Elephant Conflict	2021	2022	2023
	63	80	74

Source : Government of Assam, Assam state Biodiversity Board

(2) Rhino Poaching

For the first time in decades, Assam reported no cases of poaching incidents in 2022. In the past, more than a dozen rhinos were poached each year. The coordinated efforts of the forest and police departments, the use of technology, and the deployment of armed commandos have helped the state in keeping a check on poachers.

Table 8 - 12 Number of Rhino poaching

Species	Year		
No. of Rhino Poaching	2021	2022	2023
	2	0	3

Source: Government of Assam, Assam state Biodiversity Board

8.5 Institutional Arrangement and Capacities of Implementing Agency for Environmental and Social Considerations

8.5.1 Overview

DoF will be the responsible agency (IA) for this project and will execute the proposed activities. All activities of the Project shall be implemented in accordance with the legislation system at the national and state level, which provides clear guidelines and procedures for environmental and social safeguards. However, DoF does not have dedicated units or personnel for implementation of environmental procedures such as screening, categorization, and environmental review as per prevailing laws and regulations.

In this regard, the Environmental Social Assessment Framework (ESAF) shall be the principal document to serve as an instrument to guide the IA on undertaking the necessary environmental and social due diligence on each project activity. It would provide the basis for detailed procedures for screening, categorization, and environmental review of the Project and its activities. For the implementation of ESAF, the IA will assign nodal officers for environmental and social consideration.

8.5.2 Institutional Arrangement

Under the Project, most of the aspects related to environmental and social issues and protection are to be managed by the DoF, Directorate of Fisheries, State Government of Assam. DoF is responsible for overall planned intervention in the Project, legal/policy development, ensuring adequate consultation and participation, inclusion of vulnerable groups such as STs, small-scale and marginal farmers, and women-headed households, in planning and implementation and the equitable distribution of benefits associated with site-level project interventions. DoF is responsible for overall planned intervention in the Project, legal/policy development, ensuring adequate consultation and participation, inclusion of vulnerable groups such as STs, small-scale and marginal farmers, and women-headed households, in planning and implementation and the equitable distribution of benefits associated with site-level project interventions. The district administration is the intermediary agency responsible for land administration and benefits to the project-affected stakeholder.

The ESAF will be implemented through the institutional structure of the Project and a director/officers at each administrative level shall be appointed as focal persons for ESAF compliance. Table 10.5.1 highlights the institutional structure for ESAF with key environmental and social management roles and responsibilities.

Table 8 - 13 Institutional Structure for ESAF Implementation and Monitoring

Institution	Role in the Project	(Additional) Role and/or Responsibility in ESAF
Directorate of Fisheries	- Decision-making body - Lay down the broad policy framework for functioning of the society - Review the society's performance - All administrative and financial powers - Monitor utilization of funds	- Overall supervision of the ESAF and its implementation and M&E - Facilitation and coordination with various line departments and other agencies - Provide directions/advice to the PMU and DIU to ensure smooth/ efficient project operation on environment and social consideration - Periodical checks and due diligence on safeguards reports and monitoring data.
Project Management Unit (PMU) at State Level	- Project implementation, supervision and monitoring of all activities. - Documentation and reporting	- Report to concerned departments in the state government as well as to JICA in relation to environmental and social considerations - Consultation and guidance to DoF/DIU/cooperative Organizations and field level officers on information disclosure and consultation - Technical guidelines on beneficiary selection, safeguard checks/ guidelines for particular activities (if required) - Development of planning/ monitoring forms, review of monitoring data, reporting, assistance with evaluations - Finalize criteria for categorization (Category B or C) as per JICA Guidelines. - Review of participatory environmental and social assessments - Performance of due diligence follow-up - Guide, instruct, prepare guidelines, establish and operate M&E, disseminate project information, hand-holding support in the field for all project activities.
District Fisheries development Office	- Function as the dedicated and extended wing of the PMU for project implementation at the district level and as a subordinate office of the autonomous society. - Facilitate project implementation at the district level, and would extend all technical inputs and guidance to the cooperative of Farmers Organizations etc.	- Coordinate, monitor and supervise the ESC relevant activities at the district level - Conduct the screening and selection of subcomponents and determine the required procedures for specific components following the guidance/instruction of the PMU - Liaise with other line departments at the appropriate level for inter-sectoral convergence - Provide any specific support required for implementation and monitoring of the Project - Coordinate with subject matter experts
Project Operation and Management Office at DIU	Support the DIU and facilitate project implementation at district level, and would extend all technical inputs and guidance to the field level organizations as and when required and through regular review meetings, frequency of which to be determined during the preparatory phase of the Project	- Coordinate, monitor and supervise the ESC relevant activities at the district level, including the screening and selection of components and determination of the required procedures for specific components following the guidance/instruction of DMU - Liaise with other line departments at the appropriate level for inter-sector convergence - Provide any specific support required for implementation and monitoring of the Project.
Cooperative of Farmers organization	- Assist in selecting target beneficiaries - Clarify local needs and expectations on the Project	- Conceive and raise awareness in the locality on environmental and social considerations. - Provide support in micro planning activities at the components level - Participate in environmental and social assessments - Support public consultation and due diligence checks

Source: Prepared by the JICA Survey Team

As mentioned earlier, DoF does not have any dedicated units or personnel for the purpose of ESC. Hence, one specialist and nodal officers will support the PMU and DIU for the compliance of the environmental and social safeguards for its smooth and efficient implementation such as environmental and social assessment, and management and monitoring of the environmental and social aspects within the ambit of the Project, which are proposed as follows:

Environmental and Social Consideration Specialist: The expert is expected to support the PMU and DIU to review the project activities with focus on the compliance on ESAF, provide guidance and technical advice to the PMU and DIU for required environmental and social safeguard measures, as well as reporting to JICA to ensure smooth and efficient implementation of environmental and social safeguard measures.

Nodal Officers - Institutional Development at PMU and Project Operation and Management Officer at DIU: The project officers shall be engaged on contractual basis with the PMU and DIU from the initial preparatory phase of the Project. Once the project implementation begins, the nodal officers shall maintain the continuity of the introduced processes/measures during the intermittent period when the PMC Expert is not mobilized to the Project. The nodal officers will report to the Director under PMU who would be holding the additional charge to ensure the compliance of ESC. The officers will assist the PMU and DIU in the following aspects:

- i) To facilitate and coordinate with various implementation and line departments;
- ii) To update and finalize ESAF;
- iii) To supervise/ manage the project activities to ensure that the required procedures indicated in ESAF are followed properly. The experts may also be required to follow-up in the field, where particular issues are identified and report to PMU.

The institutional arrangement for safeguard monitoring system is more or less similar to the project component monitoring system. At the field level, monitoring and reviews will be conducted by the respective level implementing organization and report to DIU. Then, the DIU Officer shall compile the monitoring results that need to be reviewed regularly and report to the PMU, which shall analyze the result and share to the concerned departments in the state government as well as in a form of annual report to JICA. The organization chart cum safeguard flow is shown in Attachment 4-2.

8.5.3 Draft Environmental and Social Management System Checklist

As mentioned above, the PMU shall mobilize nodal officers at the preparatory phase of the Project and the experts shall support the PMU and DIU for the finalization of the ESAF document, which fully addresses all issues arising under the Project and its activities/components. Mitigation measures will be built into the project component design and implementation. Under the Project, as mentioned above, the overall coordination and support for ESAF will be provided through the PMU headed by the Director, who would be entrusted with additional responsibility to ensure implementation and monitoring and compliance of the ESAF during the project implementation. Under the supervision of the PMU, nodal officers will look after the environmental and social safeguard aspects in support with the Subject Matter DFDO for their activities in each designated work field. In order to examine the proposed institutional arrangement and enhance its system, the draft Environmental Social Management System (ESMS) checklist for the Project has been prepared and depicted in Attachment 4-3.

8.6 Draft Environmental and Social Impact Assessment Framework (ESAF)

8.6.1 Overview

Under the Project, it is anticipated to have multi-sectoral interventions and activities, that would be implemented at several sites with many components and activities, although many of these are yet to be defined in detail component site location, size/scope of the activity. In these circumstances, it would be inappropriate at this stage of the project preparation to assess the environmental and social impacts and propose detailed management and mitigation measures. Considering the present status, the JICA Survey Team, however, assessed the broad types of activities proposed and outlined the procedures to manage and mitigate potential risks associated with the activity during the project implementation. Accordingly, ESAF, which provides guidance on the appropriate management and mitigation measures against environmental and social risks, was prepared as the main safeguard instrument considering the existing

environmental and social management systems in India and Assam State as well as the JICA requirements.

8.6.2 Structure

The ESAF of the Project is structured as follows, while the draft ESAF with detailed measures and procedures is presented in Attachment 4-4.

- i) Project Summary Description will describe the project objectives, project components and expected outcomes, and phasing of Project.
- ii) Environmental and Social Consideration Policies of JICA: briefly describes JICA's environmental and social safeguard policies and clarifies how the Project shall be categorized and what types of measures will be required.
- iii) Existing Environmental and Social Management Systems: Outline the legal and policy context for environmental and social safeguard in India as well as in the Assam State.
- iv) Environmental and Social Considerations and Potential Impacts: details-out the environmental and social considerations within the Project and assessment of positive and negative impacts.
- v) Environmental and Social Management Measures and Monitoring: explains the procedures to be followed to manage and monitor environmental and social aspects.
- vi) Environmental Management Plan and Environmental Monitoring Plan: describes the management measures adopted for various environmental concerns, risks associated with the Project/subcomponent activities and monitoring plans to address environmental concerns (a draft monitoring form is Attachment 4-5).
- vii) Institutional Arrangement and Capacity Development for ESAF: identifies the recommended institutional arrangement and capacity development and training requirements for effective implementation of the ESAF.
- viii) Consultations and Participation: describes the mechanisms for consultations and participation.
- ix) Grievance Redress Mechanism: identifies the available and suggested mechanisms for grievance redressal, and
- x) Cost Estimation and Budget Allocation: identifies the required cost to implement ESAF, with the estimation of the necessary human resources and capacity development program, and its budget allocation.

8.6.3 Target Social Groups

The ESAF shall be applicable to all communities and people from all social groups within the project area. The draft framework is designed to ensure their participation in the course of the project implementation and include as beneficiaries as well as to avoid/mitigate any negative impacts due to the Project and its activities. The ESAF indicates the key groups identified in the framework to address environmental and social considerations.

Chapter 9 Recommendations

Implementation of technical cooperation project

During the Survey, there was a significant reduction in project costs [REDACTED]. Accordingly, the number of months of PMC assignments has to be reduced due to budgetary constraints, and it is anticipated that almost all of the assignments will be spent on the smooth operation of the activities of sub-components.

The sub-components concerning the hatchery certification system, blue tourism, and the private partnerships including Japanese companies are areas where the precedent and knowledge accumulation is particularly limited in Assam. On the other hand, since these fields are the ones in which Japan has a wealth of knowledge, it is therefore desirable to dispatch individual experts in accordance with the implementation of this project with the aim of maximizing and consolidating the project effects by providing technical advice and transfer.

Implementation of second phase

The Project had to be scaled down [REDACTED], as directed by the Central Government of India. As a result, all Beel-related activities were transferred to SWIFT and deleted from the Project, as well as much of the supply chain-related infrastructure development will be implemented in PMMSY, leaving only aquaculture activities, a part of supply chain and fisheries administration & training infrastructure in the project. Also, only 8 out of 35 districts were covered instead of all the districts. Therefore, in order to achieve balanced fisheries development in Assam State as a whole, it is essential to implement the second phase of the project based on the results of the Project first phase. Specifically, it is proposed;

- i) To expand the target districts with maintain the productivity realized by first phase.
- ii) Work on the development of other water bodies as mentioned in Figure 4-1, such as Derelict water, which have potential but have been left out of other project schemes. Namely in the second phase, it is recommended to exploit derelict water body and convert them to aquaculture ponds. So that ponds area will be increased, and fish production will grow more together with the improvement of productivity implemented in first phase.
- iii) To add/adopt the components demonstrated in sub-components 1-4 (new species in polyculture) and findings in sub-components 1-5 such as efficient production by using Biofloc.

Flexible project implementation considering seasonality of activities

Assam State is not necessarily suitable for aquaculture activities due to cold winter season and low water temperature period. It is advisable to flexibly adjust the implementation plan to avoid the low temperatures period as much as possible for production of fries, which are vulnerable to the environment, not to mention adult fish, which have a large body size and are highly adaptable to the environment. In addition, the summer monsoon season brings heavy rainfall and thus road conditions deteriorate, so infrastructure construction and other works should be avoided as much as possible during this period.

Collaboration with relevant organizations in India

As India is the second largest inland aquaculture producer in the world, it has excellent research and technology development institutions in the country. In particular, the CIFA in Odisha State is promoting the breeding of aquaculture species and supplying quality varieties to the sector. Aquaculture production is not only about technology itself, but also about good seed and good feed. In order to ensure the success of the project and thus increase aquaculture production in Assam as a whole, it is important to work closely with relevant institutions and actively promote the use of quality breeds.

Collaboration with relevant fisheries development schemes in and out of the country

As for fisheries promotion schemes in Assam, SWIFT financed by ADB and PMMSY financed by the Government of India are working concurrently; PMMSY has been actively promoting aquaculture sector investment ahead of the others, and it is essential to work in collaboration or in different ways on a case-by-case basis. In addition, as the fields of intervention are different from those of SWIFT, there will still be areas where collaboration is possible and areas where it is not. Where collaboration is possible, it will be done as a matter of course, but for those areas where collaboration is not possible,

adjustments should be made so that there is no competition for personnel over the limited number of DOF staff (at the state, district and block level).

Increasing the number and strengthening the capacity of DoF staff

Currently, the number and capacity of DOF staff is extremely weak, especially at the district and block level. The State Government of Assam should first increase the number of staff and promote human resource development. With regard to the latter point, various training programs are planned within the Project, and their capacity can be strengthened through the implementation of these programs and on-the-job training during the implementation of the Project .

DX promotion

The exit management with smooth transition of system execution (with controls over application and data) and handing over of entire setup will be done through-

- Determination of the project completion as per scope and contract condition
The project team will review the status of project and confirm the completion of work as per the contract for further handing over and exit of vendor. If any extension is required based on additional scope or determination, then the exit of vendor will be extended accordingly.
- Documentation with handing over items / information check-list
The project team will prepare the list of items / information identified for handing over with the DX system for further operational and monitoring requirements through recorded meetings and knowledge sharing sessions during the period and before the date of contract completion.
- Transition of the responsibilities
The responsibilities, functional management and control, data and other administrative control are transferred to the vendor's (Implementation team) to the project team (or its identified / nominated) representatives subject to the expertise, experience as well as system training.
- Transfer of rights and authority
The project team will determine legal credentials and required regulatory compliance for transfer of DX system from vendor to the DoF for further execution and Management.
- Knowledge Transfer trainings
The project team will determine the status of expertise of identified and nominated officers for taking over the system and level of knowledge gain through routine trainings during the implementation as well as operational period. Further, if additional training is required then the project team will recommend the same, and vendor will arrange it as a priority within the period of handing over passé.
- Operation and Management (post-completion of JICA loan project)
The DoF has no dedicated IT department of resources to handle the system. Also, the technical expertise is also limited w.r.t. handling of the IT setup and applications. However, the training and capacity-building activities have been carefully designed and incorporated in the proposal to build the overall capacity of the department. This is also recommended that DoF requested the Department of IT – Asam / NIC to provide technical expertise post contract completion to taking of handing over as well as to manage the DX system for further operation continuity.
The proposed system will be designed and implemented to manage all the activities by the DoF for the government (department itself), the citizen (Beneficiaries) as well as the business entities related to DoF. The proposed system will be implemented with operational support by the vendors during the period of contract. However, to ensure the smooth functioning of the implemented system with data, the handing over of the system to the department user with proper exit management is hereby proposed with this document.

Environmental and Social Consideration

Referring to the EIA Notification (2020), all projects and activities are broadly categorized into three categories, i.e., Category A, B1, and B2, based on the spatial extent of potential impacts on human health as well as natural and man-made resources. In case a project is classified as Category B2, environmental survey and environmental clearance issued by the State Environment Impact Assessment Authority are not necessary. The Project has several activities, e.g., construction of facility etc., but the area of the subcomponent is not large, the largest facility in the subcomponent is only 350 m². Therefore, the Project might be classified as Category B2. However, Introduction and construction of facilities may cause noise and working accident. Therefore, environmental and social impacts should be considered after the selection of component site with further information.

JICA Environmental and Social Guidelines will be classified the project as Category C. The JICA Guidelines do not require Initial Environmental Examination (IEE) for Category C projects. This project aims to be funded by JICA, but it is deemed that IEE is basically not necessary. However, the project should involve stakeholders and fully explain the project at the component sites.

In the meantime, as final location and contents of the components would not be determined before the JICA loan agreement, the IEE cannot be conducted during this survey (F/S) stage. This survey will review the environmental and social impact assessment framework and collect information on environmental and social considerations so that necessary mitigation measures will be taken just after specifying the components. If a component is regarded as Category A or B, the project is required to conduct environmental and social considerations study.

The ToR of the JICA Survey requires to prepare the criteria for selection of components from the viewpoint of environmental and social considerations and establish the environmental and social impact assessment framework. Classification of the category for each component and necessary environmental and social consideration measures are determined/prepared through two steps, i.e., the F/S period and detailed design period, in accordance with the ToR. Hence, it is difficult to determine the necessity of environmental and social study during the F/S stage, and the decision will be made after the selection of the components using the framework.

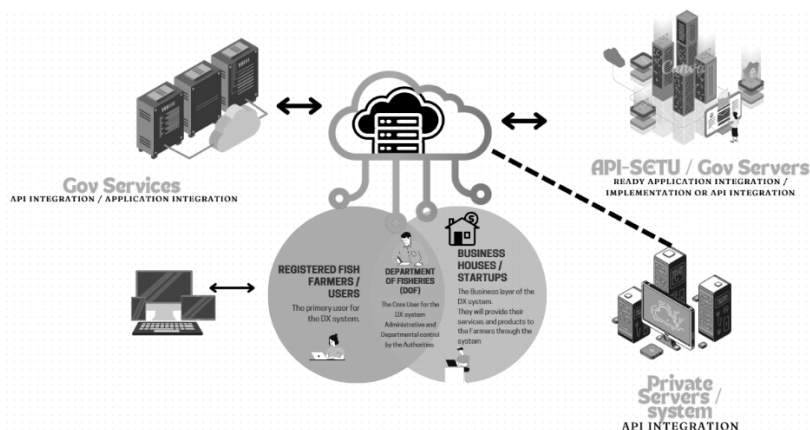
The DPR mentions that EIA and IEE are not necessary with preliminary screening even though present situations at sites and original designs are not clear. After the selection of the components site with original designs, screening at each component must be implemented; therefore, the F/S survey should collect environmental and social information and predict possible necessary procedures to make provision for smooth implementation of the project. The environmental checklist is given in Attachment 4-6.

ATTACHMENTS

Attachment 1: Details of DX component

(1) Proposed DX System Description

The proposed DX system provides ease of doing business for all the stakeholders under the DoF. The interface of the system will provide functional access to the registered farmers with administrative control of DoF. Also, the system will provide a platform for the business entities to do business with the farmers through the DX platform. Below is the graphical layout of the proposed interface for the stakeholders:



Graphical layout of the proposed DX system

As above indicated, the proposed DX system will be design based on available IT building blocks managed and maintained by the Government of India as well as states with support of “India Stack”(an unified software platform, the first national digital infrastructure in the world, offering a low-cost digital push), InDEA and “API Setu Program”.

The API Setu program is an initiative of the Government of India to promote the development and adoption of Application Programming Interfaces (APIs¹) in various domains and sectors. APIs are standardized interfaces that allow different software applications to communicate and exchange data with each other. The API Setu program aims to create a national API ecosystem that enables seamless integration and interoperability of various government and private services, such as health, education, agriculture, finance, etc. The program also provides guidelines and best practices for designing, developing, publishing, and consuming APIs in a secure and scalable manner.

The proposed DX system will leverage the API Setu program to access and provide various digital services across different levels of governance and administration. The system will use the available IT building blocks and platforms managed and maintained by the Government of India and the states, such as the India Enterprise Architecture (INDeA), the Digital Service Delivery Platform (DSDP), the e-Governance Service Delivery Gateway (eGSDG), the National Data Sharing and Accessibility Policy (NDSAP), the National e-Governance Services Ltd. (NeSL), the Ministry of Electronics and Information Technology (MeitY), etc. These platforms and policies will ensure the standardization, security, scalability, and sustainability of the DX system and its components.

The key modules under the DX system will be as follows;

1) User Management Module:

The User Management Module will be the core module for registration, profile-based record management and provide access to applications based on authorization and role matrix. This module will provide the following functionality:

¹ An API, or application programming interface, is a set of rules or protocols that enables software applications to communicate with each other to exchange data, features and functionality.

- It will allow the users (all the stakeholders) to register on the DX system using their Aadhaar number, mobile number, email address with one-time password (OTP) verification. In this registration process, the system will be integrated with the “Unique Identification Authority of India (UIDAI)” server for verification and authentication of registered data at server. The department user will be registered o based on the designation and records available with the department. This platform will adopt single SSO access of the system based on role matrix for all the users, including government officers, fishery producers and business stakeholders. In the registration process, users will be required to select their status with some personal information. Thereafter, users will access the designated portal separated by their status.
- It will verify the identity and eligibility of the users using the API Setu program and the relevant databases of the government and the states.
- It will assign a unique user ID and password to each user and store their profile information, such as name, address, date of birth, gender, etc., in a secure database.
- It will enable the users to update their profile information, reset their password, and manage their preferences and settings on the DX system.
- It will provide the users with access to various digital services offered by the DX system based on their identity, eligibility, and consent, to analyze the records with logs of usage and feedback of the users and generate reports and analytics for Management Information System (MIS).

2) Farmers’ ID Registration and Management

The fish producer’s registration as well as to issue their ID (Registration Card) will be the key point of the DX system to set up the profile and assign required functionality. This feature will allow the fish farmers to generate and manage their ID card (in the DoF prescribed format) through the DX system, which will verify their identity and eligibility as fish farmers or fishers in Assam. The registration process will require the user’s registration with Adhar Number, DoF related information and bank account number, etc., as well as their farm or fishing details, such as location, size, production, species, etc. The registration to issue Fishers’ ID and Pond Health Card requires following information; name, address, size of farms (number and area of ponds), ownership of land, target species, approximate production of previous year (table fish and seeds, respectively), any support taken from Government/ other funding institutions with its details (such as year, name of scheme, amount received etc), training received if any.

The users will also need to upload their latest photograph and signature for the ID card. This Card will also provide the Digital Code and QR Code for DX related transaction purposes through mobile etc. After the registration is completed, the users will receive a confirmation message and a QR code, which they can use to collect their physical ID card from the nearest DoF office. Also, the digital card will be available online for download and digital use for services offered through DX system. The ID card will have a unique identification number and a barcode, which will link to their digital profile on the DX system.

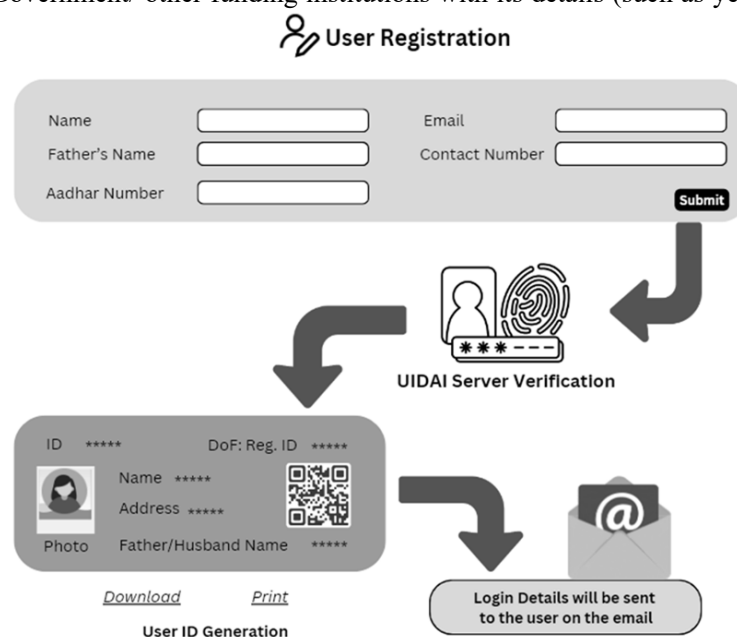


Figure : Process of User Registration

The users can also manage their ID card information and business records through the DX system. They can update their profile information, reset their password, and manage their preferences and settings on the DX system. They can also view their history of applications, transactions, and interactions with the DoF and other institutions. They can also access various digital services offered by the DX system based on their identity, eligibility, and consent, such as applying for government schemes, receiving input support, accessing technical information, requesting loans, etc. The DX system will also analyze the records with logs of usage and feedback of the users and generate reports and analytics for MIS. The recording system of their farming activities will be incorporated with Farmers' ID. Therefore, the user can record and track their farming activities in the system, such as their pond information, their income/expense, pond health status, etc.

The farmers can be provided with the information of various Government schemes/ programs and apply for obtaining various supports and benefits from the Assam Government and relevant institutional organizations. Those supports will include timely input support, distribution of technical information & materials, attesting upon the loan application, etc. For DoF, the list of registered ID Card holders to be maintained at district level mainly will be the basis for selection of beneficiaries in the development projects in future. It will also be utilized as a statistical reference.

Furthermore, the User management will provide a platform to register the group of fish farmers like FPOs / FPCs, Aqua Culture Labs and other stakeholders who are associated in the fish farming business and its support services. In this section they will manage and maintain their credentials and information duly verified by the department (like submission through login with relevant documents/ information that will be verified and approved by the DoF in the system.).

3) Document Management Module:

The DX system will enable the department users and stakeholders (like fish farmers, FPOs, business Users etc.) to upload, download, share, and manage various documents related to fish farming. The documents may include reports, certificates, licenses, permits, bills, receipts, invoices, agreements, contracts, etc. The system will provide features such as document categorization, tagging, searching, filtering, sorting, editing, versioning, and archiving. The system will also ensure the security and confidentiality of the documents by applying access control and encryption mechanisms. The users and stakeholders will be able to access the documents through their respective dashboards and profiles. The system will also generate notifications and alerts for any document-related activities or tasks. The document management functionality will facilitate smooth and efficient communication and coordination among the department users and stakeholders, as well as improve the transparency and accountability of the fish farming sector.

4) Digital Learning Management System

A digital learning management system (DLMS) that facilitates the delivery, tracking, and evaluation of online learning courses and programs for the employees. The DLMS allows the employees to access various learning materials, such as videos, slides, quizzes, and assignments, at their own pace and convenience. The DLMS also provides the trainers and managers with tools to monitor the learners' progress, performance, and feedback, and generate reports and analytics. The DLMS is aligned with the competency-based learning framework and the career development plan of the organization. The training and extension will be provided in the system to stakeholders, which includes government officers, farmers, and other related beneficiaries. The services will include.

- Application system for technical trainings, or extension services
- Online training and webinar
- Online publication of training and extension materials
- Online technical consultation counter, etc.

5) Realtime Dashboard and Reporting (with Analytics)

The statistical data collection will be digitalized in the system. The data collection process of district officers will be supported by the mobile system of the digital platform. In addition, the collected data will be published in the dashboard in a real time manner, so that anyone can access the data in Assam state. The dashboard will also include official documents (policy, law, notification, etc.), or any other publications from DoF.

6) Program / Project Management

The program and project management module will enable the DoF to plan, monitor, and evaluate the progress (Physical work done as well finance progress) and performance of its programs and projects, as well as the budget allocation and expenditure. The module will allow the DoF to define the objectives, indicators, targets, and milestones for each program and project, and link them to the strategic goals and outcomes of the department.

The module will also enable the DoF to track the activities, deliverables, risks, issues, and dependencies of each program and project, and generate reports and dashboards to visualize the status and results. This module will integrate with the e-inventory and e-accounting and payment modules to ensure the accuracy and consistency of the financial data and transactions related to the programs and projects. The module will facilitate the collaboration and communication among the stakeholders involved in the programs and projects, such as the DoF staff, the beneficiaries, the donors, the contractors, and the auditors.

7) The other key modules for DoF as well as other authorized users:

The proposed DX system will be implemented based on available common building blocks as well as with integration of other services. Under the “InDEA”, Common Building Blocks and Reference Building Blocks (generic applications) are available that help increase productivity or provide shared infrastructure environment, and tools that enable build applications. A set of these readily available applications, tools and infrastructure is proposed to be adopted/ adapted to be part of the InDEA Architecture.

S. No	Common/Reference Building Block of InDEA 2.0	Functionality
1	e-Office	• Creates paperless environment through e-Files. • Complies with all the office procedures prescribed by Central/ State Secretariat Office manuals. • Well stabilized and user-friendly • Complies with security and confidentiality requirements. • Can be launched in a short time of 4 to 8 weeks for small to large offices (10 users to 10,000+ users) • Maintained by NIC at notified licensing cost per user
2	KMS (Knowledge Management System)	• Bundled along with e-Office. • Enables systematic organization of knowledge of the Ministry or department for easy access by the employees while processing the files. • Knowledge includes Office Memos, policy documents, domain-specific knowledge
3	LMS (Learning Management System)	• Designed and developed by NIC, based on LMS Standards • Currently contains several courses, one Governance. • The Ministry can host a wide variety of courses and content on the agriculture domain that can be used across the country. • Can be a useful tool for self-paced capacity building.
4	Search Engine	• Under development by NIC/MeitY
5	Payment Gateway	• UPI and BHIM can be leveraged
6	Service Plus	• A platform for rapid development and deployment of digital services - G2C and G2B • Deployed by several Ministries and Governments. • Developed and supported by NIC

S. No	Common/Reference Building Block of InDEA 2.0	Functionality
7	Language Tools	• A set of tools called 'Bhasha' that provide capabilities for translation, building of websites in local languages. • Useful in sending communications to the farmers in their language. • Compliant with relevant Standards.
8	Consent Manager	Developed to comply with the Consent requirements under the privacy laws. • Critical for ensuring that all projects relating to data sharing comply with the applicable regulations. • Well, established through its extensive use in Digi Locker
9	E-Mail	• e-mail system developed by NIC on Outlook platform. • Can enable the Ministry to enforce the email policy of the GoI strictly across all its offices.

Employee Record Management (HRMS): The Employee Management functionality under the DX system will enable the DoF to digitize and automate the processes related to work management, attendance, task management, performance evaluation, payroll, benefits, leave, transfer, and Retirement record of the staff. The functionality will also provide a self-service portal for the employees to access and update their personal information, view their pay slips, and tax deductions, apply for leave and reimbursements, and submit feedback and grievances.

E-File system (with e-Office): An e-file system will be integrated and implemented under InDEA2 program, GoI, and it will allow the employees to upload, store, share, and manage their work documents electronically, and ensures the security, privacy, and accessibility of the files. The e-file system also enables the automation of workflows, such as approval, review, and feedback processes, and reduces the paper consumption and clutter in the organization. The e-file system is designed to meet the department-specific requirements and standards under the DX initiative.

E-Community: With this module users can create and join online communities of interest and practice within the system through SSO, where they can share knowledge, resources, experiences, and opinions with other users who have similar interests or expertise.

E-Communication: This module will work as a communication layer in the DX system and support all the modules with its functionalities. This will enable users to communicate and collaborate with internal and external stakeholders, as well as receive timely and relevant notifications about various events and activities.

News & Media Management: The News and Media Management module under DX will provide comprehensive solution for collaborating, managing, publishing, and distributing news and media content across multiple channels and platforms.

eMarketing and event Management: The module will allow the DoF authorities to create and manage events such as fairs, melas, exhibitions, workshops, seminars, conferences, etc. related to fisheries and aquaculture. The module will also integrate with the e-Marketing and e-Procurement modules to support the DoF authorities to showcase and sell the products and services of the fisheries and aquaculture sector during the events. The module will enable the DoF authorities to create and manage the stalls, booths, kiosks, etc. for displaying and selling the products and services.

E-procurement & Inventory: The module will be providing the facility to the user to purchase or sell the production, required raw materials, equipment, and services through the online platform. The platform will enable the users to compare the prices, quality, and availability of various suppliers and service providers and select the best option for their needs. The platform will also facilitate the bidding, tendering, and contracting processes for the procurement of goods and services. The platform will integrate with the government platforms such as GeM (Government e-Marketplace), e-NAM (National Agriculture Market), and e-RAKAM (e-Rashtriya Kisan Agri Mandi) to provide the users with access to a wider range of products and services.

The platform will also integrate with third-party platforms such as Amazon and Flipkart to offer the users more choices and convenience.

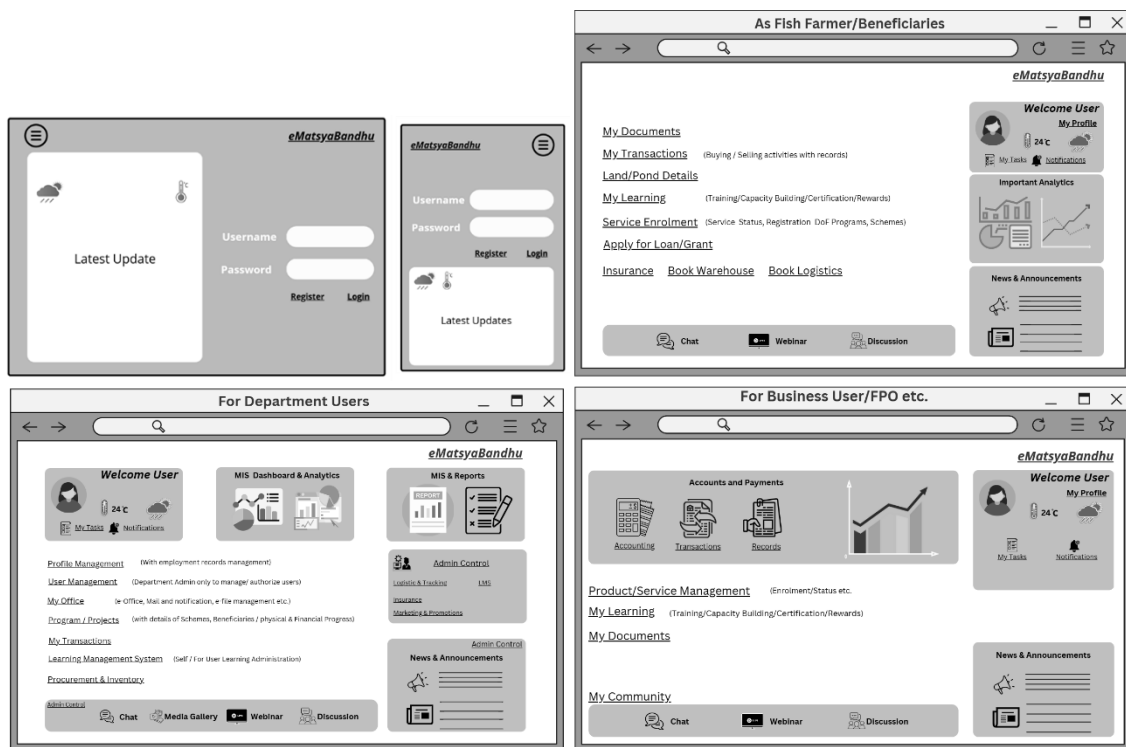
E-Accounting and Payment Module: The users will manage their financial transactions related to their buy / sale the production or required raw material, payment against services procured through DX system (like Insurance, fish foods, rent payment for storage, fee payment for logistics etc.) online. The module integrates with the Unified Payments Interface (UPI) and the users' bank accounts to facilitate the payment of freight charges, taxes, duties, insurance premiums, and other fees. The module also allows the users to receive refunds, incentives, and subsidies (Direct Benefit Transfer) from the government or other agencies. The module generates and maintains the digital invoices, receipts, and statements for all the transactions and provides the users with the option of downloading them anytime. The module integrates with the e-Insurance and Program / Project Management modules to automatically update the payment status and budget utilization of the consignments, programs, and projects.

Logistics and Tracking: This module enables the users to book and track their consignments online using a web-based interface. The module allows the users to enter the details of the sender, receiver, origin, destination, weight, volume, type, and value of the goods. The module also generates a unique consignment number and a QR code for each booking. The users can track the status and location of their consignments using the consignment number or the QR code. The module also provides the users with notifications and alerts on any changes or delays in the delivery process. The module integrates with the e-Insurance and e-Accounting modules to provide the users with the option of insuring their consignments and paying for the transportation services online.

E-Insurance: The users can avail insurance for their production from registered insurance companies online at DX system. The module allows the users to compare the insurance plans and premiums offered by different insurers and select the best option for their needs. The module also facilitates the online payment of the insurance premiums and the generation of the insurance policy documents. The users can view and download their insurance policies anytime from their dashboard. The module also provides the users with the option of filing claims online in case of any damage or loss of their consignments. The module also notifies the users about the status and progress of their claims. This can integrate with third party insurance provider companies (like policy Bazar etc.) to provide their services with user login.

8) Graphical User Interfaces

Below are the Mid fidelity wireframes being for your reference and understanding only about the functionality including all three interfaces: (System access will also be available on the Department Web portal through login.)



Note: In the above image, the information, and Tags (App Name) is for representation only and does not have any legal value

Image of Graphical User Interface (Web and Mobile)

(2) Project Activities, Timeline for Development and Implementation of DX System:

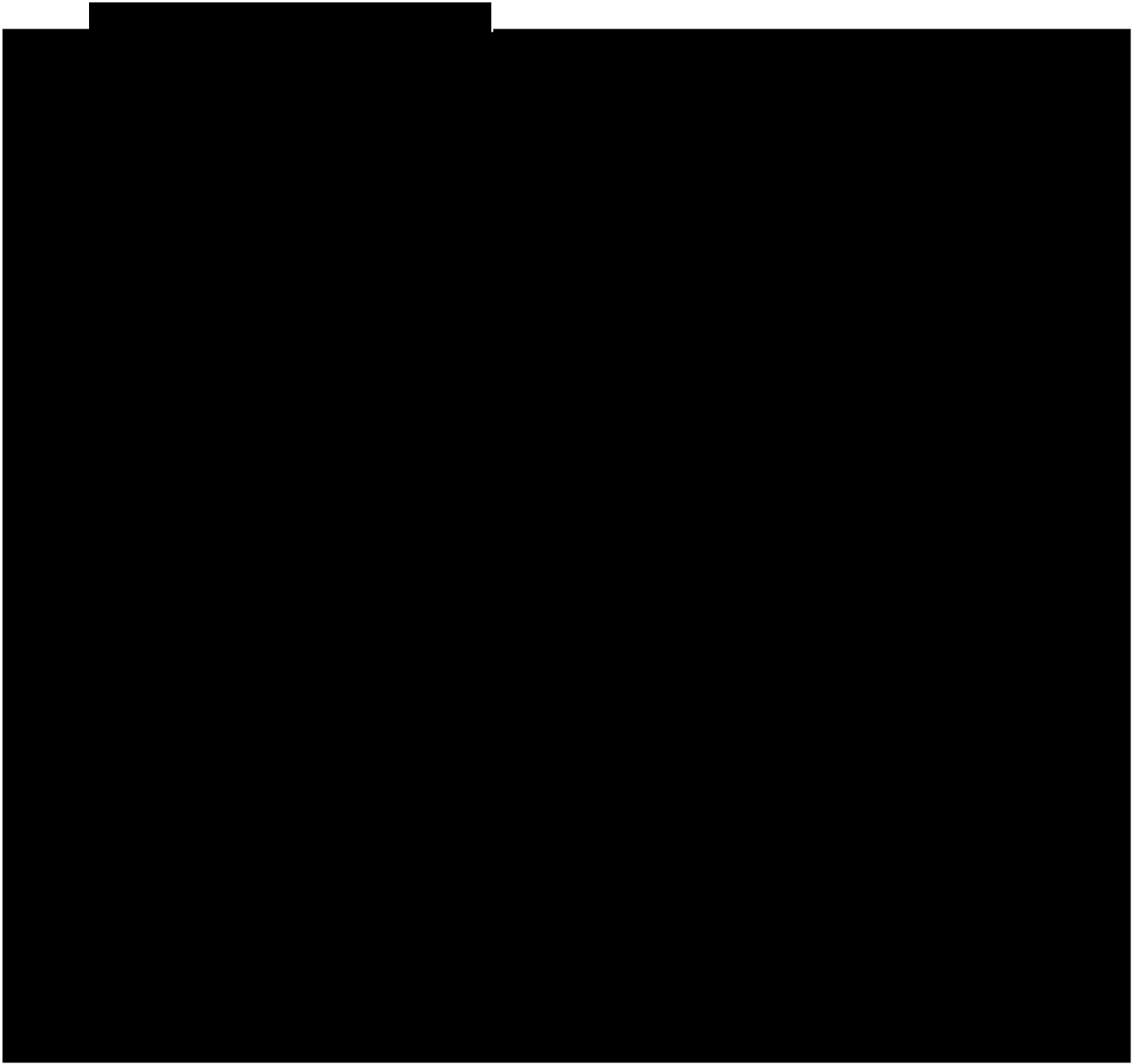
The following table summarizes the functionalities and the timeline to implement and manage the DX system for the DoF.

Functionality	Description	Timeline
Setup for implementation of DX system	Administrative arrangement and mobilization of Vendor's team	
Requirement Gathering	Understanding the requirements coordinated with the existing infra and proposed functionality for the proposed system.	
Designing and Submission of required document	Submission of System document (including system design document (SDD), System Resource Specifications (SRS), Data flow diagram document (DFD) etc.) to start development / customization and implementation of the DX system	
Development / Customization and Implementation of the system (with Pilot Testing)	Development, Customization and go-live of the system at production for UAT	
Workflow Automation	Process and workflow will be identified and configure as per the existing department working and hierarchy for implementation, in the system.	
Data Digitization & Migration	The data will be digitized and optimized for migration from the existing system to the new DX system with data quality and integrity.	
Data Analytics	The Dashboard and MIS will be designed based on identified KPI and other information heads for DoF Authorities w.r.t. the Department activities as well as program/ project activities for decision making and performance monitoring.	
Portal Development	The Web Interface will be developed and integrated with the existing Department site and maintaining the web portal and mobile app for the DoF, which will provide online access and information to the stakeholders, such as citizens, businesses, and department officials.	
Policy Formulation for Farmers' ID	The policy for Farmers' ID registration will be formulated in parallel with system development.	
Training and Capacity Building	The training and capacity building activities will be conducted to the DoF staff and users on how to use the DX system effectively and efficiently.	
Maintenance and Support	All technical support will be provided to manage and maintain the system for error free efficient operations of DX.	
Exit Management and Handover	The DX system will be handed over to the DoF with proper documentation and knowledge transfer and ensuring the sustainability and scalability of the system.	

Attachment 2: Human resource of target districts

[illegible]

Attachment 3: Economic cost budget



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



Annual Benefit (Production) (Unit: INR Million)	Annual O&M Cost (Unit: INR Million)	Discount Rate
363	10	i = 6.0%

Cash Flow (Economic price)											Present Value (Unit: INR Million)			Economic Value Indicators (Unit for NPV: INR Million)			
Year	Procurement / Construction	Consultant	Cost			Total Cost	Benefit Production	Benefit CO2 Sequestration	Total Benefit	Net Benefit	Total Cost	Total Benefit	Net Benefit	Net Present Value (NPV)	1,598		
			Adm	O&M	Replacement												
1 2025	192	0	9	0	0	201	0	0	0	-201	190	0	-190	Benefit / Cost Ratio (B/C)	1.96		
2 2026	376	39	21	3	0	439	0	0	0	-439	390	0	-390				
3 2027	376	44	21	5	0	446	10	0	10	-437	375	8	-367				
4 2028	376	35	22	8	0	441	29	0	29	-412	349	23	-326	Economic Internal Rate of Return (E IRR)	12.9%		
5 2029	277	29	17	10	0	333	68	0	68	-265	249	51	-198				
6 2030	0	0	0	10	0	10	143	0.012	143	133	7	101	94				
7 2031	0	0	0	10	0	10	228	0.012	228	218	7	151	145	Sensitivity Analysis (E IRR)			
8 2032	0	0	0	10	0	10	300	0.012	300	290	6	188	182				
9 2033	0	0	0	10	0	10	349	0.012	349	339	6	207	201				
10 2034	0	0	0	10	0	10	363	0.012	364	354	6	203	197	Benefit			
11 2035	0	0	0	10	0	10	363	0.012	364	354	5	191	186				
12 2036	0	0	0	10	3	13	363	0.012	364	351	6	181	174				
13 2037	0	0	0	10	3	13	363	0.012	364	351	6	170	164	Cost			
14 2038	0	0	0	10	3	13	363	0.012	364	351	6	161	155				
15 2039	0	0	0	10	2	12	363	0.012	364	352	5	152	147				
16 2040	0	0	0	10	0	10	363	0.012	364	354	4	143	139	Base	12.9%		
17 2041	0	0	0	10	3	13	363	0.012	364	351	5	135	130				
18 2042	0	0	0	10	3	13	363	0.012	364	351	5	127	123				
19 2043	0	0	0	10	3	13	363	0.012	364	351	4	120	116	-10%	11.7%		
20 2044	0	0	0	10	2	12	363	0.012	364	352	4	113	110	10.7%	10.9%		
21 2045	0	0	0	10	0	10	363	0.012	364	354	3	107	104	9.7%	8.5%		
22 2046	0	0	0	10	3	13	363	0.012	364	351	4	101	97				
23 2047	0	0	0	10	3	13	363	0.012	364	351	3	95	92				
24 2048	0	0	0	10	3	13	363	0.012	364	351	3	90	87	-20%			
25 2049	0	0	0	10	2	12	363	0.012	364	352	3	85	82				
26 2050	0	0	0	10	0	10	363	0.012	364	354	2	80	78				
27 2051	0	0	0	10	3	13	363	0.012	364	351	3	75	73				
28 2052	0	0	0	10	3	13	363	0.012	364	351	3	71	69				
29 2053	0	0	0	10	3	13	363	0.012	364	351	2	67	65				
30 2054	0	0	0	10	2	12	363	0.012	364	352	2	63	61				
Total	1,597	147	90	276	44	2,154	8,760	0.308	8,760	6,606	1,662	3,260	1,598				

Attachment 4: Environmental and social considerations

Attachment 4-1 List of Project requiring prior Environment Clearance or Prior Environment Permission

Project	Category with threshold limit			Remark
	A	B1	B2	
1 (a) Mining of Minor Minerals	>100 hectare of mining lease area	> 5 hectares and ≤ 100 hectares of mining lease area	< 5 hectares of mining lease area	Note: (1) Mining of minor mineral projects with mine lease area more than 2 hectare and up to 5 ha shall be referred to Distract Level Expert Appraisal Committee (2) Mining lease area includes cluster situation
(b) Mining of Major Minerals including Coal	>100 hectare of mining lease area	≤ 100 hectares of mining lease area	Dump mining (excavation or handling of dump or overburden or waste material)	
2 Offshore and Onshore Oil & Gas including CBM and Shale Gas				
(a) Exploration	-	-	All projects	
(b) Development and Production (including infrastructure facilities e.g. Gas Collecting or Gathering Station, Early production Systems, pipelines, etc.).	All projects	-	-	
3 River Valley	>75 megawatts hydroelectric power generation;	≤ 75 megawatts >25 megawatts hydroelectric power generation;	Up to 25 Megawatts hydroelectric power generation	Note: Category 'B1' river valley projects falling in more than one State or Union Territory shall be appraised at the Central Government Level.
4 Irrigation	≥ 50,000 hectares of culturable command area	>10,000 hectares and <50,000 hectares of culturable command area.	> 2000 hectare and < 10,000 hectares of culturable command area.	
5 Thermal Power	≥ 500 megawatts (coal/lignite/naphtha & gas based); ≥ 100 megawatts (all other fuels).	> 5 megawatts and < 500 megawatts (coal / lignite / naphtha & gas based); ≥ 5 megawatts and <100 megawatts (all other fuels except biomass and municipal solid non-hazardous waste);		

Project		Category with threshold limit			Remark
		A	B1	B2	
			>15 megawatts and <100 megawatts (using municipal solid non-hazardous waste / biomass as fuel).	≥ 5 megawatts and ≤ 15 megawatts, based on biomass or non- hazardous municipal solid waste using auxiliary fuel such as coal, lignite/ petroleum products up to 15%.	
6	Nuclear Power or processing of nuclear fuel	All projects	-	-	
7	Coal washeries	≥ 1 million ton per annum throughput of coal	<1million ton per annum throughput of coal	-	Note: If Coal washery is located within mining lease area, the proposal shall be appraised together with the mining proposal.
8	(a) Mineral Beneficiation involving physical process and physicochemical processes	-	All projects	Small and Medium enterprises	Note: If Mineral Beneficiation plant located within mining lease area the proposal shall be appraised together with the mining proposal.
	(b) Chemical processing of ores/ concentrate	≥ 1.0 million ton per annum throughput	<1.0 million ton per annum throughput		
9	Pellet plants or agglomeration plants	-	All Projects	Small and Medium enterprises	
10	Metallurgical Industries (ferrous & non-ferrous)				
	(a) Integrated Plants Steel	> 1 million ton per annum of crude steel	≤ 1 million ton per annum of crude steel		
	(b) Sponge Iron Plants	>0.5million ton per annum	≤ 0.5million ton per annum		
	(c) Non-ferrous smelting and refining	All projects	-	-	
	(d) Ferro Alloy Plants	>1.5 Lakh ton per annum	≤1.5 Lakh ton per annum	-	
	(e) Secondary metallurgical industry (Toxic metals)	≥20,000 ton per annum	<20,000 ton per annum	-	
	(f) Secondary metallurgical industry (Nontoxic metals)	-	(i) Foundries involving furnaces such as Induction Furnace or Electric Arc Furnace or submerged arc furnace or other gas-based furnaces with capacity more than 1,50,000 ton per annum	(i) Foundries involving furnaces such as Induction Furnace or Electric Arc Furnace or Submerged arc furnace or other gas-based furnaces, with capacity more than 1,00,000 ton per annum to 1,50,000 ton per annum	

Project		Category with threshold limit			Remark
		A	B1	B2	
			(ii) Foundries involving furnaces such as cupola and other furnaces with capacity more than 1,00,000 ton per annum	(ii) Foundries involving furnaces such as cupola or other furnaces using coal with capacity more than 60, 000 ton per annum to 1,00,000 ton per annum (iii) Standalone rerolling mills involving pickling with a capacity more than 1,00,000 ton per annum. (iv) Standalone rerolling mills not involving pickling with a capacity more than 2, 00, 000 ton per annum. (v) Medium enterprises	
11	(a) Cement Plants	≥ 1.0 million ton per annum production capacity except plants with vertical shaft kiln.	(i) <1.0 million ton per annum production capacity (ii) All cement plants with vertical shaft kiln.	Small and Medium enterprises.	Note: Fuel for cement industry may be coal, petcoke, mixture of coal and petcoke and coprocessing of waste provided it meets the emission standards
	(b) Standalone clinker grinding units		≥ 1.0 million ton per annum production capacity	(i) Stand-alone grinding units up to 1 million ton per annum (ii) All standalone grinding units in case of transportation of clinker and finished product proposed through rail / sea mode. (iii) Small and Medium enterprises.	
12	Lead acid battery manufacturing (excluding assembling and charging of lead acid battery)	-	All projects	-	
13	Petroleum industry refining	All projects			
14	(a) Coke oven plants	≥ 0.8 million ton per annum	< 0.8 million ton per annum	-	
	(b) Coal Tar processing units or Calcination plants	-	All projects	-	

Project		Category with threshold limit			Remark
		A	B1	B2	
15	Asbestos milling and asbestos based products	All projects	-	-	
16	Chlor-alkali industry or Production of Halogens	≥300 ton per day production capacity if a unit located outside the notified industrial estates.	(i) ≥ 300 ton per day production capacity if a unit located within the notified industrial estates. (ii)	<300 ton per day production capacity if a unit located within the notified industrial estates.	Note: No new Mercury Cell based plants will be permitted and existing units converting to membrane cell technology are exempted from the Notification if provided there is no increase in the production capacity.
17	Soda ash Industry	All projects	-	-	
18	Skin/hide processing including tanning industry	All projects located outside the notified industrial estates.	All projects located within notified industrial estates.	All projects of leather production without tanning and located within the notified industrial estates.	
19	Chemical fertilizers and standalone ammonia plants.	(i) All projects except Single Super Phosphate including sulphuric acid. Standalone ammonia plants	Single Super Phosphate including sulphuric acid production.	-	
20	Manufacturing of Acids	Stand-alone phosphoric acid or ammonia.	Stand-alone sulphuric acid	All other acids	
21	Pesticides including insecticides; herbicides; weedicides; pest control; etc., and their specific intermediates (excluding formulations)	All projects located outside the notified industrial estates.	All projects located within the notified industrial estates.	-	
22	Petro-chemical complexes (industries based on processing of petroleum fractions, natural gas, production of carbon black)	All projects	-	-	
23	Manmade fibers manufacturing	Viscose Staple Fiber (VSF); Viscose Filament Yarn (VFY); and Rayon.	Nylon and Others	-	
24	Petroleum products and petrochemical based processing including production of carbon black and electrode grade graphite (processes other than cracking & reformation and not covered under the complexes)	All projects located outside the notified industrial estates.	All projects located within the notified industrial estates.	Medium enterprise	

Project	Category with threshold limit			Remark
	A	B1	B2	
25 Synthetic Organic Chemicals				
a) Dyes & dye intermediates	-	All projects except column (5)	(i) Projects proposed with zero liquid discharge and located within the notified industrial estates. (ii) All micro, small and medium enterprises.	
b) Bulk drugs and intermediates excluding drug formulations	-	All projects except column (5)	(i) Projects proposed with zero liquid discharge and located within the notified industrial estates. (ii) All micro, small and medium enterprises.	
c) Synthetic rubbers	All projects located outside the notified industrial estates.	All projects located within the notified industrial estates.	All micro, small and medium enterprises.	
d) Basic organic chemicals, other synthetic organic chemicals, chemical intermediates, synthetic resins and synthetic adhesives	All projects located outside the notified industrial estates.	All projects located within the notified industrial estates.	(i) All small and medium enterprises. (ii) Manufacturing of synthetic resins /adhesives up to 1000 ton per annum.	
26 Distilleries and molasses-based manufacturing units (e.g. Yeast)	(i) Molasses based distilleries ≥ 100 kilo liters per day; (ii) Molasses based manufacturing units (e.g. Yeast) ≥ 100 ton per day; (iii) Non-molasses based distilleries ≥ 200 kilo liter per day.	(i) Molasses based distilleries < 100 kilo liter per day. (ii) Molasses based Yeast manufacturing units < 100 ton per day (iii) Non-molasses based distilleries < 200 kilo liter per day	(i) Country Liquor (e.g. based on Mahua flower, Cashew, etc.) units more than capacity of 10 kilo liter per day. (ii) Expansion of distilleries within the premises, having earlier Prior Environment Clearance and for production of ethanol to be used as fuel for blending only.	
27 Manufacturing of paints, varnishes, pigments, intermediates (excluding blending / mixing)	All projects located outside the notified industrial estates.	All projects located within the notified industrial estates.	Medium enterprise	
28 Pulp & Paper Industry	Pulp manufacturing and Pulp & Paper manufacturing industry except from wastepaper	-	Paper manufacturing from wastepaper or ready pulp involving deinking or bleaching or decoloring.	

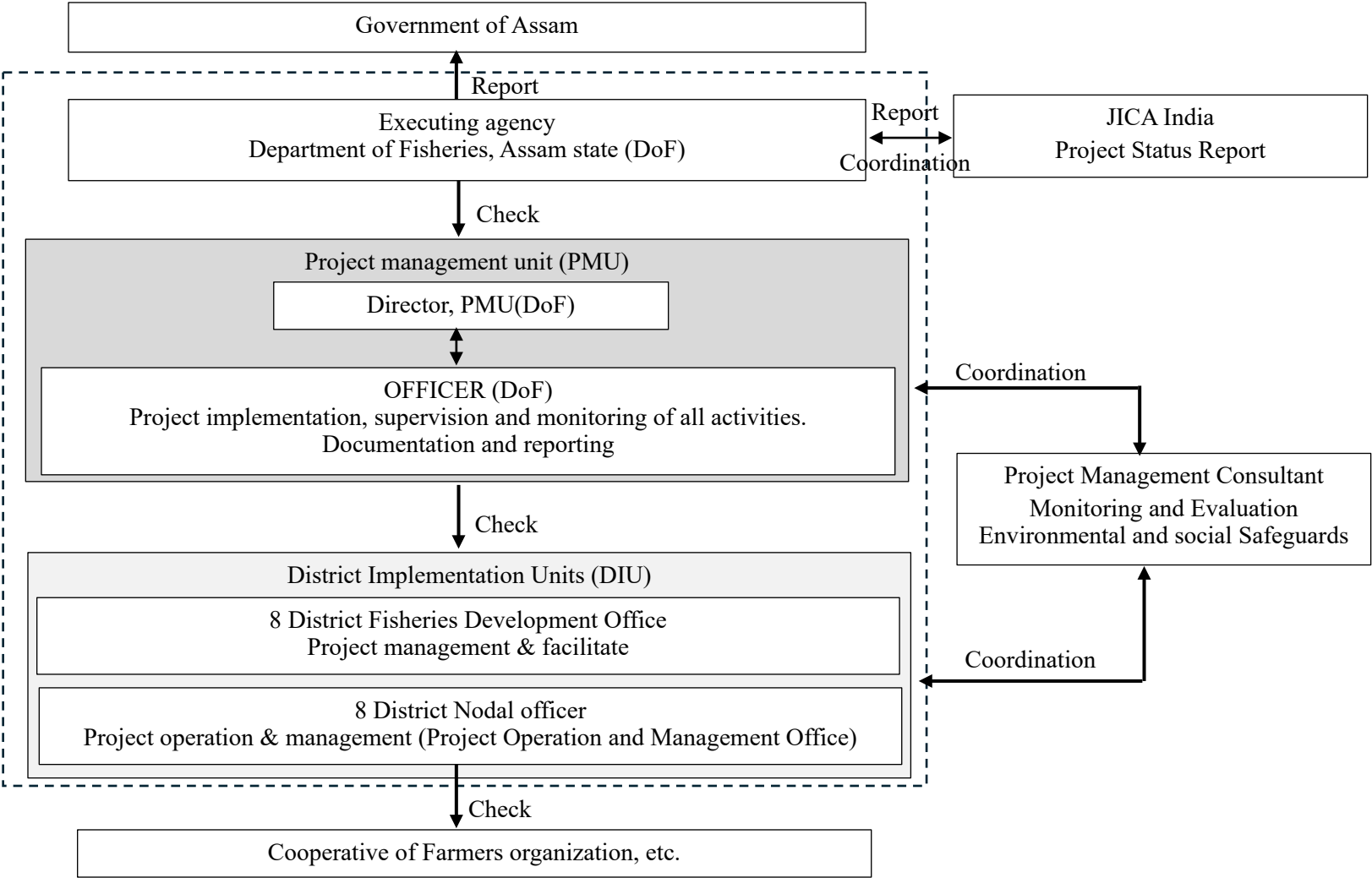
Project	Category with threshold limit			Remark
	A	B1	B2	
29 Sugar Industry	-	≥ 5000 ton of cane per day crushing capacity	-	
30 Manufacturing of explosives, detonators, fuses including management and handling activities		All projects		
31 Pipelines				
a) Oil & gas transportation pipeline (crude and refinery or petrochemical products), passing through national parks or sanctuaries or coral reefs or Ecologically Sensitive Areas.	All Projects	-	-	
b) Slurry pipelines (coal, lignite and other ores) passing through national parks or sanctuaries or coral reefs, Ecologically Sensitive Areas.	All Projects	-	-	
32 Airports and heliports including terrestrial and water ports	All projects including terrestrial airstrips, which are for commercial use.	-	Water aerodromes which are for commercial use. Heliports which are for commercial use.	
33 All ship breaking yards including ship breaking units	All projects	-	-	
34 Industrial Estate including parks; complexes; areas; export processing Zone (EPZs); Special Economic Zones (SEZs); Biotech Parks; Leather Complexes; Coastal Economic Zones (CEZs); Special Investment Region (SIR); National Investment and Manufacturing Zones (NIMZs); Industrial Cluster; Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs)	(i) If the area of proposed project is more than 500 hectares and houses at least one Category 'A' or Category 'B1' project listed in the schedule. (ii) If area of the proposed project is less than 500 hectares and houses at least one category 'A' project listed in the schedule.	If the area of the project is less than 500 hectares and houses at least one category 'B1' project listed in the schedule.	(i) If the area of the proposed project is more than 500 hectares and does not house category 'A' or 'B1' project listed in the schedule. (ii) Irrespective of the area of the proposed project and houses at least one Category 'B2' project listed in the schedule	
35 Common hazardous waste, Treatment, Storage and Disposal Facilities (TSDFs)	All integrated facilities having incineration & Landfill or incineration alone.	All facilities having land fill only.		

Project		Category with threshold limit			Remark
		A	B1	B2	
36	Common Bio Medical Waste Treatment Facilities	-	All projects		
37	Ports, harbors, breakwaters and capital dredging (inside and outside the ports or harbors and channels)	≥ 5 million ton per annum of cargo handling capacity (excluding fishing harbors).	< 5 million ton per annum of cargo handling capacity (excluding fishing harbors). ≥ 30000 ton per annum of fish handling capacity.	All projects in respect of Inland water ways	
38	Highways or Expressways or Multi-modal corridors or Ring Roads	(i) New National Highways or Expressways or Multi-modal corridors or Ring Roads (ii) Expansion or widening of existing National Highways or Expressways or Multi-modal corridors or Ring Roads by length more than 100 km involving widening or right of way more than 70m on existing alignments or re-alignments or by-passes.	All new State Highway projects (ii) State Highway expansion projects in hilly terrain (above 1,000 meter above mean sea level).	(i) Expansion or widening of existing National Highways or Expressways or Multi-modal corridors or Ring Roads by length between 25km and 100km involving widening or right of way more than 70 m on existing alignments or realignments or bypasses. (ii) Expansion or widening of existing State Highways (500m to 1000 m above mean sea level)	Note: Width at toll plaza and junction improvement at intersection of other roads excluded from right of way.
39	Aerial ropeways	-	-	All projects located in notified Ecologically sensitive areas.	
40	Common Effluent Treatment Plants (CETP)	-	All projects	-	
41	Common Municipal Solid Waste Management Facility (CMSWMF) involving land filling and /or incineration	-	All projects	-	
42	Building Construction and Area Development projects	-	>1,50,000 sq. mtrs. of built-up area and or total land area of > 50 hectare	(i) >20,000 sq. mtrs. and 50,000 sq. mtrs. of built-up area (ii) > 50,000 sq. mtrs. and < 1,50,000 sq. mtrs. of built-up area projects having provisional 'certificate of green building' or relating to industrial sheds, educational institutions, hospitals and hostels for	Note 1. Projects under (i) and (ii) of Column (5) shall not be referred to Appraisal Committee. 2. Any change in the intended use, prior-permission from the Regulatory Authority for amendment in the prior-EP shall be obtained. All

Project		Category with threshold limit			Remark
		A	B1	B2	
				educational institutions	such cases shall be referred to Appraisal Committee.
				> 50,000 sq. mtrs. and < 1, 50,000 sq. mtrs. of built-up area	Note: Projects under Column (5) shall be referred to Appraisal Committee
43	Elevated roads or standalone flyovers or bridges	-	-	>1,50,000 sq.mtrs. of built-up area	
Note: General Conditions shall not apply for: Items 9, 10(f), 11(b), 25, 38, 40, 41, 42, and 43 Riverbed mining projects on account of inter-state boundary; and All Category 'B2' projects. Category 'B2' projects shall not be placed before Appraisal Committee except for those projects mentioned against the item					

Source: Draft EIA Notification (No. S.O.750(E) dated 17th Feb, 2020) of MoEF & CC,

Attachment 4-2 Organization chart of the executing agency’s Environmental and Social Management System



Attachment 4-3 Environmental and social Management System Checklist

	Questions	Answer	Improvement Plan
1. Policy (Environmental and Social Policy)			
	Does the executing agency have any formal environmental policy or procedures? If yes, please describe their outlines and provide appropriate documentation. If no, does the executing agency have any plan to set such policy or procedures?	The Executing Agency (EA), DoF does not have formal environmental policies or procedures to avoid negative impact on the natural and social environment. However, all activities undertaken by EA must be implemented in accordance with the relevant environmental laws, policies and procedures of GoI (defined by MoEF&CC and others) and the state government of Assam.	The existing Indian and Assam state legal/policy framework is sufficient for eliminating and mitigating serious adverse environmental and social impacts. The Project may involve certain sub-components which may have minor environmental impacts (e.g. small-scale infrastructure development and constructions). Such activities would not require environmental clearance as per the legislations. ESAF has to be prepared and that would act as the one of the principal documents to define measures to avoid adverse environmental and social impacts.
	Are there any types of sub-components in which the executing agency will not take part due to the environmental and social risks under the Project? (e.g., projects involving handling of hazardous wastes or removal of endangered plants or animals).	The Project and its activities and sub-components are not anticipated to have any environmental risks such as handling of hazardous wastes or endangered plants or animals. Moreover, areas within 5 km radius of ecologically sensitive areas and that required land acquisition have not been selected as the project target sites.	
2. Procedures (screening, category classification and review procedures)			
	Does the financial intermediary / executing agency have any environmental procedures such as screening, categorization and environmental review? If yes, please describe what procedures will be taken, in detail under the Project.	The Indian legislation system provides clear guidelines and procedures for environmental safeguard. The EA is not directly responsible for implementation of environmental procedures such as screening, categorisation and environmental review under the applicable laws and regulations as the nodal agency is the DoF.	ESAF shall be the principal document, which will clarify the basis for detailed procedures for screening, categorisation and environmental review of the Project and its activities. Additional supporting documents, as deemed necessary, need to be prepared during the preparatory stage of the Project.
	Please describe how you ensure that sub-components are implemented in compliance with the national laws and regulations and applicable JICA's requirements, during their planning, construction and operation stages.	Under the project the Executing Agency will implement the Project through its Departmental Structure in the field (District level and below). The EA would be hiring contractors for infrastructure development. The EA would be utilizing elaborate standard bidding document of Assam state along with the legally binding contract document between the EA and the Contractor. This would cover stringent terms	ESMF will be further reviewed in accordance with latest JICA requirements.

	Questions	Answer	Improvement Plan
		and conditions for safeguards as per the law such as adoption of appropriate safety standards, use of quality materials, control of water, air and noise pollution, soil excavation, waste disposal, minimum wages, proper workplace facilities etc. Stringent monitoring systems will be in place to ensure compliance to the laid down laws and rules	
3. Organization and Staff (institutional framework and staff allocation)			
	Please provide us with the organization chart of the executing agency's Environmental and Social Management System (ESMS).	The organization chart is shown in Attachment 4-2	Organisational structure for ESAF implementation in the Project will be clarified at the initial stage of the Project.
	Who is responsible for environmental and social management within the financial intermediary/executing agency? (name/role and title)	DoF is responsible to ensure implementation and monitoring and compliance or ESAF.	
	Are there any staff with training for environmental and social considerations in the executing agency? If so, describe them.	There is no trained staff for environmental and social considerations in the EA. Thus, it is proposed to have 1 expert for environment and social safeguards, who will take care of all training aspects on environmental and social considerations.	This will ensure institutionalization of rules and procedures for environmental and social considerations within the organization as well as would ensure post project continuity.
	What experience, if any, does the executing agency have of hiring or dealing with environmental consultants?	No prior experience of hiring or dealing with environmental consultants but have had experience of hiring consultant for aquaculture and fishery sector.	
	What was the budget allocated to the ESMS and its implementation during a year? Please provide budget details including staff costs and training as well as any actual costs.	All costs associated with matters related to environmental and social safeguard will be covered by addressing relevant issues in the Project's approach or technical methodologies, thus, it normally does not incur as separate budget allocations. However, some budget allocation towards environmental and social considerations under the Project, mainly in the form of capacity building costs and cost for hiring agency/experts in the field of environment and social consideration may be additionally provided.	
4. Monitoring and Reporting			
	Does the executing agency prepare environmental and social monitoring reports for the sub-components?	The construction work related to infrastructure development would be implemented through contractors having detailed ToR with inherent mechanism for adherence to environmental and social considerations as per law and standard practice.	

	Questions	Answer	Improvement Plan
		Moreover, environmental and social monitoring of activities will also be conducted as part of the regular project monitoring.	
	Please describe how the executing agency monitors the social and environmental performance under the project.	The Project's framework for M&E system will serve as the basis for carrying out environmental and social monitoring/ evaluation of sub-component activities.	
	Is there an internal process to report on social and environmental issues to senior management?	There is no systematic monitoring and reporting process for environmental and social issues. However, issues arising from field-based programmes are reported to senior management as required. Particular issues may be highlighted when necessary and dealt with accordingly.	
	Do you prepare any environmental and social reports? For other multilateral agencies or other stakeholders - E&S reporting in the Annual Report	Environmental and social reports are not being prepared by the EA.	EA will prepare and submit regular monitoring reports to JICA. These reports will contain designated sections on environmental and social aspects. The Project will include independent evaluations which will also assess the Project's implementation of the ESAF and environmental and social issues related to the Project.
5. Experience (results of the environmental and social management)			
	Has the executing agency signed any national or international agreements or declarations concerning environmental issues?	International agreements or declarations on environmental issues have been signed by the Government of India and are thus applicable to the Project. The EA has not signed any such agreement/ declarations.	
	Has the executing agency ever received any criticism of its environmental record? If so, what was the criticism?	EA has not received any such criticism so far.	
	Does the executing agency carry out environmental audits of its properties to analyze health and safety issues, waste disposal, etc.?	The EA itself is not responsible for environmental audit.	
	Please state any difficulties and/or constraints related to the implementation of the ESMS.	The EA lacks expertise and experience in managing and monitoring environmental and social risks in a systematic way and it will be the principal challenge.	Through the implementation of the Project, establishing the proposed safeguards frameworks and measures assisted by relevant expert/specialist(s), and through specific trainings, EA will build its capacity and experience for managing and monitoring environmental and social risks
6. Need of Capacity Development and Improvement Plan			
Yes, the indicative capacity development programs are proposed in the ESAF.			

Attachment 4-4 Draft Environmental and Social Assessment Framework (ESAF)

1. Objectives of ESAF

During project design and implementation, it is very important to carefully assess the Environmental and Social vulnerabilities within the society. Environmental vulnerability is a condition when the coherence of ecosystem is threatened by human activities or interference and/or natural causes, which could occur over spatial or temporal scales. Vulnerability could possibly increase with the intensity and frequency of human interventions and/or natural hazards. Social vulnerability is the inability or helplessness of people/ societies to withstand the adverse impacts from multiple stressors to which they are exposed and most such people are socially excluded, underprivileged, often discriminated against and restricted to access to the benefits of development or opportunities offered through socio-economic improvement programs.

The Environmental and Social Assessment Framework (ESAF) for the “Assam Fisheries Development and Livelihood Project (AFDLP)” has been prepared to act as the primary reference document that outlines the Environmental and Social Considerations (ESC) that will be addressed in the design and implementation of the project.

Although, the project is not expected to have any significant negative environmental impacts, there may also be the possibility of slight negative environmental and social impacts as well that cannot be ruled out due to the development activities under the project. In this regard, the draft ESAF is prepared to assess the negative impacts and ensure that such impacts are mitigated in accordance with JICA’s policies on environmental and social considerations in development projects, as well as relevant policies, laws and regulations of the country and the state.

Although the project covers multi-sectoral interventions and activities, that would be implemented at several sites/locations, still many of these activities are yet to be defined in absolute details such as site location, coverage, size/scope of the activity. Thus, in these circumstances, it would be inapt at this stage of the project preparation to assess the environmental and social impacts and propose detailed management and mitigation measures. However, the Survey Team assessed the broad types of activities proposed and prima facie outlined procedures to manage and mitigate potential risks associated with the activities during the project implementation. Accordingly, the ESAF which provides guidance on the appropriate management and mitigation measures for the associated environmental and social risks has been prepared as the main safeguards instrument considering the existing environmental and social management systems in India and the state of Uttarakhand and as per JICA requirements.

2. Project Summary Description

2-1 Project and sub-components overview

(1) Project Objectives

Government of Assam has implemented numbers of World Bank aided fishery development program, the latest being the Assam Agricultural Competitiveness Project (AACP:2004-2015), and the on-going Assam Agri-business and Rural Transformation Project (APART:2017-24).

Sustainable development of carp polyculture is considered to be the main theme in line with the slogan of “Grow More Fish” in Assam State, and it sounds quite appropriate for ASLIP to focus on this central issue. At the same time, there would be a lot of other relevant activities needed to support such aquaculture development. Those are capacity building of the implementing agency namely the Department of Fisheries, encouragement of more investment from private sector, introduction of new aquaculture technologies including diversification of target species, and improvement of value chain, which will also consist of major project components.

(2) Rational of project

This project is highly appropriate to realize the vision set out in the “Assam State Fisheries and Aquaculture Policy”, which is currently being prepared, and to resolve the issues mentioned above. The Vision of the Assam State Fisheries Policy can be summarized as “Maximize sustainable production from the fisheries sector for nutritional security and economic prosperity”. The mission of the Department of Fisheries to achieve this Vision is as follows.

- Sustainable utilization of fish resources
- Increase of fish production by aquaculture, promotion of high value fishes
- Increase fish production and productivity
- Improving livelihood opportunities
- Strengthening social security and welfare measures for fishers
- Conservation and management of fish resource
- Facilitating improved post-harvest practices and value addition with industrial and market linkages

In particular, increasing production is a central issue of the state's fisheries policy, as indicated by the DoF's slogan "Grow more fish," and the above fisheries policy sets a goal of "doubling" production by FY2029-30. It also sets a numerical target to increase the annual per capita consumption of fishery products from the current 12 kg/person/year to 15 kg/person/year.

From a socioeconomic perspective, there are approximately 2.5 million people working in the fisheries sector, accounting for about 10% of the state's population. The share of fisheries GDP in the state GDP is 3.05%, which is higher than that of other countries in general. The importance of this sector is recognized not only in terms of food security, but also in terms of employment and the state economy.

(3) Subcomponent overview

The project will be implemented in 8 pre-selected districts that have been thoroughly discussed and selected by the DoF and JICA study team. The subcomponents in the table below will be implemented within these 8 districts, and the following selection criteria will be used to select sites that avoid Category A of the JICA guidelines.

- The subcomponent site will not be required large-scale resettlement and commercial relocation
- The subcomponent site is not located in an ecologically important protected area such as a national park.

Table 1 Subcomponent Overview



2-2 EIA for subcomponents

The project is classified as Category FI under the JICA Guidelines for Environmental and Social Considerations, because the sub-components could not be identified prior to loan approval.

The project is planned to be carried out in 8 Districts, of which the ‘Extension and capacity building projects’ etc listed above will focus on soft components, such as capacity building and DX structures.

Therefore, the projects to be considered for EIA implementation are 'Improvement of aquaculture productivity project', but the final site and subject have not yet been selected and finalized, and the EIA has not been carried out. In addition, a review of the Draft Notification EIA 2020 in India indicates that the size and content of the proposed facility does not require an EIA to be carried out.

3. Environmental and Social Laws

3-1 Environmental and Social Laws of India and Assam

Major National and State Level Laws and Regulations Relevant to Environmental and Social Considerations (ESC) are described below.

In India, apart from the various national level laws/policies, the state governments formulate their own laws, rules, regulations, guidelines, policies and standards covering various aspects of ESC, consistent with key relevant national laws and regulations. The important and relevant national and state level legal frameworks which are applicable for ESC in relation to the proposed Project and its activities are outlined in Table 2.

Table 2 National/State Level Legal Framework for Environmental and Social Considerations

Law/Policy	Description / Outline	
A. Environment Protection and EIA		
National Forest Policy, 1988	Envisages 33% of the area of India should be under forest/tree cover through involvement of local communities in joint forest management programs	MoEF&CC, State Forest Department, VPs
Wildlife Protection Act, 1972	The Act prohibits killing/trapping of wild animals, control of collection, protection, and sale of specified plants, defines restrictions on access and use of protected areas	MoEF&CC, State Forest Department, State Wildlife Board
Biological diversity Act, 2002	An Act to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.	Acts of the Parliament of India
Assam biodiversity rules, 2010	The Government of Assam constituted the "Assam State Biodiversity Board" on 29 September 2010 to promote biodiversity conservation in the state, sustainable use of its components and equitable sharing of benefits arising out of the use of biological resources and traditional knowledge associated with these resources. At the same time, this Assam Biodiversity Rules were notified in 2010.	Department of environment & forest, Government of Assam
Threatened species of Assam Notification, 2018	In exercise of the powers conferred by section 38 of the Biological Diversity Act 2002, the central government, in consultation with the government of Assam, hereby notifies the species of plants and animals which are on the verge of extinction, and prohibit or regulate the collection, for the State of Assam.	MoEF&CC
Environmental Regulations	The Government of India has adopted the following union level regulations and laws pertaining to environment protection and control of pollution: – The Water (Prevention & Control of Pollution) Act, 1974 and rules framed thereunder. – The Air (Prevention & Control of Pollution) Act 1981 and rules framed thereunder. – The Water (Prevention & Control of Pollution) Cess Act, 1977, as amended by Amendment Act, 1991, 2003, and rules framed thereunder – Environment (Protection) Act, 1986 and the rules/notifications framed thereunder: – Environmental Protection Rules, 1986. – Environmental Impact Assessment Notification, 1994, 1997, 2002, 2004, 2006, 2020 as amended. – Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016. Manufacture, Storage and Import of Hazardous Chemical Rules, 1989;	Central Pollution Control Board,

	- Plastics Manufacture, Sale and Usage Rules, 1999 and 2003; - Bio-Medical Waste (Management and Handling) Rules, 1998 and Amendment Rules 2000, 2003, 2016; - The Noise Pollution (Regulation and Control) Rules, 2000; - Municipal Solid Wastes (Management and Handling) Rules, 2000; - Ozone Depleting Substances (Regulation) Rules, 2000; - Batteries (Management and Handling) Rules, 2001; - The Manufacture, Use, Import, Export, and Storage of Hazardous Micro Organisms, Genetically Engineered Organisms or Cells Rules, 1989. - Chemical Accident (Emergency Planning, Preparedness, and Response) Rules, 1996. - There are additional rules that are notified considering the need for the betterment of the health of the society in general as well as their bearing on the environment. Apart from Uttarakhand State Pollution Control Board, there are other agencies as well that are responsible for the implementation of these rules: - Public Liability Insurance Act, 1991. - Motor Vehicle Act, 1988.	
B. Pollution Control and Waste Management		
Plastic Waste Management, Rules, 2015	Plastic Waste (Management and Handling) Rules, 2011 rules more effectively and to give thrust on plastic waste minimization, source segregation, recycling, involving waste pickers, recyclers and waste processors in collection of plastic waste fraction either from households or any other source of its generation or intermediate material recovery facility and adopt polluter's pay principle for the sustainability of the waste management system, the Central Government reviewed the existing rules.	MoEF&CC
The Guwahati waterbodies (Preservation and Conservation) Act, 2008	An act to provide for preservations, protection conservation, regulation and maintenance of waterbodies and to develop the waterbodies into natural water reservoir and convert into eco-tourism recreation center to suit the ecological balance within the jurisdiction of Guwahati Metropolitan Development Authority and to protect the waterbodies from the encroachers and damages.	Legislative department Government of Assam
C. Land Acquisition/ Involuntarily Resettlement		
Right to Fare Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	An Act to ensure a humane, participative, informed and transparent process for land acquisition for industrialization, development of essential infrastructural facilities and urbanization with the least disturbance to the owners of the land and other affected families. The Act notifies to provide fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition and make adequate provisions for such affected persons for their rehabilitation and resettlement, and for ensuring that the cumulative outcome of compulsory acquisition should be that affected persons become partners in development leading to an improvement in their post-acquisition social and economic status and for matters connected therewith or incidental thereto.	Acts of the Parliament of India
Assam Right to Fare Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2015	This rules were pblshede as required by section 112 of Right to Fare Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.	Department of revenue & disaster management
Notification land acquisition rehabilitation and resettlement amended rules, 2022	This notification was addendum to the Assam Right to Fare Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2015	Department of revenue & disaster management

The Assam Land (Requisition and Acquisition) Act, 1964, amended up to 1985	This Act was brought to consolidate the law of requisition and speedy acquisition of premises and land for public purposes mainly centering round requisition and acquisition on account of flood control and associated activities with the enactment of the Assam Land Act, 1964 that was amended in 1985.	Directorate of land requisition, acquisition and reforms
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3-2 Adequacy of environmental standards.

The principal environmental standards and international standards in India and Assam are shown in the table below.

(1) Ambient Air Quality

In Assam State, ambient air quality is being monitored in seven towns/cities, namely: Dibrugarh, Dispur, Gauripur, Guwahati, Jorhat, Silchar and Tezpur. As per the notification dated 18 November 2009 on the National Ambient Air Quality Standards by the Central Pollution Control Board, the air quality standards have been fixed for a 24-hour average including 100 $\mu\text{g}/\text{m}^3$ for Respirable Suspended Particulate Matter (RSPM), 80 $\mu\text{g}/\text{m}^3$ for SO_2 , and 80 $\mu\text{g}/\text{m}^3$ for NO_2 , while the annual average standard has been set at 60 $\mu\text{g}/\text{m}^3$ for RSPM, 50 $\mu\text{g}/\text{m}^3$ for SO_2 , and 40 $\mu\text{g}/\text{m}^3$ for NO_2 .

The environmental standards in India are generally comparable to those of international organizations and Japan, with the exception of $\text{PM}_{2.5}$ and PM_{10} , and the standard values are appropriate. Although the values of $\text{PM}_{2.5}$ and PM_{10} are higher than those of international organizations, this is acceptable considering the current atmospheric conditions in India. The current observational data is shown in website (<https://www.aqi.in/dashboard/india/assam>)

Table 3 National Ambient Air Quality Standards

Pollutants	Time weighted average	Concentration in ambient air		
		Industrial Area	Residential, Rural & other Areas	Sensitive Area
Sulphur Dioxide (SO_2)	Annual Average*	80 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$	15 $\mu\text{g}/\text{m}^3$
	24 hours****	120 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$	30 $\mu\text{g}/\text{m}^3$
Oxides of Nitrogen as NO_2	Annual Average*	80 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$	15 $\mu\text{g}/\text{m}^3$
	24 hours****	120 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$	30 $\mu\text{g}/\text{m}^3$
Suspended Particulate Matter (SPM)	Annual Average*	360 $\mu\text{g}/\text{m}^3$	140 $\mu\text{g}/\text{m}^3$	70 $\mu\text{g}/\text{m}^3$
	24 hours****	500 $\mu\text{g}/\text{m}^3$	200 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$
Respirable Particulate Matter (RPM) (size less than 10 microns)	Annual Average*	120 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$	50 $\mu\text{g}/\text{m}^3$
	24 hours****	150 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$	75 $\mu\text{g}/\text{m}^3$
Lead	Annual Average*	1.0 $\mu\text{g}/\text{m}^3$	0.75 $\mu\text{g}/\text{m}^3$	0.50 $\mu\text{g}/\text{m}^3$
	24 hours****	1.5 $\mu\text{g}/\text{m}^3$	1.0 $\mu\text{g}/\text{m}^3$	0.75 $\mu\text{g}/\text{m}^3$
Ammonia	Annual Average*	0.1 mg/m^3	0.1 mg/m^3	0.1 mg/m^3
	24 hours****	0.4 mg/m^3	0.4 mg/m^3	0.4 mg/m^3
Carbon Monoxides	8 hours**	5.0 mg/m^3	2.0 mg/m^3	1.0 mg/m^3
	1 hours	10.0 mg/m^3	4.0 mg/m^3	2.0 mg/m^3
*	Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval			
**	24 hourly/ 8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days. Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week at uniform interval.			

NOTE:

1. National Ambient Air Quality Standard: The levels of air quality with an adequate margin of safety, to protect the public health, vegetation and property.
2. Whenever and wherever two consecutive values exceed the limit specified above for the respective category, it would be considered adequate reason to institute regular/ continuous monitoring and further investigation. S.O. 384(E), Air (Prevention & Control of Pollution) Act, 1981, dated April 11, 1994] [EPA Notification: GSR 176(E), April 02, 1996].
1. Include vide Notification SO.955(E), Air (Prevention & Control of Pollution) Act, 1981, dated October 14, 1998]

Source: National Ambient Air Quality Standard https://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf

(2) Ambient Noise Level

Regarding noise standards, the state board regularly conducts ambient noise monitoring for 8 (Silchar, Dibrugarh, Sivasagar, Tezpur, Golaghat, Nagaon, Bongaigaon and Guwahati) areas/zones spread over the entire state.

Table 4 Noise Level Standards

Zone code	Zone	LIMITS IN dB(A)	
		Day time 6AM to 9PM	Night time 9PM to 6AM
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence	50	40

Source: The Noise Pollution (Regulation and Control) Rules, 2000. <https://cpcb.nic.in/noise-pollution-rules/>

(3) Water quality standards

The water quality data reflects level of impacts on water quality and helps in ascertaining the nature and extent of pollution control measures that are required. The Central Pollution Control Board is sponsoring the water quality monitoring of major rivers of the state through its national program, namely, “National Water quality Monitoring Programme (NWMP). The Objective of NWMP is to standardized measurement of identified parameters in order to define status and trends of water quality. Under NWMP systematic procedures of collection, preservation and transportation, storage, analysis of water samples and dissemination of data are followed for sample locations from natural waterbodies (surface and ground water). The State Pollution Control Board in collaboration with the Central Pollution Control Board is carrying out water quality monitoring at 29 locations in the state. Regular monitoring of water quality is being carried out and data are being forwarded to CPCB. Table 5 shown the criteria for primary water quality.

Table 5 Primary Water Quality Criteria

Designated Best Use	Class of Water	Criteria
Drinking Water Source Without Conventional Treatment but After Disinfection.	A	1. Total coliform organism MPN/100 ml shall be 50 or less. 2. pH between 6.5 and 8.5. 3. Dissolved oxygen 6 mg/l or more. 4. Biochemical oxygen demand 5 days 20 oC 2 mg/l or less.
Outdoor Bathing (Organised)	B	1. Total coliform organism MPN/100 ml shall be 500 or less. 2. pH between 6.5 and 8.5. 3. Dissolved oxygen 5 mg/l or more. 4. Biochemical oxygen demand 5 days 20 oC 3 mg/l or less.
Drinking Water Source After Conventional Treatment and Disinfection	C	1. Total coliform organism MPN/100 ml shall be 5,000 or less 2. pH between 6 and 9. 3. Dissolved oxygen 4 mg/l or more. 4. Biochemical oxygen demand 5 days 20 oC 3 mg/l or less.
Propagation of Wildlife and Fisheries	D	1. pH between 6.5 and 8.5. 2. Dissolved oxygen 4 mg/l or more. 3. Free ammonia (as N) 1.2 mg/l or less.
Irrigation, Industrial Cooling Controlled Waste Disposal	E	1. pH between 6.5 and 8.5. 2. Electrical conductivity at 25 0C micro mhos/cm max. 2,250 3. Sodium absorption ratio max. 26. 4. Boron max 2 mg/l.

Source: Web site of central pollution control board. <https://cpcb.nic.in/wqstandards/>

Table 6 Water Quality standard

Pollutants	India	Japan River	Japan Lakes
pH	6.5- 8.5	6.7-7.5	6.7-7.5
BOD	-	3mg/l or less: nature	-
COD	-	-	4mg/l or less: nature
DO	4 mg/l or more.	6mg.l or more.	6mg/l or more.
Total nitrogen	1.2 mg/l or less.	-	1.0mg/l or less : Carp
Total phosphorus	-	-	0.1mg/l or less : Carp
Total suspended solids	-	25mg/l or less	3.0mg/l or less
Total coliform bacteria	2,500MPN/100 ml. or less	1,000MPN/100mL or less	1,000MPN/100mL or less

Source: Ministry of environment and forest notification, September 2000.

Japan Fisheries Water Standards, Japan Fisheries Resource Conservation Association

3-3 Environmental and Social consideration Policies of JICA

3-3-1 Environmental and Social Considerations of JICA

A project aiming for economic and social development may nevertheless carry a risk of having negative impacts on the environment or society, such as pollution, loss of natural habitat, involuntary resettlement, and infringement of people's rights. Avoidance or minimization of such risks must be realized as an integral part of the project itself, with its cost included into the development cost. This is the essence of Environmental and Social Considerations, and they must be applied to JICA projects in accordance with the Guidelines for Environmental and Social Considerations (ESC Guidelines).

3-3-2 Key Process Elements as per the requirements of JICA Guideline

Key processes in JICA projects related to environmental and social considerations are summarized below;

(1) Categorization of Projects

Projects are categorized according to the scope/severity of the environmental and social impacts or risks, indicated as follows;

- Category A: Significant adverse impacts (e.g. Large-scale development/ infrastructure),
- Category B: Generally site-specific impacts, few impacts are irreversible, normal mitigation measures can be designed,
- Category C: Minimal/little adverse impact
- Category FI (Financial intermediary): Substantial selection and appraisal of sub-components after JICA approval of funding.

This Project is categorized as category FI because the Sub-components cannot be specified prior to JICA's approval for financing, and they may have environmental impacts under the JICA guidelines for environmental and social considerations (January 2022). The proposed Project is not anticipated to have any significant negative impacts on the environment. Although, it is not possible to precisely state which sub-components will be executed in which specific location and scale, the Project will exclude sub-components that fall under "Category A" due to significant environmental impacts or risks.

Table 7 Category Classification of JICA guidelines

Category	Classification Requirements
Category A	The project is likely to have significantly adverse impacts on the environment or society. For example: • A project with a wide range of impacts, impacts that are irreversible, complicated, or unprecedented, and impacts that are difficult to assess. • A project for a sector that requires special attention (e.g., a sector that involves large-scale infrastructure development), involves activity that requires careful consideration (e.g., large-scale involuntary resettlement), or takes place inside or adjacent to a sensitive area (e.g., protected natural habitat). Examples of sectors, activities, and areas that require special attention are listed in 'Appendix 3' of the ESC Guidelines.
Category B	The project may have adverse impacts on the environment or society, but these impacts are less significant than those of Category A projects. These impacts are site-specific; few, if any, of them are irreversible; in most cases, they can be mitigated more readily than Category A projects. Responsibilities of the project proponents include the planning and monitoring of necessary ESC activities. ESC procedures such as Initial Environmental Examination and stakeholder participation may be required, depending on the scale and nature of the adverse impacts.
Category C	The project is likely to have minimal or no adverse impact on the environment or society.
Category F1	JICA provides funds to a Financial Intermediary, which in turn implements sub-components that may have adverse impacts on the environment or society, but these impacts cannot be identified in detail prior to JICA's approval. If there is a sub-component that can be categorized as Category A, it needs to go through the same procedure as a Category A project including JICA's environmental review and information disclosure prior to its implementation.

Source: The basic of environmental and social considerations, JICA

(2) Information Disclosure and Consultation

Executing Agency (EA) of the Project shall monitor the sub-components following the Environmental Monitoring Programme (EMoP) which is the requirement for only Category B sub-components. Such sub-components information on the environmental and social impacts is encouraged to disclose to all relevant stakeholders.

3-3-3 Requirements as per JICA Guidelines

JICA certifies that projects do not deviate considerably from the World Bank's Safeguard Policies, and refers to it as a benchmark to the standards of international development agencies; to internationally recognized standards, or international standards, treaties, and declarations, etc. and to the good practices, etc. of developed nations as appropriate.

In accordance with JICA guidelines, the following conditions are examined with respect to the project implementation. Financial intermediary or the executing agencies are required to comply with the following requirements:

- Ensure appropriate environmental and social considerations,
- Sufficiency of institutional capacity to confirm environmental and social considerations of the financial intermediary/ executing agency is sufficient; if requires adequate measures be taken to strengthen the capacity,
- Financial intermediary or executing agency to assess potential positive and negative environmental impacts of sub-components, takes appropriate measures to avoid, minimise, mitigate, or compensate for potential negative impacts, and promote positive impacts if any available,
- Disclosure of the results of environmental reviews on its website after concluding agreement documents, and
- Confirm with project proponents on the results of monitoring items that have significant environmental impacts. Project proponents are undertaking environmental and social considerations for projects that fall under Categories A, B, and FI.

4. Existing Environmental and Social Management Systems

The following section focuses on the existing environmental and social management systems in Indian and the state of Assam and examines the probable method for implementing the Project. The existing legal and regulatory frameworks are confirmed to be consistent with the requirement of the JICA Guideline and the World Bank's Safeguard Policies. An overview of the environmental and social legal frameworks and institutional arrangements processes and procedures for its implementation are presented below.

4-1 Systems for Environmental Management

India has enacted stringent environmental legislation (that includes various laws, rules, regulations, notifications, and policies) for protection and management of environment and has created institutions to monitor and enforce those legislation. In the following sections, the processes adopted in India for environmental clearance is described. Under the scope of EIA laws and regulations in India, all projects and activities requiring "Environmental Clearance" (EC) are classified broadly into two categories - Category A (hereafter refer to as "Indian EIA Category A") and Category B (hereafter refer to as "Indian EIA Category B"), which is based on the spatial extent of potential impacts on natural and man-made resources.

Indian EIA Category 'A' projects or development activities are mandated to conduct EIA studies along with conducting the "Public Consultation" as per the procedure specified in the Notification, and the environmental clearance is required from the Central Government or MoEF&CC.

Indian EIA Category 'B' projects fall under the purview of the state authority as mentioned in EIA notification 2020 and decentralized procedure is done. The Government of India has constituted the State Expert Appraisal Committee (SEAC) and State Environmental Impact Assessment Authority (SEIAA) committee for decentralized procedure of environmental clearance. The category 'B' projects are further divided into Category 'B1' (projects that require submitting an EIA report) and Category 'B2' project activities which do not require EIA report. The stages in the environmental clearance procedure as per EIA notification 2020 is described.

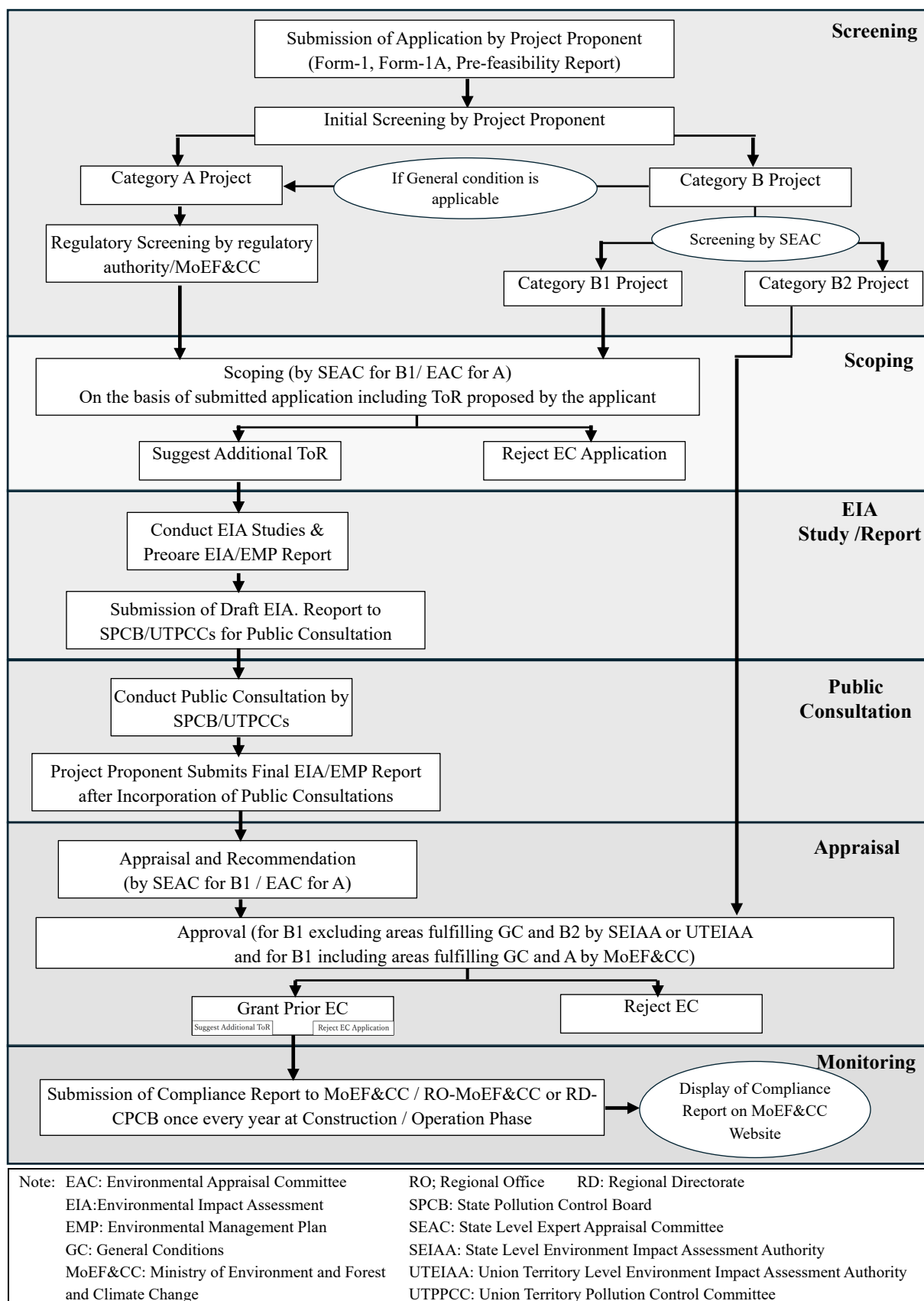


Figure 1 Prior Environmental Clearance Process as per Indian EIA Law

4-2 Systems for Social Management

JICA concerns that development projects are implemented with special attention to vulnerable groups such as the poor, landless/landed poor, indigenous peoples (or STs in India) and women. Rights of local communities and STs should be respected in all interventions.

The potential negative social impacts are much lower compared with the large infrastructure projects which involve physical displacement and involuntary resettlement, but still there is a possibility to negatively impacts the local communities on their livelihoods, loss of access, ownership or use rights, and increased conflicts on agriculture lands. In the following sections, the procedures for land acquisition and involuntary resettlement applied in India are presented.

Land Acquisition and Involuntary Resettlement:

Until 2013, GoI and the states were following the Land Acquisition Act, 1894. In the year 2007, GoI introduced the National Rehabilitation and Resettlement Policy. In November 2013, 'The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act' was passed by the Parliament. This objective behind the formulation of the Act was to bring in a transparent process of land acquisition through consultative and participatory approach for land acquisition with the least disturbance to the owners/families of the land with fair compensation and appropriate rehabilitation and resettlement of the families.

The 2013 Act brought in several key changes to the process of land acquisition in the country.

- It increased the compensation provided to landowners, from 1.3 times the price of land to two times the price of land in urban areas, and two to four times the price of land in rural areas.
- Unlike the earlier act, which did not provide rehabilitation and resettlement (R&R), the 2013 Act provided R&R to landowners as well as to those families which did not own land, but were dependent on the land for their livelihood. The act permits states to provide higher compensation and R&R.
- It mandated that a Social Impact Assessment (SIA) be conducted for all projects, except for those land that are required urgently. An SIA assesses certain aspects of the acquisition such as whether the project serves a public purpose, whether the minimum area that is required is being acquired and the social impact of the acquisition.
- It mandated that the consent of 80% of landowners be obtained for private projects and the consent of 70% of landowners be obtained for public-private partnership projects. However, consent of landowners is not required for government projects.

On the 3rd of April 2015, the Act exempted five categories of projects, namely: (i) defense, (ii) rural infrastructure, (iii) affordable housing, (iv) industrial corridors (set up by the government/government undertakings, up to 1 km on either side of the road/railway), and (v) infrastructure projects, from this provision of the 2013 Act including the requirement of a social impact assessment and the limits that apply for acquisition of irrigated multi-cropped land, through issuing a notification.

The processes involved in land acquisition and involuntary resettlement are depicted in below;

However, under the project, no anticipated resettlement and rehabilitation due to project activities would be required because the construction of the project will take place on government properties.

Process of Land Acquisition

- Preparation of Social Impact Assessment study, a public hearing on the assessment made and publication of the study.
- Appointment of an expert group to assess the Social Impact Assessment and further the government's examination of proposals for land acquisition.
- Publication of preliminary notification and appointment of officers.
- Preliminary survey of land.
- Hearing of objections.
- Preparation of Rehabilitation and Resettlement Scheme by the Administrator and its review thereafter.
- Approval and publication of the above scheme.
- Intimating the interested parties through notification.
- A meeting of the interested parties with the collector at a time, date and place fixed by the collector.
- Enquiry to objections of the interested parties by the collector.
- Land Acquisition.

Process of Resettlement and Rehabilitation

- Government intends to acquire land for public purposes
- Consultation with concerned assam municipality or municipal cooperation
- Social Impact Assessment Study
- Public Hearing for SIA: Report on SIA made in public in local Language
- Appraisal on SIA report by independent multi-disciplinary expert group
- Preliminary Notification is published
- Survey and Census of Affected Families and Prepare R&R Scheme by Administrator(R&R)
- Collector reviews the R&R Scheme, and Submits to Commissioner(R&R) for approval
- Approved R&R Scheme is made public
- Secretary issues a Declaration indicating 'need of land for public purpose', 'settlement area identified', and summary of R&R scheme to the Government
- Requireing body deposits amount towards cost of land acquisition
- Collector provides the R&R awards to each affected family

4-3 Existing Agencies for Environment and Social Management System

As the Executing Agency (EA), Department of Fisheries (DoF) in the state government of Assam, shall be responsible for the implementation of the entire Project, while the project are to control and support the project activities in their sites from actors perspective. Comparing the JICA guidelines with national Indian and Assam state laws, there is no significant gap regarding environmental and social considerations. However, DoF does not have any direct mandate and system for environment and social management, for screening, managing and monitoring environmental and social risks. Thus, it is recommended to incorporate subject matter experts to establish and institutionalize ESMS within the project, supported by PMC in charge of environmental and social safeguards for compliance of the required environmental and social safeguards, that further described in Section 7 of this document.

5. Assessment of the environmental and social impact of our activities

5-1 Environmental and Social Considerations, Potential Impacts and Mitigation Measures

As mentioned above, it is impracticable at this survey phase to assess the detailed environmental and social impacts and propose management and mitigation measures for each subcomponent level which are not yet defined in detail. Therefore, in this section, the potential environmental and social impacts for proposed broad types of activities are assessed and mitigation measures are proposed through ESMS checklist (Attachment 4-3), and component-wise potential deleterious environmental and social impacts assessment (Table 9). The purpose of the initial assessment is to summarise the potential (especially negative) impacts which could be referred when Environmental Management Plans (EMPs) as well as Environmental Monitoring Plan (EMoP) are required to prepare.

5-1-1 Environmental and Social Considerations and its Potential Impacts

There are few negative impacts from the project, although there are some environmental and social considerations related to the construction subcomponent of the facility. The environmental projections are shown in the table below.

(1) Overview of Environmental and Social Impact Components

The principal subcomponents requested for the project, which outline the environmental and social impact components, are the TCPC, Aquaculture Laboratory, and Fish market. The planning site is within the DOF site and there are no commercial or residential buildings present. Noise and construction accidents are expected to occur during the construction of the components described above, however, the small size of the components will minimize their impact.

(2) Scoping

The Scoping of the environmental and social impacts of the subcomponent execution is shown in the table below.

Table 8 Scoping Results

Category	Environmental Item	Assessment		Reasons for assessment
		Before and during construction	During operation	
Pollution Control	Air Quality	D	D	During construction and operation, the project is not expected to have any impact.
	Water Quality	D	B-	During construction, the project is not expected to have any impact. During operation, the facility's effluent will be properly drained by the installation of septic tanks and negative impacts will be controlled.
	Wastes	D	D	During construction, no impacts are expected from this project. General waste from the facility is expected to be produced during operation, but the impact will be negligible.
	Soil Contamination	D	D	During construction and operation, the project is not expected to have any impact.
	Noise and vibration	D	D	During the construction period, noise and vibrations from construction vehicles, etc. are expected to occur around the planning site. During operation, the project is not expected to have any impact.
	Odor	D	D	During construction and operation, the project is not expected to have any impact.
Natural Environment	Protected Areas	D	D	The planning site is not a protected area.
	Ecosystem Biodiversity	D	D	The project will have no negative impact on the ecosystem.
	Water Phenomena	D	D	During construction and operation, the project is not expected to have any impact
	Lands and Geology	D	D	During construction and operation, the project is not expected to have any impact.
Social Environment	Resettlement/ Land Acquisition	D	D	This project will not require resettlement or land acquisition.
	Living and Livelihood	D	D	This project will not have any negative impacts on employment or commercial activities around this project site.
	socially vulnerable group	D	D	This project will not have any negative impact on vulnerable groups in society.
	Heritage	D	D	There are no historical sites or cultural heritage sites around this project site.
	Landscape	D	D	During construction and operation, the project is not expected to have any impact.
	Ethnic Minorities and Indigenous Peoples	D	D	During construction and operation, the project is not expected to have any impact.
	Working Conditions	B-	D	During construction, there are concerns about worker accidents.
	Community health, safety and security	D	D	During construction and operation, the project is not expected to have any impact.
	Impacts during Construction	B-	D	During construction, there are concerns about worker accidents. During operation, accidents are not expected.

A+/-: Severe impact expected

B+/-: Not serious, but moderate impact expected

C+/-: Unclear degree of impact

D+/-: Little to no impact expected

5-1-2 Impact assessment and mitigation measures

The subcomponent will have very few negative impacts on the environment. However, noise, accidents, and the working environment during construction should be considered. This can be mitigated by not working at night and by carrying out safety education and safety measures against accidents. In addition, village areas in Assam have almost no sewage network. Septic tanks should be installed for drainage of domestic water from subcomponent facilities.

Table 9 Mitigation measures, responsibilities and costs

No	Environmental Item	Negative impact	Mitigation measures	responsible agency	executing agency	Cost
During construction						
1	Noise and vibration	During construction, Noise and vibration will be caused by construction vehicles. During operation, Noise and vibration will not be a problem.	The impact on the surrounding area can be controlled by not carrying out construction work at night.	DOF	Contractor	Particularly costs are not charged.
2	Working Conditions	During construction, there is a possibility of accidents to workers.	Accidents can be reduced by providing safety education for the operation of construction vehicles.	DOF	Contractor	Particularly costs are not charged.
3	Accident	The use of construction vehicles may cause accidents on and around the working site.	Install safety fences and assign traffic control personnel at construction sites. In addition, safety education for the operation of construction vehicles will be carried out.	DOF	Contractor	Particularly costs are not charged.
During operation						
1	Water quality	During operation, domestic wastewater will be generated when the facility is in use.	Wastewater is properly drained by installing septic tanks to control negative impacts.	DOF	DOF	Included in construction costs

6. Environmental and Social Management Measures and Monitoring

ESAF has been prepared to ensure that potential adverse environmental and social impacts associated with the Project are either avoided or minimised in line with the JICA Guideline as well as relevant policies, laws and regulations of GoI and the state of Assam. ESAF targets at managing the potential unfavourable and negative impacts, with the help of simple procedures to expedite appropriate environmental and social management.

Although EIA study would not be required for the entire Project, however, the Project may need to be evaluated from the environmental and social risk perspective before implementation of sub-components components. Overall, the proposed project activities do not have any substantial negative environmental impact as they include small building/infrastructure development etc. Moreover, the project area exclusion criterion also says that the sub-component areas will be outside eco-sensitive zones defined by the Environment & Forest Department in Assam. In general, the project is not considering any activity within ecologically sensitive zones from the boundary of the Wildlife sanctuary/National parks and will be further checked with Environment & Forest Department whether the sub-component areas are within "notified" eco-sensitive zones.

The following sections further indicates the outline of important procedures/ requirements of ESAF.

The different stages of the procedures/requirement of ESAF is depicted in below:

1. Screening and Selection of Sub-components
2. Environmental and Social Assessment
3. Preparation of Environmental management Plan (EMP)
4. Preparation of Environmental Monitoring Plan (EMoP)
5. Implementation and Monitoring of Sub-components

6-1 Screening and Selection of Sub-Components

Generally, the guidelines for selection of sub-Component reinforce the key objectives of the Project. The categorisation (Category B or C) of sub-component as per the JICA Guideline as well as the finalisation of exclusion criteria will be completed by PMU prior to the commencement of the Project or at the early stage of the preparatory work. In accordance with the JICA Guidelines, tentative exclusion criteria have been developed and are summarised in the Table 10.

Table 10 Sub-component Exclusion Criteria

Component	Exclusion Criteria for Sub-component
1 Overall	- Subcomponent /Activities likely to have major adverse impacts on the environment - Subcomponent /Activities fall into “Category A” as per the JICA Guideline.
2 Natural Environment	- activities conducted inside protected areas such as national parks/ wildlife sanctuaries - likely to cause damage to wildlife and their habitats. - activities that cause pollution of water sources
3 Social Environment	- activities that promote child labour - activities that could lead to the exploitation of women/ vulnerable groups - activities that give adverse impact on ST/SCs. - acquisition of private land and/or resettlement - cause damage to places of religious importance, historical monuments or cultural properties

6-2 Environmental and Social Assessments

Although, the Project is not anticipated to bring-out deleterious environmental and social impacts, yet it is suggested to conduct Environmental Assessment (EA) and Social Assessment (SA) for specific sub-component classified as Category-B. EA and SA shall be conducted after the screening and selection procedures are completed. The assessment results will be utilised for the preparation of EMP/EMoP. The following sections describe the key tasks for the assessments and indicative contents of the reports.

(1) Environmental Assessment (EA)

The main purpose of EA is to help understand the issues and risks associated with environmental aspects, and the resultant impacts on the target population. Regular monitoring of environmental parameters such as air and water quality, noise levels, degradation of forests, soil erosion, solid waste disposal, disposal of sewage, etc., will enable the Project to understand the temporal changes in environmental conditions. Such monitoring activities would enable the Project to devise short/long-term, recommendations, strategies and mitigation measures to address the concerns and issues that affect the environment.

EA plan will be prepared by the PMU, providing reasonable details outlining the objectives, contents, methods and schedule for its implementation. Table 11 specifies key tasks for EA.

(2) Social Assessment (SA)

The main purpose of the Social Assessment (SA) is to help understand basic social issues and risks, and to determine social impacts on the target population of the proposed sub-components. Analysis of the collected socio-economic information enables the Project to prioritise critical issues and means to address them, in consultation with other stakeholders.

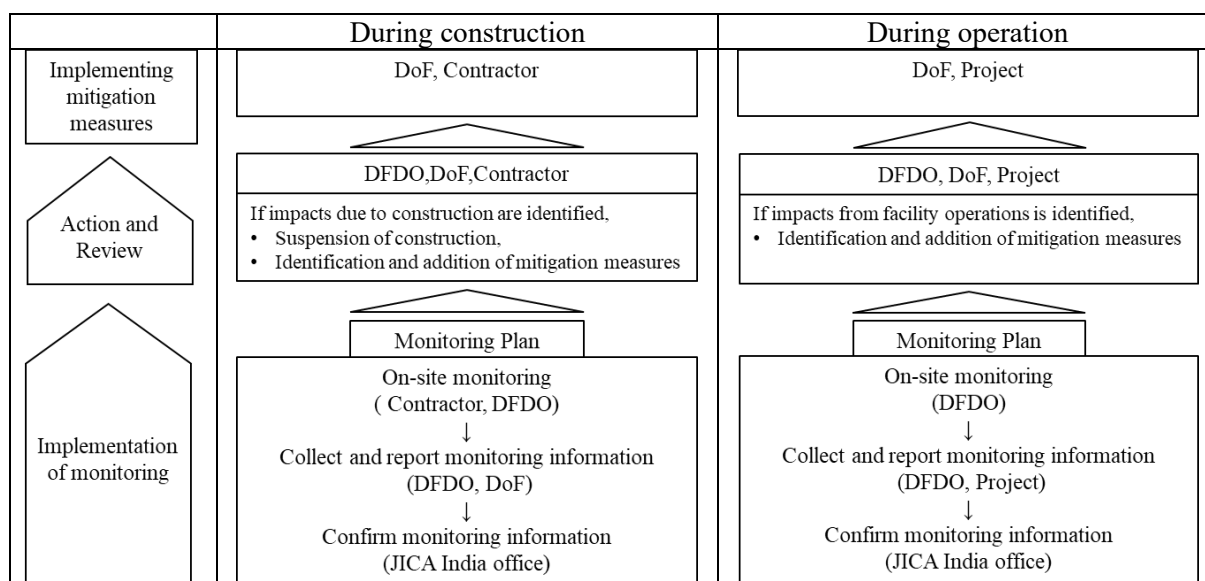
Table 11 Key Tasks for Environmental and Social Assessment

Task	Descriptions
Describe Environmental Setting	It will address the existing environmental setting, in terms of physiography and geology, land-use patterns, dependence on agriculture, ambient air quality, noise levels, water quality, socio-economics, stakeholder group etc.
Legal and Regulatory Environmental and social Consideration	Provides an account of the existing legal and regulatory environment, compliance with multilateral funding agencies, such as World Bank, JICA, if any, etc. Also with regards to ownership of and access to arrangements and its implications to different stakeholders, specifically the poor and vulnerable.
Impacts Assessment and Mitigation Measures	It will describe all the activities/ sub-components that have potential to impact the environment and social in a deleterious manner, assess and analyse in-depth various potential negative impacts related activities/ sub-components, provide mitigation measures environmental and social risk and vulnerabilities.
Devise Strategies to Manage and Monitor Environmental Concerns and Parameters	Provide strategies to manage and monitor potential environmental concerns and parameters. It will also provide roles and responsibilities of various key positions, institutions, bodies that will manage and monitor the control and protection of environmental aspects, etc. It also examines the opportunities for community involvement in project preparation and implementation, the existing and proposed framework for property rights/ access, and sustainable management and monitoring of environment and social.
Recommendations for Project Design and Implementation Arrangements	It reviews proposals for project design and provide guidance to the implementing agency on participatory alternatives and institutional strengthening measures appropriate to the environmental characteristics of the project area(s). This will provide a basis for integrating the environmental analysis of the core elements into proposals for implementation arrangements.
Development of a Monitoring Plan	The monitoring system needs to have local participation in the generation and refinement of indicators over the project cycle in order for the affected people to be involved in balancing their own interests in the management of their land and system.

6-3 Preparation of Environmental Management Plan

Environmental Management Plan (EMP) shall consist and cover environmental mitigations and consideration measures which shall be taken during the construction and operation phases, which shall examine description and assessment results of environmental, social, health and safety impacts. The EMP shall be prepared only for “Category B” sub-components. Although quantifications of impacts as well as concerned mitigation measures of sub-components are yet to be determined, indicative EMP is described in below. Any additional costs for the proposed mitigation measures shall be included in the construction cost. (For mitigation measures, see above 5-1-2))

The mitigation measures for construction impacts and monitoring will be implemented under the following structure. If monitoring identifies project impacts on the surrounding environment, measures will be considered by DoF and the construction contractor during construction. During operation, measures will be considered by DOF and the project. In case of complaints to the DFDO, the DoF and the construction contractor will discuss mitigation measures during construction and report to the JICA India Office. During operation, the DoF will take the lead in discussing mitigation measure.



6-4 Preparation of Environmental Monitoring Plan

Environmental Monitoring Plan (EMoP) provides monitoring plan to administer and scrutinize the implementation of proposed environmental mitigation measures and considerations and to regularly monitor the quality of surrounding environments during construction, and operation phases. EMoP ensures that environmental and social safeguards adopted measures are bringing the desired results. Therefore, indicators of environmental and social considerations are used to measure the quality environmental parameters and safeguard processes. Table 12 presents indicative monitoring items, their indicators, means of verification, frequency and responsible parties for measuring safeguards measures that have been implemented.

It is the responsibility of the designated DIU officers to implement and monitor, as an integral part of the project implementation, and for the purpose of site-level planning and implementation, the designated DIU officers ensure the required monitoring activities are conducted. The compliance of environmental and social safeguards during implementation of sub-component must be also closely observed by DIUs, and relevant local stakeholders, etc. Periodic visits should also be carried out by the designated officers to confirm that mitigation measures for deleterious impacts are being carried out properly by the contractors.

Table 12 Indicative Environmental Monitoring Programme

Aspects	Parameters to be monitored	Locations/Frequency/Method	Executing Agency	Responsible agency
Construction Phase				
Air pollution	Dust, smoke	- Sub-component areas - Once in a month - Visual checks	DFDO	DoF
Noise and Vibrations	Construction noise	- Sub-component areas - Once in a month - Site visit/Sound Level Meter/ complaints from local residents	DFDO	DoF
Soil pollution	Oil	- Sub-component areas - As necessary during the construction period - Visual checks	DFDO	DoF
Impact of livelihoods	Dust, smoke, Construction noise, etc	- Sub-component areas - Once in a month - Site visit/Sound Level Meter/ complaints from local residents, etc	DFDO	DoF
Working	Construction	- Sub-component areas	DFDO/	DoF

Aspects	Parameters to be monitored	Locations/Frequency/Method	Executing Agency	Responsible agency
Condition	accidents	- Once in a month - Site visit	Contractor	
Accidents	Construction accidents	- Sub-component areas - Once in a month - Site visit	DFDO/ Contractor	DoF
Operation Phase				
Surface water quality	pH, Dissolved Oxygen, Free Ammonia (as N)	- Sub-component area and nearest villages - Once in six months - Collecte sample and analyse	DFDO/ Project/ Community	DoF

The institutional arrangement for the implementation and monitoring system for the EMP and EMoP is basically same as the project component monitoring system, but again it should be noted that only the sub-components which are identified as Category B as per JICA Guideline shall be the target of this monitoring. For details about the sample monitoring format at this level refer Attachment Monitoring form. DIU officer will compile monitoring results and reviews regularly, thereafter report to PMU, which analyse the result and share to concerned departments in the state government as well as report to JICA.

7. Institutional Arrangement and Capacity Development for ESAF

7-1 Institutional Arrangement

Under the Project, most of the aspects related to environmental and social issues and protection are to be managed by the DoF, Directorate of Fisheries, State Government of Assam. DoF is responsible for overall planned intervention in the Project, legal/policy development, ensuring adequate consultation and participation, inclusion of vulnerable groups such as STs, small-scale and marginal farmers, and women-headed households, in planning and implementation and the equitable distribution of benefits associated with site-level project interventions. DoF is responsible for overall planned intervention in the Project, legal/policy development, ensuring adequate consultation and participation, inclusion of vulnerable groups such as STs, small-scale and marginal farmers, and women-headed households, in planning and implementation and the equitable distribution of benefits associated with site-level project interventions. The district administration is the intermediary agency responsible for land administration and benefits to the project-affected stakeholder.

The ESAF will be implemented through the institutional structure of the Project and a director/officers at each administrative level shall be appointed as focal persons for ESAF compliance. Table 13 highlights the institutional structure for ESAF with key environmental and social management roles and responsibilities.

Table 13 Institutional Structure for ESAF Implementation and Monitoring

Institution	Role in the Project	(Additional) Role and/or Responsibility in ESAF
Directorate of Fisheries (DoF)	- Decision-making body - Lay down the broad policy framework for functioning of the society - Review the society's performance - All administrative and financial powers - Monitor utilization of funds	- Overall supervision of the ESAF and its implementation and M&E - Facilitation and coordination with various line departments and other agencies - Provide directions/advice to the PMU and DIU to ensure smooth/ efficient project operation on environment and social consideration - Periodical checks and due diligence on safeguards reports and monitoring data.
Project Management Unit (PMU) at State Level	- Project implementation, supervision and monitoring of all activities. - Documentation and reporting	Report to concerned departments in the state government as well as to JICA in relation to environmental and social considerations

		• Consultation and guidance to Dof/DIU/cooperative Organizations and field level officers on information disclosure and consultation • Technical guidelines on beneficiary selection, safeguard checks/ guidelines for particular activities (if required) • Development of planning/ monitoring forms, review of monitoring data, reporting, assistance with evaluations • Finalize criteria for categorization (Category B or C) as per JICA Guidelines. • Review of participatory environmental and social assessments • Performance of due diligence follow-up • Guide, instruct, prepare guidelines, establish and operate M&E, disseminate project information, hand-holding support in the field for all project activities.
District Fisheries Development Office	• Function as the dedicated and extended wing of the PMU for project implementation at the district level and as a subordinate office of the autonomous society. • Facilitate project implementation at the district level, and would extend all technical inputs and guidance to the cooperative of Farmers Organizations etc.	• Coordinate, monitor and supervise the ESC relevant activities at the district level • Conduct the screening and selection of subcomponents and determine the required procedures for specific subcomponents following the guidance/instruction of the PMU • Liaise with other line departments at the appropriate level for inter-sectoral convergence • Provide any specific support required for implementation and monitoring of the Project • Coordinate with subject matter experts
Project Operation and Management Office at DIU	• Support the DIU and facilitate project implementation at district level, and would extend all technical inputs and guidance to the field level organizations as and when required and through regular review meetings, frequency of which to be determined during the preparatory phase of the Project	• Coordinate, monitor and supervise the ESC relevant activities at the district level, including the screening and selection of subcomponents and determination of the required procedures for specific subcomponents following the guidance/instruction of PMU • Liaise with other line departments at the appropriate level for inter-sector convergence • Provide any specific support required for implementation and monitoring of the Project.
Cooperative of Farmers organization	• Assist in selecting target beneficiaries • Clarify local needs and expectations on the Project	• Conceive and raise awareness in the locality on environmental and social considerations. • Provide support in micro planning activities at the subcomponents level • Participate in environmental and social assessments • Support public consultation and due diligence checks

Source: Prepared by the JICA Survey Team

As mentioned above, DoF does not have any dedicated units or personnel for the purpose of ESC. Hence, one specialist and nodal officers will support the PMU and DIU for the compliance of the environmental and social safeguards for its smooth and efficient implementation such as environmental and social assessment, and management and monitoring of the environmental and social aspects within the ambit of the Project, which are proposed as follows:

Environmental and Social Consideration Expert: The expert is expected to support the PMU and DIU to review the project activities with focus on the compliance on ESAF, provide guidance and technical advice to the PMU and DIU for required environmental and social safeguard measures, as well as reporting to JICA to ensure smooth and efficient implementation of environmental and social safeguard measures.

Nodal Officers - Project Operation and Management Officer at DIU: The project officers shall be engaged on contractual basis with the PMU and DIU from the initial preparatory phase of the Project. Once the project implementation begins, the nodal officers shall maintain the continuity of the introduced processes/measures during the intermittent period when the PMC Expert is not mobilized to the Project. The nodal officers will report to the Director under PMU who would be holding the additional charge to ensure the compliance of ESC. The officers will assist the PMU and DIU in the following aspects:

- i) To facilitate and coordinate with various implementation and line departments;
- ii) To update and finalize ESAF;
- iii) To supervise/ manage the project activities to ensure that the required procedures indicated in ESAF are followed properly. The experts may also be required to follow-up in the field, where particular issues are identified and report to PMU.

The institutional arrangement for safeguard monitoring system is more or less similar to the project component monitoring system. At the field level, monitoring and reviews will be conducted by the respective level implementing organization and report to DIU. Then, the DIU Officer shall compile the monitoring results that need to be reviewed regularly and report to the PMU, which shall analyze the result and share to the concerned departments in the state government as well as in a form of annual report to JICA.

7-2 Capacity Development Programme

In order to ensure effective implementation of the proposed ESAF, it would be mandatory to enhance capacity of various agencies and stakeholders. In this regard, capacity development programmes, supported by the above proposed specialist/experts will not only help in establishing environmental and social management system, but would also ensure that environmental and social safeguards are effectively operationalised.

As a guiding principle an indicative capacity development programme has been formulated and depicted in below as a reference to formulate a detailed capacity development training programmes related to ESC. The indicative training programmes given below should be revised and specified further by the hired specialist/experts in consultation with the PMU.

- ✓ Training 1: Program for Management/Administrative Level (once a year in the five years at each district, two days training/year/district, PMU officials need to attend only one training in one of the district)
 - | Key Participants: Designated officials of PMU
 - | Programme:
 - Topic 1: General Orientation on ESAF for the Project
 - ✓ Legal framework on environmental and social safeguard of India and JICA
 - ✓ Basic introductory concept of safeguard
 - ✓ Environmental and social impact assessment: overview & regulations
 - ✓ Safeguard issues (vulnerable groups, SCs, STs, etc.)
 - ✓ ESAF: steps and procedures with respect to the Project
 - Topic 2: Monitoring and Evaluation for Environmental and Social Safeguard
 - ✓ Concept of M&E
 - ✓ M&E and reporting procedures
 - ✓ Use of M&E results and feedback, including Grievance Redressal Mechanism (GRM)

- ✓ Training 2: Program for Field/ Operational Level (once a year in the five years at each district, two days training/year/district)
 - Key Participants: Designated officials and staff of DIU and field level officers
 - Programme:
 - Topic 1: General Orientation on ESAF for the Project
 - ✓ Basic introductory concept of safeguard
 - ✓ Safeguard issues (vulnerable groups, SCs, STs, etc.)
 - ✓ Environmental and social impact assessment: overview
 - ✓ ESAF: steps and procedures with respect to the Project
 - ✓ Environmental protection, EIA and social safeguard regulations (specific)
 - ✓ Process of community consultation and public participation
 - ✓ Micro-planning
 - ✓ PRA for data collection, analysis and report preparation
 - Topic 2: Monitoring and Evaluation for Environmental and Social Safeguard
 - ✓ Concept of M&E
 - ✓ M&E and reporting procedures
 - ✓ Use of M&E results and feedback, including GRM
- ✓ Training 3: Farmer's Facilitation and ESA for Environmental consideration (Once a year in the five years/ the location/timing shall be determined accordingly)
 - Key Participants: Designated field level officers, Representatives of cooperative
 - Programme:
 - ✓ ESAF: steps and procedures with respect to the Project
 - ✓ Project activities planning
 - ✓ Role of related organizations
 - ✓ Participatory ESA procedures
 - ✓ Conflict resolution/ grievance procedures

8. Public Consultation and Disclosure Mechanism

Public consultation is one of the key regulatory tools used to improve transparency, efficiency and effectiveness of regulation, regulatory alternatives and improved accountability arrangements. It is an apt process to provide information to farmers, project-affected persons and other stakeholders relevant to the proposed Project, so that they are (i) sufficiently educated about the project's objectives, activities, benefits and risks; (ii) have equal opportunities to participate in the Project; (iii) receive culturally appropriate benefits which are more suited to their interests, capabilities and priorities (these shall be identified during the course prior to consultations), and are shared equitably; (iv) are not adversely affected by the Project or its associated activities; adverse impacts shall be mitigated appropriately; and (v) can raise project related grievances and make sure required mechanisms are in place.

Consultations provides an opportunity and platform for people to express and share their views and concerns, contribute to design and implementation of the programme activities, discussions on sensitive social mitigation measures.

8-1 Public consultation

As for the public consultation, although there are some exemptions, all Category 'A' and Category "B1" projects of new or expansion proposals or modernization etc. shall undertake Public Consultation. The general process is as follows (EIA Draft Notification 2020):

- The project and DoF shall arrange to forward copies, one hard and one soft, of the draft EIA Report along with the Summary EIA, simultaneously with application for conduct of public hearing, to the following authorities or offices, within whose jurisdiction the project will be located:
- Concerned Regional Office of the Ministry, Concerned Regional office of SPCB or UTPCC, District Magistrate, District Industries Office, Urban Local Bodies (ULBs) , Development authorities, etc.
- On receiving the draft EIA report, the above-mentioned authorities, shall make the same available for inspection, electronically or otherwise, to the public during normal office hours till the Public Hearing is over.

- The SPCB or UTPCC concerned shall also make similar arrangements for giving publicity about the project within the State or Union Territory and make available the Summary of the draft EIA Report for inspection in select offices or public libraries or any other suitable locations etc.
- Regarding Notice of Public Hearing, the Member-Secretary of the concerned SPCB or UTPCC shall finalize the date, time and exact venue for the conduct of public hearing within ten days of the date of receipt of application with the consent of officer presiding over the public hearing. He shall advertise the same in one major National Daily and one Regional vernacular Daily or Official State Language in another five days from the date of consent of presiding officer. A minimum notice period of twenty days shall be provided to the public for furnishing their responses.
- The advertisement shall also inform the public about places or offices where public could access the draft EIA Report and the summary EIA Report before the public hearing.
- Regarding public hearing, A representative of the applicant shall initiate the proceedings with a presentation on the project and the Summary EIA report.
- Persons present at the venue shall be granted the opportunity to seek information or clarifications on the project from the applicant. The summary of public hearing proceedings, reflecting all the views and concerns expressed shall be recorded by the representative of the SPCB or UTPCC.
- A Statement of issues raised by the public and comments of project proponent shall also be prepared in the local language or in English and annexed to the proceedings.
- The proceedings of public hearing shall be conspicuously displayed at the office concerned. The SPCB or UTPCC shall also display the proceedings on its website for general information. Comments, if any, on the proceedings may be sent directly to the concerned regulatory authorities and the project proponent concerned.

The time period for different activities relating to conduct of public hearing shall be as follows:

- (i) Finalization of the date, time and exact venue for the conduct of public hearing within ten days of the date of receipt of application;
- (ii) Advertise the details of public hearing in one major National Daily and one Regional vernacular Daily or Official State Language in another five days from the date of consent of presiding officer.
- (iii) Notice period of twenty days shall be provided to the public for furnishing their responses.
- (iv) The SPCB or UTPCC concerned shall sent the public hearing proceedings to the concerned Regulatory Authority within five days of the completion of the public hearing.

8-2 Grievance Redress Mechanism

India has a public grievance redress system called CPGRAMS (Centralized Public Grievance Redress and Monitoring System) (<https://pgportal.gov.in/>)

CPGRAMS is an online platform available to the citizens 24h/7days to lodge their grievances to the public authorities on any subject related to service delivery. It is a single portal connected to all the Ministries/Departments of Government of India and States. Every Ministry and States have role-based access to this system. The status of the grievance filed in CPGRAMS can be tracked with the unique registration ID provided at the time of registration of the complainant. CPGRAMS also provides appeal facility to the citizens if they are not satisfied with the resolution by the Grievance Officer. After closure of grievance if the complainant is not satisfied with the resolution, he/she can provide feedback.

Also, Project-level GRM which shall be applied to all sub-component is expected to be institutionalised, in which project-related grievances such as disputes over locations of infrastructure development, intended farmer's support, beneficiaries of value chain and marketing development, distribution of project benefits, contractor and his workers, project-related staff or consultants, etc. can be reported directly to the project.

9. Cost Estimation and Budget Allocation

9-1 Personnel

As already proposed in the previous section, considering the current capacity of the implementation agencies, external specialist/experts in charge of environmental and social safeguard should be designated as indicated below. The cost of such personnel has been incorporated into the proposed budget.

✓ Environmental and Social Consideration Specialist (ESCS):

It is proposed that Several man-months need to be allocated, during Preparatory and Implementation phase, for the ESC specialist under PMC. The specialist would support the project in all aspects related to ESC and is expected to review the project activities with focus on the compliance of ESAF, and provide directions or advice to PMU, etc. to ensure smooth and efficient implementation of environment and social safeguard measures, including reporting to JICA.

✓ Nodal Officer / Monitoring and Evaluation cum Environmental consideration Expert (ESE):

ESE shall/ could be responsible for environmental safeguards aspects under the project and responsible for implementation of ESC/ESAF from environmental safeguard aspects under the project.

1-2 members from respective administration level such as PMU, etc. shall be nominated as responsible positions for environmental and social safeguard and these costs shall be covered by their own organization, i.e. DoF or the project.

9-2 Capacity Building Programme

The following capacity building trainings are proposed in the Section 7 in this document and ESCS shall support PMU, etc. to ensure such capacity building trainings are delivered at each administrative level adequately.

The above (section7) mentioned 3 trainings would be imparted as a lecture style and no special equipment is required so that the cost requirement would be small (i.e. mainly for personnel, material preparation, accommodation or allowance for participants, etc.) Also, at the sub-component level, these trainings shall be imparted as a part of other trainings considering that several trainings would be organized while project implementation.

Attachment 4-5 Environmental and Social Monitoring Forms

1. During Construction

(1) DOF, PMU & Environmental expert level

(Used for monitoring by DoF personnel and PMU environmental specialists during on-site inspection, and to summarize information shared from subcomponent sites.)

Date of site inspection	Subproject/ Location	Issues	Mitigation measures undertaken	Remark
1. Air pollution				
2. Noise and Vibration				
3. Water pollution				
4. Waste of construction etc.				
5. Soil contamination				
6. Impact on ecosystem				
7. Impact of livelihoods				
8. Accidents and traffic management				
9. Working condition				

(2) District officer & nodal officer

(Used for periodic monitoring by field-level officers at subcomponent sites)

Air pollution

Parameter	Purpose	Check items	Observation results	Locations/Frequency
Dust, smoke	Verification the impact of dust from construction vehicles, etc.	Dust dispersion situation Health damage to surrounding residents		- Sub-component areas - Once in a month

Noise and Vibrations

Parameter	Purpose	Check items	Observation results	Locations/Frequency
Noise Vibration	Verification the impact of noise & Vibration from construction vehicles, etc	Noise and vibration situation Health damage to surrounding residents (Check the situation other than natural sounds (85dB or less))		- Sub-component areas - Once in a month

Soil pollution

Parameter	Purpose	Check items	Observation results	Locations/Frequency
Oil	Verification the situation of oil leaks, etc. caused by construction vehicles, etc.	Visually check for oil leaks and oil on the ground.		- Sub-component areas - As necessary during the construction period

Impact of livelihoods

Parameter	Check items	Observation results	Locations/Frequency
Residents of the area	Verification that residents are able to live and work in the same conditions as before construction. Noise and vibration situation. Health damage.		- Sub-component areas - Once in a month

Work condition

Check & Observation items	Observation results	Locations/Frequency
Dust, noise, and vibration control during construction, waste disposal measures, maintenance status of construction vehicles, safety training for vehicle operation, and accident prevention measures.		- Sub-component areas - Once in a month

Accident

Parameter	Check items	Observation results	Locations/Frequency
Worker	Safety measures Accident occurrence status Safety measures for dangerous areas, etc. Safety education		- Sub-component areas - Once in a month

2. During Operations

(1) DOF, PMU & Environmental expert

(Used for monitoring by DOF personnel and PMU environmental specialists during on-site inspection, and to summarize information shared from subcomponent sites.)

Date of site inspection	Subproject/ Location	Issues	Mitigation measures undertaken	Remark
1. Water pollution				
2. Waste of Household.				
3. Impact on ecosystem				
4. Impact of livelihoods				
5. Accidents and traffic management				

(2) District officer & nodal officer

(Used for periodic monitoring by field-level officers at subcomponent sites)

Water pollution

Purpose	Verification the impact of wastewater from the facility.			
Method	Collects sample and analyze			
Parameters	Standard Value	Result	Locations/Frequency	
pH	Between 6.5 to 8.5		- Sub-component area and nearest villages - Once in six months	
Dissolved Oxygen	4 mg/l or more			
Free Ammonia (as N)	1.2 mg/l or less			

Source: Class of water D, Designated Best Use Water Quality Criteria, Central Pollution Control Board

Attachment 4-6 JICA Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental and social Considerations (Reasons, Mitigation Measures)
I Permits and consultations	(1) EIA and environmental certificates	(a) Have EIA reports been already prepared in official process? (b) Are the EIA reports, etc. written in the official or widely used language of the country concerned? (c) Have EIA reports been approved? (If not yet approved, the expected date of approval should be indicated in the "Concrete Environmental and Social Considerations" column) (d) Are EIA reports and other approvals accompanied by conditions ancillary to the approval of the EIA report, etc.? If there are conditions ancillary to the approval, will the conditions be satisfied? (e) In addition to the above, have any necessary environmental permits been obtained from local authorities? (f) Have the items listed in Annex 2 of the Guidelines been covered (the scope and level of detail may be adjusted depending on the potential impacts of the project)? (g) Have the environmental and social considerations been verified for the entire scope of the project, cumulative impacts, derivative and secondary impacts, and inseparable operations?	(a) N (b) - (c) - (d) - (e) - (f) - (g) -	(a) EIA reports are not prepared. (b) The EIA report is written in an official language. (c)(d)(e)(f) The EIA report has not been approved. For this project, it is envisaged that the project will be classified into categories for which an EIA is not required, in accordance with Indian law. (g) Scoping of the possible sub-components has been done to ascertain the environmental and social status and proposed mitigation measures within the Environmental and Social Considerations Framework.
	(2) Explanation to the Local Stakeholders	(a) Have local stakeholders been properly analyzed and identified? (b) Have local stakeholders been adequately informed of the project and its impacts through a process that ensures meaningful consultation, including information disclosure, to gain their understanding? (c) Have records of consultations with local stakeholders, including the gender and other attributes of participants, been prepared? (d) Have comments from stakeholders been reflected in the project content?	(a)N (b)N (c)N (d)N	(a)(b)(c)(d) Specific stakeholder consultation meetings/workshops are yet to be planned. However, a series of meetings were held with various stakeholders in relation to project formulation. Comments of local stakeholders will be integrated into the design of sub-projects and activities prior to their implementation, following the social assessment and consultation processes. Consultation and information disclosure procedures to be implemented before and during preparatory phase, prior to subproject (component) implementation. EIA is not required for the proposed project according to Indian Law. However, based on necessity, public consultation related to project shall be considered.
	(3) Examination of Alternatives	(a) Have the scope of multiple alternatives for the project/plan been adequately considered? (b) Have feasible alternatives been considered in terms of technical, financial, and environmental and social considerations with a view to reducing total greenhouse gas emissions in terms of environmental and social items and, if necessary, total greenhouse gas emissions? (c) Have comparisons been made with alternatives that do not implement the project?	(a)N (b)N (c)N	(a)(b)(c) The project location and components have not been fully determined yet. However social and environmental considerations are to be factored into project design (through exclusion/selection criteria for project activities).

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental and social Considerations (Reasons, Mitigation Measures)
2 Pollution control	(1) Water Quality	(a) Considerations will be made to prevent pollution of surrounding waters by effluent from aquaculture ponds, etc.? (b) For feed, chemicals/antibiotics, etc., are appropriate standards for their use established, and is a system in place to disseminate these standards to the public? (c) Waste water from aquaculture ponds, processing facilities, fishing vessels, etc., will satisfy the effluent standards, etc., of the country concerned? (d) For domestic wastewater and rainwater drainage, do they meet the discharge standards, etc. of the country concerned? (e) Wastewater discharged into the area will not satisfy the environmental standards, etc. of the country concerned? (f) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)Y (b)Y (c)Y (d)Y (e)N (f)N	(a)(b)(c) There is no pollution to the surrounding water as aquaculture operations are carried out in accordance with the guidelines of the Aquaculture Research Institute(CIFA), The monitoring carried out by the government(NWMP) is within the standard values in the main ponds in Assam. (d)(e)(f) The facilities planned in the subcomponent will be equipped with septic tanks to reduce the environmental impact of wastewater.
	(2) Wastes	(a) Are wastes properly treated and disposed of in accordance with the regulations of the country concerned (in particular, processing facilities)? (b) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)Y (b)Y	(a)(b) During construction, no impacts are expected from this project. General waste from the facility is expected to be produced during operation, but the impact will be negligible
	(3) Noise and vibration	(a) Noise and vibration satisfy the standards, etc. of the country concerned (especially for processing facilities)? (b) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)Y (b)Y	(a) During the construction period, noise and vibrations from construction vehicles, etc. are expected to occur around the planning site. During operation, no impacts are expected from this project. (b) The impact on the surrounding area can be controlled by not carrying out construction work at night.
	(4) Odor	(a) Are there any odor sources? Measures will be taken to prevent odors (especially at processing facilities)? (b) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)Y (b)Y	(a)(b) During construction and operation, there are no impacts expected from this project.

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental and social Considerations (Reasons, Mitigation Measures)
3 Natural environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? (b) Is there a possibility that the project will affect the protected areas? (c) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)N (b)N (c)N	(a)(b)(c) The planning site is not a protected area.
	(2) Biodiversity	(a) Does the project site include primary forests, natural tropical forests, and ecologically important habitats (coral reefs, mangrove swamps, tidal flats, etc.)? (b) Does the project site contain habitats for valuable species that require protection under the laws of the country concerned, international conventions, etc.? (c) Does the project involve significant conversion or significant degradation of important habitats or important forests, and is there concern about significant impacts on biodiversity? If of concern, will appropriate measures be taken to address impacts on biodiversity? (d) Is there a risk of negative impacts on aquatic life, vegetation, or wildlife? (e) Are fishing methods that have minimal impact on the ecosystem, such as preventing over-collection of aquatic organisms and fish, and preventing abandoned fishing gear? (f) Are measures taken regarding eutrophication and red tide in the water body due to aquaculture feedstuffs considered? (g) Is there a risk of ecosystem disturbance due to the introduction of non-native species (species that are not native to the area), pests, etc.? (h) If there is concern about other significant impacts on biodiversity, will measures be taken to reduce such impacts?	(a)N (b)N (c)N (d)N (e)- (f)N (g)N (h)N (i)N	(a)(b)(c)(d)(h) The subcomponent sites are confirmed to exclude protected areas and other ecologically important sites, so there is no impact on biodiversity. (e) The project is an aquaculture project and there will be no over-harvesting. (f) (g) As aquaculture is carried out in accordance with the guidelines of the Institute of Aquaculture, Government of India (CIFA), there is no pollution to the surrounding water. (i) The construction of facilities in the subcomponents will be carried out within existing administrative grounds, so there will be not negative impacts.
	(3) Hydrospheric	(a) Are surface and groundwater flows affected negatively by changes in the water system due to the installation of aquaculture ponds in inland and coastal areas? (b) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)N (b)-	(a)(b) The subcomponent will use existing aquaculture ponds, so there will be no new installation work. There will be no impact on the water system, surface water and groundwater.
	(4) Morphology and Geology	(a) Does the creation of the site in a coastal area result in major alteration of the topography and geological structure around the proposed site, subsidence or loss of natural beaches? (b) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)- (b)-	(a)(b) The construction of facilities in the subcomponent will be not negative impact since it is located within the existing administrative site.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental and social Considerations (Reasons, Mitigation Measures)
4 Social environment	(1) Resettlement and site acquisition	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Does the project make efforts to minimize the impact of displacement? Does the acquisition of other sites or loss of means of livelihood occur? (c) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (d) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (e) Is the compensations going to be paid prior to the resettlement? (f) Is the compensation policies prepared in document? (g) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (h) Are agreements with the affected people obtained prior to resettlement? (i) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (j) Are any plans developed to monitor the impacts of resettlement? (k) Is the grievance redress mechanism established?	(a)N (b)- (c)- (d)- (e)- (f)- (g)- (h)- (i)- (j)- (k)-	(a)(b)(c)(d)(e)(f)(g)(h)(i)(j)(k) The Project have not any activity, which involves involuntary, resettlement or relocation of villages/ habitations.
	(2) Living and Livelihood	(a) Does the project have a negative impact on the livelihoods of the population? If necessary, will consideration be given to mitigate the impacts? (b) Does the project allocate rights related to water use (e.g., fishing rights) appropriately? (c) Does the project have negative impacts on ecosystem services (provisioning and regulating) and affect the health and safety of communities (especially indigenous peoples dependent on such services)? (d) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)N (b)- (c)N (d)N	(a) There will be no negative impacts on the livelihoods of residents due to the project. (b) There are no concerns because the project will use existing aquaculture ponds. (c) There will be no negative impacts of the project on ecosystem services or community health and safety. (d) There will be little negative impact as the construction of facilities in the sub-component will be within the existing administrative premises, but measures will be taken to mitigate against noise, etc.
	(3) Socially vulnerable	(a) Does the project give appropriate consideration to socially vulnerable groups such as women, children, the elderly, the poor, persons with disabilities, refugees and internally displaced persons, and minorities? (b) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)Y (b)N	(a)(b) The facility construction work in the subcomponents will be carried out within the existing administrative site, so there will be no negative impact.
	(4) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws? (b) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)N (b)N	(a)(b) The facility construction work in the subcomponents will be carried out within the existing administrative site, so there will be no negative impact

Cate gory	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental and social Considerations (Reasons, Mitigation Measures)
	(5) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken? (b) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)N (b)N	(a)(b) The facility construction work in the subcomponents will be carried out within the existing administrative site, so there will be no negative impact
	(6) Ethnic Minorities and Indigenous Peoples	(a) Does the project take into consideration the mitigation of impacts on the cultures and lifestyles of the country's minorities and indigenous peoples? (b) Have the land and resource rights of the minorities and indigenous peoples been respected? (c) If necessary, have indigenous peoples' plans been prepared and made publicly available? (d) Does the project make efforts to ensure that minorities and indigenous peoples are fully informed and free to reach prior agreement? (e) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)N (b)N (c) (d) (e)	(a)(b)(c)(d)(e) There are no specific ethnic and indigenous minorities in the area surrounding the site.
	(7) Working conditions	(a) Will the project comply with the relevant country's occupational safety and health laws?? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	(a)Y (b)Y (c)Y	(a) The project will be required to comply with the occupational safety laws of India. (b) Implement safety measures such as safety precautions and signage at the site during the construction period. (c) Provide safety training, including public health.
	(8) Health, safety and security of the local communities	(a) Is there any negative impact on hygiene, etc., such as disease outbreaks (including HIV and other infectious diseases) due to the influx of workers, etc. associated with the project? Are mitigation measures in place? (b) Is there any negative impact on community safety, such as worsening of public security, due to the influx of workers, etc. associated with the project? Are mitigation measures in place? (c) If security personnel or other security personnel employed by the counterparty in the formation and implementation of the project are to be used, will appropriate measures be taken to ensure that they will not use their security capabilities except for preventive and self-protection purposes? (d) Will the construction have any negative impacts? Will mitigation measures be provided?	(a)N (b)N (c)N (d)Y	(a) Currently, there are no outbreaks of corona or other epidemic diseases, and daily hand washing and gargling can be handled, (b) There will be no impact because the work will be outsourced to an appropriate contractor. (c) Appropriate measures can be taken by implementing safety measures and safety training. (d) Negative impacts such as noise and accidents are risks, but can be mitigated by not conducting construction work at night and by providing thorough safety education.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental and social Considerations (Reasons, Mitigation Measures)
5 Others	(1) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities? (e) Is there a grievance mechanism in place for environmental and social considerations?	(a)Y (b)Y (c)Y (d)N (e)Y	(a) Monitoring is programmed within the project. (b)The project is planned with reference to the Indian National Environmental Standards. (c) An Environmental and Social Assessment Framework has been prepared and a system has been proposed. (d) The frequency is not specified, but will be confirmed after the project implementation starts. (e) A grievance redressal system is in place in India. The Environmental and Social Assessment Framework has been developed and a grievance redressal mechanism has been proposed.
	(1) Reference to Checklist of Other Sectors	(a) For processing and storage facilities, the relevant check items in the checklist pertaining to the mining industry should be additionally evaluated, if necessary. (b) If necessary, the relevant checklist items for ports should be additionally evaluated (e.g., when port facilities are also being developed).	(a)- (b)-	(a)(b) The project does not include processing and storage facilities or port facilities.
6 Note	(2) Note on Using Environmental Checklist	(a) If necessary, also check the impact on transboundary or global environmental issues (e.g., transboundary disposal of waste, possible elements related to global warming issues, etc.). (b) For projects that are expected to generate more than a certain amount of greenhouse gases, have the total greenhouse gas emissions been estimated prior to project implementation?	(a)- (b)	(a) The project doesn't cause negative impact to transboundary or global issues. (b) India's per capita GHG (greenhouse gas) emissions are 1.91 tons. A simple calculation shows that this value would be achieved with approximately over 13,000 people working on the project at any given time. There will be small and simple facility construction, and the number of workers on the project is estimated to be about 100 at most. Therefore, although it is an estimate, we do not believe that the subcomponent will emit more than 25,000 tons of greenhouse gases per year.

Attachment 5: Gender action Plan

GENDER ACTION PLAN FOR ASSAM FISHERIES LIVELIHOOD IMPROVEMENT PROJECT

Significance of Gender Action Plan in the Project

Assam Livelihood Improvement Project aims to enhance livelihood of people in Assam through the increase of production of fish. To increase the production, it is crucial that fishers, both men and women, actively participate in the fishery activities. Integrating gender perspectives into planning, implementing and monitoring can ensure equal opportunities for men and women in the project and maximize its impacts. This Gender Action Plan (GAP) is a strategic plan for promoting gender equality and the empowerment of women in the Project by specifically outlining activities, responsible parties, indicators, and verification methods.

General Background of Women's Situation in Assam

The development plan "Assam 2030", established in 2016, lists gender equality as its fifth goal, aiming to eliminate discrimination and violence against women and girls, promote share responsibilities in the household, and ensure equal participation and opportunities of men and women in political, economic and public life. In various schemes related to fisheries, promoting women's participation in fishery is also encouraged. The Pradhan Mantri Matsya Sampada Yojana (PMMSY), national scheme to promote sustainable development of the fisheries sector, encourages participation of women in fishery through financial support. In this scheme, while 40% of the total budget is allocated as subsidy for beneficiaries in the general category and 60% for beneficiaries in scheduled tribes and castes, 60% is allocated to women, irrespective of their category. The Assam Agribusiness and Rural Transformation Project (APART), the World Bank-supported project aiming to add value and improve resilience of selected agriculture value chains including fishery, targets to ensure that 30% of all beneficiaries are women. One of the activities of APART is the promotion and establishment of FPCs. In Assam, out of the total 32 fisheries FPOs/FPCs, 25 FPCs have been established under APART, of which 24 have women members.

Meanwhile, in Assam, there is room for intervention to achieve gender equality in social and economic life and household. According to the Economic Survey, Assam 2023-24², the labor participation rate in Assam is 90.1% for men and 20.3% for women, showing a large disparity between men and women. Reasons behind would be that women in Assam often remain responsible for reproductive activities such as housework and childcare. Another possible reason may be that majority of women in Assam do not drive cars or motorbikes, which limits their mobility to the immediate surrounding area and reduces opportunities for jobs. Violence against women is another issue for women in Assam. National Health Family Survey 2019-21 (NFHS-5)³ reveals that 34% of ever-married women in Assam aged 18 to 49 have experienced spousal physical, sexual, or emotional violence, which is the 5th highest among all 28 states and 8 union territories in India. It is also noteworthy that early marriage among women is still prevalent in Assam. NFHS-5 shows that 30.8% of women in Assam (more than 40.0% in seven districts) aged 20 to 24 years married before age 18 years, while the national average is 23.3%.

Regarding aquaculture, which is the scope of this project, in the case of aquaculture at home, men are involved in a series of tasks such as releasing fry, feeding, cleaning, capturing fish, and selling fish at the market, while women are usually involved in feeding and cleaning. In large-scale aquaculture ponds owned by cooperatives and FPOs/FPCs, women are hardly involved in aquaculture. On the other hand, many women are involved in ornamental fish production and food processing (e.g. production of dried fish and pickled fish). After raising of ornamental fish or processing food at home, women go to the markets within walking distance to sell the products.

Gender Related Issues in Fishery in Assam

1) Gender-based perception about Fishery:

As mentioned above, schemes such as PMMSY and APART are promoting women's participation in fishery. However, a field study by the JICA survey team confirmed that some communities, cooperative societies, and women themselves perceive that "fishing is men's job." Due to this perception, there is a case where women who start aquaculture receive negative reactions from their family members and

² <https://des.assam.gov.in/information-services/economic-survey-assam>

³ <https://nhm.assam.gov.in/documents-detail/national-family-health-survey-5-2019-20>

communities. Even when fishing training is provided by the cooperative societies, it is heard that female members hesitate to participate because they do not have a confidence on doing fishery.

- 2) Less involvement of women in the decision making on household expenditure:
In Assam, men are usually involved in the series of aquaculture activities at home, from releasing fry to raising, feeding, capturing, and selling at the market, while women are partially involved in feeding and cleaning the ponds. In some areas, women is the main actors to lead aquaculture at home, while asking their husbands or male neighbors to help with capturing fish. In both cases, however, it was heard that husbands decide how to spend the income, even though both husbands and wives participate in aquaculture. One reason for this may be that in Assam, husbands are the ones who sell fish at the market, so there may be a perception that "it is the husband who earns money in the household." Also, women's involvement in aquaculture activities at home may be considered as a "part of the housework," not the contribute to the household economy.
- 3) Lack of knowledge about the management of farmers group with gender perspective:
The Assam Co-operative Act, enacted in 2007, requires that a cooperative society's board of directors must include at least two women (the same act applies when establishing an FPO). In addition, government and donors' schemes encourage the inclusion of female members in FPOs/FPCs. Although women has the membership of farmers group, it should be noted that not all female members are able to participate in activities on the same level as male members. For example, if a general meeting is expected to last a long time, female members who are responsible for housework and childcare at home may choose not to attend the meeting.
- 4) Unequal share of burdens on housework and childcare at household:
In Assam, women generally take responsibility of housework and childcare. Therefore, when women are going to participate in training, especially long-continued training or training in remote areas, they sometimes face opposition from their husbands, or they themselves are hesitant to participate in those trainings. Additionally, women feel difficulties to participate meetings of farmers group e.g. annual general meeting, when it is expected to hold for long hours. Eventually, they miss opportunities to join decision making of the group.
- 5) Lack of opportunities for Fishery Development Officers (FDOs) to receive gender training:
FDOs play a role in supporting fish farmers, including both men and women, on the front lines. However, currently there are no opportunities for them to receive gender training in the Assam DoF. Providing gender training will enable FDPs to understand the situations of male and female fishers and provide appropriate support based on their respective needs.

Gender Mainstreaming Viewpoints

- 1) A change in perception from "fishery is a man's job" to "fishery is a job that both men and women can participate in" to promote participation of women in fishery;
- 2) Promotion of equal participation in decision-making and shared family responsibility for the effective participation of women in fishery and enhance productivity;
- 3) Reflecting women's needs in the management of farmers groups and promoting their participation in decision-making;
- 4) Capacity building of FDOs on gender mainstreaming to enable them to promote gender equality and women's empowerment in fishery sector in Assam.

Key strategic interventions to promote gender equality and women's empowerment in the Project (in chronological order)

- Assignment of Project Management Consultant (PMC) in charge of gender mainstreaming.
To promote gender mainstreaming in the project, PMC in charge of gender mainstreaming is assigned. His/her responsibilities in the Project overall are as follows.
 - Provide necessary guidance in all stages of the Project including planning, implementation, monitoring and evaluation with the gender point of view.
 - Create a "Gender Guideline for Construction" to construct facilities in the Project with the gender point of view. After all the facilities are constructed, conduct discussions with users and modify the guideline if necessary.
 - Create a "Manual for Gender Training in Fishery Sector" and utilize in gender training in the Project. After trainings are completed, conduct discussion with trainers and modify the manual if necessary.

- Conduct a briefing of gender mainstreaming in the Project for Project Management Unit (PMU)
To promote gender mainstreaming in this project, it is important that project management side has a common understanding of gender. Therefore, after the project launched, gender briefing session for PMU will be conducted by the PMC in charge of gender mainstreaming. The proposed topics are as follows:
 - Explain basic concepts related to “gender,” “gender equality and women’s empowerment,” “gender norms,” “gender issues,” and “gender mainstreaming.”
 - Explain gender issues in Assam's fishery industry which were identified in the preparatory survey.
 - Explain of the Gender Action Plan.
- Conduct a gender training for FDOs (ToT):
FDOs, including District FDOs (DFDOs) and block-level FDOs play a key role in supporting fishers on the front lines. Gender training for FDOs as a ToT can enable them to have a correct understanding of gender, understand the needs of both male and female fishers, and provide appropriate support for them. The proposed training contents are as follows.
 - Explain the basic concepts of “gender,” “gender equality and women’s empowerment,” “gender norms,” and “gender issues.”
 - Visualize the participation of men and women in fishery using gender analysis tools such as “Activity Profile.”
 - Visualize workload and burden between men (husbands) and women (wives) using gender analysis tools such as “Daily Activity Profile,” and consider measures to share the burden.
 - Visualize the decision making at household using gender analysis tools such as “Access and Control Profile,” and consider measures to eliminate disparities between men and women in decision-making.
 - Explain the situation of gender-based violence and early marriage in Assam.
 - Discuss gender norms and gender issues in fishery industry and communities.
 - Based on the above gender analysis and discussion, consider how FDOs can support fishers in the front line with the perspective of gender.
- Ensure women's participation in aquaculture:
The project will support beneficiaries including farmers groups such as cooperative societies and FPOs/FPCs, as well as individual farmers, in improving productivity of fish through feed-based aquaculture. Without special attention for selecting female beneficiaries, there is a risk that the beneficiaries will be biased towards men, due to the perception that “fishery is a men’s job.” Therefore, the Project will ensure women’s participation in aquaculture by prioritizing female individual farmers as well as groups where more than 30% of the members are women during the selection of beneficiaries. It should be noted that reconsideration of housework of women is necessary to promote women’s participation in aquaculture. The Project, therefore, will include this topic in the gender training to farmers, cooperative societies and FPOs/FPCs as mentioned below.
- Ensure women's participation in cooperative societies of fish seed production:
To enhance efficiency of fish seed production, the Project will support formation of cooperative societies organized by producers. The Project will ensure women’s participation in fish seed production by having clear target of women’s participation rate in the guideline of formation of cooperative societies.
- Conduct gender training for aquaculture farmers and fish seed producers:
Gender training will be provided to aquaculture farmers with the following objectives: 1) to raise awareness that "fishery is a job that both men and women can participate in," 2) to promote equal participation of men and women in household decision-making, and 3) to reconsider share of workload in household. The proposed training content is as follows.
 - Explain the basic concepts of “gender,” “gender equality and women’s empowerment,” “gender norms,” and “gender issues.”
 - Visualize the participation of men and women in fishery using gender analysis tools such as “Activity Profile.”
 - Visualize workload and burden between men (husbands) and women (wives) using gender analysis tools such as “Daily Activity Profile,” and consider measures to share the burden.
 - Visualize the decision making at household using gender analysis tools such as “Access and Control Profile,” and consider measures to eliminate disparities between men and women in decision-making.
 - Explain the situation of gender-based violence and early marriage in Assam.
 - Create an action plan by each farmer for identified issues through the above gender analysis.
- Conduct gender training for cooperatives societies and FPOs/FPCs:
To encourage active participation of both male and female members in group activities, it is important for group management to understand the needs of members from a gender perspective and plan activities

and provide services accordingly. To realize such a situation, gender training will be provided to the management of the groups targeted in this project. The proposed training content is as follows.

- Explain the basic concepts of “gender,” “gender equality and women’s empowerment,” “gender norms,” and “gender issues.”
- Visualize the participation of men and women in group activities using gender analysis tools such as “Activity Profile.”
- Visualize the decision making of group activities using gender analysis tools such as “Access and Control Profile,” and consider measures to eliminate disparities between men and women in decision-making.
- Discussion with group members (by gender) and understand their issues and needs.
- Create an action plan for promoting gender equality and women’s empowerment in the group.
- Facilitate women’s participation in fishery technical training:
While conducting gender training above, it may be a long time to achieve shared responsibility and reduce women’s burdens at household, so women may face restrictions to participate in training held in remote area or held for long hours. In addition, since women in Assam, especially in rural areas, usually do not drive a vehicle or motorbike, they prefer to participate trainings in their vicinity. Therefore, the project will carefully consider the needs of female participants when deciding on training locations, dates, and times.
- Creation of the “gender guideline” for facility construction:
This Project plans to construct a fishery market and training facilities. To construct facilities that all users feel comfortable, reflecting the needs of both men and women is necessary. Therefore, a PMC in charge of gender mainstreaming will create a “gender guideline” for the construction of facilities, and the project will proceed the construction of facilities in accordance with this guideline.

Gender Action Plan

To overcome challenges above and promote gender mainstreaming in the project, actions shown in Table X are suggested for each sub-component of DPR.

Table Gender Action Plan of the Project

Project Component		Sub-component		Gender related Actions	Responsibility	Indicators	Means of Verification	Timeline of Verification
1	Fish Productivity Enhancement of Feed-based Aquaculture							
1-1	Promotion of feed-based aquaculture and semi-intensive aquaculture	(1)	Productivity enhancement of existing community/institutional tanks	- Prioritize female individual farmers and farmers group where more than 30% of the members are women	- By PMU with the support from PMC in charge of gender mainstreaming.	- More than 30% of selected individual farmers are women. - Farmers group have more than 30% of members are women are selected.	- Basic data from proposals at the selection	- At the selection of beneficiaries
		(2)	Productivity enhancement of existing individual ponds of progressive fish farmers					
		(3)	Productivity enhancement in existing individual ponds of small fish farmers					
1-2	Development of fish seed village	(1)	Development of fish seed production village					
		(2)	Support for organization of fish seed producers	- Prioritize female fish seed producer to organize cooperative societies.	- By CBBO with the support from PMC in charge of gender mainstreaming.	- More than 30% of selected members of each cooperative society are women.	- Basic data from proposals at the selection	- At the selection of beneficiaries
		(3)	Upgradation of carp hatchery					
1-3	Credit linkage to fishermen groups for input cost	-	-					
1-4	Research and Development	(1)	Promotion of high yield varieties of Pangasius in existing individual ponds	- Facilitate women's participation in technical trainings by considering locations and date/times.	- By PMU with the support of PMC in charge of gender mainstreaming.	- More than 80% of female training participants feel that trainings are easy to participate in terms of locations and date/time.	- Midline and end-line survey	- Midline and end-line survey

Project Component		Sub-component		Gender related Actions	Responsibility	Indicators	Means of Verification	Timeline of Verification
		(2)	Promotion of Scampi culture in polyculture system with carp	- Facilitate women's participation in technical trainings by considering locations and date/times.	- By PMU with the support of PMC in charge of gender mainstreaming.	- More than 80% of female training participants feel that trainings are easy to participate in terms of locations and date/time.	- Midline and end-line survey	- Midline and end-line survey
		(3)	Need based research studies (R&D) as per project requirement					
2 Development of Fish Value Chain								
2-1	Development of fish value chain & market infrastructure	(1)	Aquaculture business unit	- Construct aquaculture business unit in accordance with the Gender Guideline for Construction created by the gender expert of PMC.	- By PMU with the support of PMC in charge of gender mainstreaming.	- Aquaculture business unit is constructed in accordance with the Gender Guidelines for Construction.	- Gender Guideline for Construction	- Midline/endline survey
		(2)	Mobile fish kiosk					
		(3)	Gramin hygienic fish market	- Construct gramin hygienic fish market in accordance with the Gender Guideline for Construction created by the gender expert of PMC.	- By PMU with the support of PMC in charge of gender mainstreaming.	- Gramin hygienic fish market is constructed in accordance with the Gender Guidelines for Construction.	- Gender Guideline for Construction	- Midline/endline survey
3 Support of Fishery Entrepreneurs								
3-1	Development of Blue Tourism for fish farmers' livelihood enhancement	-	-	- Promote women's participation and income generations.	- By PMU with the support of PMC in charge of gender mainstreaming.	- Proposals include activities promoting women's participation and their income generations are selected.	- Basic data from proposals at the selection	- At the selection of proposals
3-2	Entrepreneurs hip Development	-	-	- Promote women's participation and income generations.	- By PMU with the support of PMC in charge of gender mainstreaming.	- Proposals include activities promoting women's participation and their income generations are selected.	- Basic data from proposals at the selection	- At the selection of proposals

Project Component		Sub-component		Gender related Actions	Responsibility	Indicators	Means of Verification	Timeline of Verification
4	Infrastructure Development for Training/Extension and Capacity Building							
4-1	Infrastructure development for aquaculture extension, training & capacity building	(1)	Upgradation of Aquaculture Lab for soil and water quality assessment, disease detection etc. at the Block HQ/Departmental Fish Farm through PPP mode	- Upgrade aquaculture lab in accordance with the Gender Guideline for Construction created by the gender expert of PMC.	- By PMU with the support of PMC in charge of gender mainstreaming.	- Aquaculture lab is upgraded in accordance with the Gender Guideline for Construction	- Gender Guideline for Construction	- Midline/endline
		(2)	Strengthening of training cum production center (TCPC), Guwahati	- Construct TCPC in accordance with the Gender Guideline for Construction created by the gender expert of PMC.	- By PMU with the support of PMC in charge of gender mainstreaming.	- TCPC is constructed in accordance with the Gender Guideline for Construction.	- Gender Guideline for Construction	- Midline/endline
4-2	Innovative and advance technology adoption for data management in fishery sector in Assam	-	-					
4-3	Distribution of pond health cards & fish farmers ID card	-	-					
4-4	Capacity building of farmers and stakeholders	-	-	(Through gender trainings for aquacultural farmers and fish seed producers) - Enhance the awareness that “both men and women can join fishery.”	(Gender training) - By DPMU and DFDOs with the support of PMC in charge of gender mainstreaming	(Gender training for aquacultural farmers and fish seed producers) - More than 90% of farmers recognize that	- Midline and end-line survey	- Midline and end-line survey

Project Component		Sub-component		Gender related Actions	Responsibility	Indicators	Means of Verification	Timeline of Verification
				- Promote share of workload and joint decision making at household between men and women - Create action plan for gender equality and women's empowerment (by each farmer/producer) (Through gender trainings for management of cooperative societies and FPOs/FPCs of aquaculture and fish seed production) - Promote incorporation of gender perspective in the management of groups (e.g. cooperative societies, FPOs/FPCs). - Create action plan for gender equality and women's empowerment (by each cooperative society/FPO/FPC) (Through fishery technical training) - Facilitate participation of women in technical trainings by considering locations and date/time.	(Fishery technical training) - By PMU with the support from PMC in charge of gender mainstreaming.	“both men and women can join fishery.” - More than 80% of female farmers realize that the share of workload at household has been improved. - More than 80% of female farmers realize that equal decision making at household achieved. - 80% of action plans created through gender training is achieved. (Gender trainings for management of cooperative societies and FPOs/FPCs of aquaculture and fish seed production) - More than 80% of female members of each group feel that their needs are reflected in group activities. - 80% of action plans created through gender training is achieved. (Fishery technical training) - More than 80% of female training participants feel that trainings are easy to participate in terms of locations and date/time.		

Project Component		Sub-component		Gender related Actions	Responsibility	Indicators	Means of Verification	Timeline of Verification	
5	Institutional Development for Project Management								
5-1	Establishment and management of SPMU/ DPMU	(1)	Recruitment of SPMU and DPMUs						
		(2)	Procurement of equipment and materials of SPMU and DPMUs						
		(3)	Project management information system	- Enhance awareness of gender among SPMU and DPMU by providing gender briefing.	- PMC in charge of gender mainstreaming	- More than 90% of staff of SPMU and DPMU understand the concept of gender, gender issues in the fishery sector of Asam, and Gender Action Plan	- Post questionnaire after gender briefing	- When the gender briefing is conducted	
5-2	Capacity building of program officers	(1)	Technical training for officers	- Enhance awareness of gender among DFDOs and block-level FDOs by providing gender training.	- PMC in charge of gender mainstreaming	- More than 90% of staff of DFDOs and block-level FDOs understand the concept of gender and gender issues in the fishery sector of Asam - More than 70% of staff of DFDOs and block-level FDOs have confident of supporting fishers with gender perspective	- Post questionnaire after gender briefing - Midline and end-line survey	- When the gender briefing is conducted - Midline and end-line survey	
		(2)	Exposure visit						
5-3	Monitoring & Evaluation	(1)	Baseline survey	- Include questionnaire regarding gender	- PMC in charge of gender mainstreaming	- Questions regarding gender is included in the baseline survey	- Survey form	- By the start of baseline survey	
		(2)	Mid-term survey	- Include questionnaire regarding gender	- PMC in charge of gender mainstreaming	- Questions regarding gender is included in the mid-term baseline survey	- Survey form	- By the start of mid-line survey	
		(3)	Endline survey	- Include questionnaire regarding gender	- PMC in charge of gender mainstreaming	- Questions regarding gender is included in the endline survey	- Survey form	- By the start of endline survey	