



# Sector Action Plan

## Agriculture

(Crops, Forestry, Fisheries, Livestock, Water Resources & Irrigation)



**Agriculture, Water Resources and Rural Institutions Division**  
Bangladesh Planning Commission  
Government of the People's Republic of Bangladesh





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June 2023

## Sector Action Plan Agriculture

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**M. A. Mannan, MP**

Minister

Ministry of Planning

Government of the People's Republic of Bangladesh &

Vice Chairman, Bangladesh Planning Commission

## Message

I am pleased to learn that the Government of Bangladesh (GOB) through Agriculture, Water Resources and Rural Institutions Division (AWRRID) of the Planning Commission has prepared the Sector Action Plan (SAP) on 'Agriculture' to achieve the goals set in the ongoing 8<sup>th</sup> Five Year Plan (2020-25). A provision of preparing the Sector Action Plan is kept in the project titled "Formulation of Sector Plan and Capacity Development of Concerned Officials for More Effective Public Investment" which is being implemented by AWRRID.

I do believe that this sector action plan has emphasized the framework for the identification of public policy initiatives. It will also help the policy maker to take projects for the public sector intervention, including the role of government agencies in developing the agriculture sector in partnership with other government institutions, private sector development partners, local government bodies and NGOs. This strategic document reflects throughout efforts by the government in outlining responsibilities by the Ministries/ Divisions/ Agencies/ Institutions.

I would like to express my heartfelt thanks to AWRRID Officials for their vision and efforts for successfully formulated and finalization the sector action plan on Agriculture. This document paves the way not only to reflect upon the agriculture development but also the clear roadmap that has been depicted in the document that contribute to the development of agriculture sector of Bangladesh.

(M. A. Mannan, MP)





**Dr. Shamsul Alam**

State Minister

Ministry of Planning

Government of the People's Republic of Bangladesh

## Message

I am really happy to learn that the Government of Bangladesh (GOB) through Agriculture, Water Resources and Rural Institutions Division (AWRRID) of the Planning Commission has prepared the Sector Action Plan (SAP) on 'Agriculture' to achieve the goals set in the ongoing 8<sup>th</sup> Five Year Plan (2020-25).

The development vision for agriculture is to ensure food and nutritional security, enhancement of sustainable intensification and diversification of climate resilient agricultural production. The major focus was centered on consolidating and expanding the productivity as well as designing policies, strategies and actions to accelerate the crop diversification commercialization process by increasing local and export market opportunities with active involvement of farmers and other stakeholders.

So far, I know it is the first formal document on implementation strategy of the 8th Five Year Plan. It reflects well throughout efforts by the government in delineating responsibilities by the Ministries/ Divisions/ Agencies/Institutions.

The sector action plan has also highlighted the framework for the identification of public policy initiatives and projects for the public sector intervention, including the role of government agencies in developing the agriculture sector in partnership with other government institutions, private sector development partners, local government bodies and NGOs.

Finally, I am delighted that AWRRID officials have successfully formulated and finalized the sector action plan on Agriculture. I would like to offer thanks to various Ministries/Divisions/ Agencies/Institutions for providing their consensus and support on the finalization of sector action plan on Agriculture.

(Dr. Shamsul Alam)







**Satyajit Karmaker**

Secretary  
Planning Division  
Ministry of Planning  
Government of the People's Republic of Bangladesh

## Message

I am very delighted to know that the Government of Bangladesh (GOB) through Agriculture, Water Resources and Rural Institutions Division (AWRRID) of the Planning Commission has prepared the Sector Action Plan (SAP) on 'Agriculture' to achieve the goals set in the ongoing 8<sup>th</sup> Five Year Plan (2020-25). A provision of preparing the Sector Action Plan is kept in the project titled "Formulation of Sectoral Plan and Capacity Development of Concerned Officials for More Effective Public Investment" which is being implemented by AWRRID.

The sector action plan is the first formal document on implementation strategy of the 8th Five Year Plan. It reflects well throughout efforts by the government in delineating responsibilities by the Ministries/ Divisions/Agencies/Institutions.

The sector action plan has highlighted the action points and framework for the identification of public policy initiatives and projects for the public sector intervention, including the role of government agencies in developing the agriculture sector in partnership with other government institutions, private sector, development partners, local government bodies and NGOs.

My sincere thanks are due to the AWRRID officials for their effort in preparing the sector action plans. I would also like to convey my thanks to various Ministries/Divisions/Agencies/Institutions for providing their relentless support in formulating and finalizing the sector action plan on agriculture.

(Satyajit Karmaker)





**A K M Fazlul Haque**

Member (Secretary)

Agriculture, Water Resources and Rural Institutions Division,  
Bangladesh Planning Commission  
Government of the People's Republic of Bangladesh

## Message

I am glad to know that Agriculture, Water Resources and Rural Institutions Division (AWRRID) of the Planning Commission has finally prepared the first formal document of Sector Action Plan (SAP) on 'Agriculture' to achieve the goals set in the ongoing 8<sup>th</sup> Five Year Plan (2020-25).

Sector Action Plan on Agriculture is crucial for Bangladesh. Agriculture is the backbone of Bangladesh's economy, providing employment to a significant portion of the population. Effectives sector action plan ensures a stable food supply, reducing the risk of hunger and malnutrition. The major focus is centered on consolidating and expanding the productivity as well as designing policies, strategies and actions to accelerate the crop diversification commercialization process by increasing local and export market opportunities with active involvement of farmers and other stakeholders.

As far as I know this sector action plan is the first formal document on implementation strategy of the 8th Five Year Plan. I think that this SAP will reflect the aggregate efforts by the government in delineating responsibilities executed by the Ministries/Divisions/Agencies/Institutions. This sector action plan will make a connectivity among the government institutions, private sectors, development partners, local government bodies and NGOs during policy formulation and intervention.

Finally, I am grateful to AWRRID officials, Planning Division, all the relevant ministries, divisions and agencies for the great support they made in formulating and finalizing the sector action plan on 'Agriculture'.

(A K M Fazlul Haque)





**Md. Sayduzzaman**

Chief (Additional Secretary)

Agriculture, Water Resources and Rural Institutions Division  
Bangladesh Planning Commission

## Foreword

It is of immense pleasure that Agriculture, Water Resources and Rural Institutions Division (AWRRID) of Bangladesh Planning Commission is going to publish the Sector Action Plan (SAP) on “Agriculture” which will help implementing the country’s Eighth Five Year Plan (2020- 2025) to achieve its goals. Development of the sector has long been recognized as a crucial factor in overall rural and agricultural development, contributing not only economic growth, but also to environmental protection and community wellbeing of the country.

The development vision for agriculture is to ensure food and nutritional security, through climate resilient agricultural production. The major focus was centered on consolidating and boosting the productivity as well as designing policies, strategies and actions to accelerate the crop diversification commercialization by increasing local and export market opportunities through the active involvement of farmers and other stakeholders.

So far, my knowledge, it is the first formal initiative on implementation strategy of the 8<sup>th</sup> Five Year Plan. It reflects well thought efforts by the government to delineate the responsibilities of the Ministries/ Divisions/Agencies/Institutions.

The Sector Action Plan on Agriculture includes Crops, Forestry, Fisheries, Livestock, Water Resources and Irrigation Sub-sectors. For developing the Plan several broad themes and challenges were identified for each of the sub-sectors. For overcoming the challenges, thematic area wise projects and actions have been proposed for implementation during 2023-25 & 2025-2030.

The sector action plan has highlighted the framework for the identification of public policy initiatives and projects for the public sector intervention, including the role of government agencies in developing the agriculture sector in partnership with private sector development partners, local government bodies and NGOs.

I am obliged to Mr. M. A. Mannan MP, Hon’ble Minister, Ministry of Planning and Dr. Shamsul Alam, Hon’ble Minister of State, Ministry of Planning for their constant guidance in finalizing the Sector Action Plan. I am indebted to the relevant officials of AWRRID for their untiring support and cooperation in managing the study. I hope that the relevance of the issues and the diverse contents and analyses would make the plan useful for the respective government agencies, policymakers, and others who are interested in understanding the environmental management, climate change and development challenges of the country.

(Md. Sayduzzaman)





**Md. Samsul Islam**

Deputy Chief and Project Director  
FSP&CD Project  
Agriculture, Water Resources and Rural Institutions Division  
Bangladesh Planning Commission  
Government of the People's Republic of Bangladesh

## PREFACE

It is the pleasure to express my sincere thanks to the Secretary of the Planning Division, Ministry of Planning and Member (Secretary) of the Agriculture, Water Resources and Rural Institutions Division, Bangladesh Planning Commission for providing their guidance and valuable support for accomplishing this Sector Action Plan for Agriculture. Efforts to provide guidance in conducting the study and to provide an endeavor to ensure quality elements in this document by all the members of the Technical Committee and Editorial Board are appreciable.

The Sector Action Plan on Agriculture has been prepared by the Agriculture, Water Resources and Rural Institutions Division of the Bangladesh Planning Commission to achieve the goals set in the 8<sup>th</sup> Five Year Plan. The Sector Action Plan has been considered an effective tool to establish a link between the Five-Year Plan and the Annual Development Program. These tools identify actions to achieve the goals contained in the five-year plan. Based on these Actions possible projects have been identified. Development projects as identified in the Action plan, will create an opportunity to bring sector-specific project formulation into a discipline. Besides, long-term plans such as SDG, Perspective Plan and Delta Plan have been aligned with the Sector Action Plan.

Our efforts will be worthwhile if our policymakers, development partners and all relevant stakeholders identify projects and programs in line with the Sector Action Plan for attaining goals and targets set forth in Eighth Five Year Plan and subsequent years.

Finally, I would like to express my gratitude to all the Project Directors involved in the projects in past, Deputy Project Director and the officials of AWRRID for their continuous support and cooperation in completing the sector action plan successfully.

(Md. Samsul Islam)





## Executive Summary

The Government of Bangladesh (GOB) through Agriculture, Water Resources and Rural Institutions Division (AWRRID) of the Planning Commission has undertaken a process of preparing Sector Action Plan (SAP) on Agriculture to achieve the goals set in 8<sup>th</sup> Five Year Plan (2020-25) under “Formulation of Sector Action Plan and Capacity Development of Concerned Officials for more Effective Public Investment (FSP&CD) Project”. The Sector Action Plan on Agriculture includes Crops, Forestry, Fisheries, Livestock, Water Resources and Irrigation sub-sectors as follows.

**Crops Sub-sector:** Bangladesh is predominantly an agrarian country. Due to its very fertile soil and favorable weather, varieties of crops grow abundantly throughout the year. Agriculture sector contributes about 11.38% to the country’s Gross Domestic Product (GDP) and employs more than 45.33% of total labor force (Ref: BBS Statistical Year Book 2022). Crop Sub-sector faces triple major challenges are: (i) recurring loss of cultivable land; (ii) exponential population growth; and (iii) climate change, which hinders the development of the Sub-sector. However, the researchers, extension personnel, policy makers and top management are concerned of the situations. The present initiative of developing SAP is an effective step to address the challenges. Application of modern scientific tools for breaking the current trend in productivity, reducing post-harvest loss, quality and timely input supply and farm mechanization could be aid insustainable improvement of the Sub-sector. It provides a comprehensive picture of sectorial goals, performances, opportunities, challenges, and above all, identify policies and strategies, underpin actions and tentative budgets, that support the on-going 8<sup>th</sup> Five Year Plan and beyond. The plan could provide a framework for the identification of public policy initiatives and projects for the public sector intervention, including the role of government agencies. Emphasis on climate smart agriculture, adopting appropriate technology for AEZs, research-extension-farmers capacity development, marketing and restoring of natural resource bases could enhance the capacity of the sub-sector. The government assured for all possible financial and management supports to make the 8<sup>th</sup> FYP successful.

**Forestry sub-sector:** Forests cover 14.1% of Bangladesh’s land area and contribute to 1.29% of gross national income (BFI 2019). This Sub-sector helps to support livelihoods of the poor, reduce impact of natural disasters, which is crucial for environmental well-being. In the 8<sup>th</sup> FYP, comprehensive forest resource assessment supports, effective planning, conservation, and management of the critical resource are highlighted with funding support. Bangladesh Forest Department is playing a major role in forest resources management since 1865. Investment for forestry was limited till independence. However, there is adequate funding support indicated in the 8<sup>th</sup> FYP. The previous achievements including the 7<sup>th</sup> FYP and 8<sup>th</sup> FYP were reviewed. The 8<sup>th</sup> FYP has agreed to include 500 meter foreshore afforestation along coastal embankments, which is a practical example for reducing damage by cyclones and tidal surges especially due to unpredictable event of climate change. The present study included narrative in clear terms with physical and financial quantity, which are priority of the Forest Departments, and MoEFCC. The constitutional obligation, sub sectorial goals, institutional strength, opportunities, challenges, policies and strategies, practical actions and tentative budgets, for 8<sup>th</sup> Five Year Plan and beyond, have been described in the action plan.

**Fisheries sub-sector:** During the past decade, the sub-sector expanded at an average annual rate of 5.26%. More than 10% of the populations are directly or indirectly engaged in various activities of fisheries sub-sector for their livelihood. Fisheries sub-sector contributes 3.57% to the national GDP and 25.30% to the total agricultural GDP of the country and contributing 1.50% to the foreign exchange

earnings by exporting fish and fish products. During the 7<sup>th</sup> FYP period, the fisheries sub-sector grew annually at 6.23%. Fisheries sub-sector plays an important role in rural employment generation and poverty alleviation. In 2020-21, the total fish production was 4.621 Million MT and the yearly growth rate was 5.9%. The two major contributing factors behind the performance of fisheries sub sector are: i) pond aquaculture using hatchery produced fingerlings; and ii) conversion of fish ponds by raising embankments around low-lying land. Inland production is historically the major supply source of fisheries products in Bangladesh. The average growth of inland fisheries was 6.7% against 3.25% for marine fisheries. At present Bangladesh ranked 3<sup>rd</sup> position in producing fish from inland water bodies, 5<sup>th</sup> in aquaculture production and 11<sup>th</sup> in marine fish production in the world. Bangladesh achieved self-sufficiency in fish production with a per capita fish consumption of 62.58 g/day against set target of 60 g/day. The objectives of the fisheries sub-sector in 8<sup>th</sup> FYP, are to enhance productivity, livelihood security and equitable distribution of benefits while conserving the potential fisheries resources and aquatic biodiversity. But the fisheries sub-sector has been facing challenges, which could limit the growth in the near future. Renewed opportunities through the development of local and global research findings combining with free international trade and marketing could combat the challenges. The main goal of agriculture is to achieve self-sufficiency in food and nutrition. To attain this goal, the government has placed highest importance on the overall development of fisheries sub-sector.

**Livestock sub-sector:** Livestock is a very important component for the development of a wealthy nation. The contribution of livestock in the gross domestic product (GDP) of Bangladesh is 1.47 – 1.50% with GDP growth rate is 3.47%. About 20% of the people in the country are directly engaged with livestock sub-sector (2021). The Livestock sub-sector consultant prepared the Action Plan on the basis of: (i) Literature Review; (ii) Key Informant Interview; and (iii) Consultative Meeting. Primary and secondary sources of data and interacted with the policy makers, researchers and professional extension workers. At the primary source, the Consultant conducted KIIs with Senior Project Officials of the Department of the Livestock Services (DLS), and Bangladesh Livestock Research Institute (BLRI). Both quantitative and qualitative observations and the current and future challenges of the Sub-sector have been analyzed for a meaningful report. The study has captured the overall development vision, mission, objectives and targets of the 8<sup>th</sup> FYP. Action could be taken on policy environment through public-private partnership and enhanced participation of private sector entrepreneurs. In participation, research and development and effective livestock farm management system could be introduced for sustainable livestock production.

**Water resources sub-sector:** Bangladesh agriculture is mainly dependent on hydrological cycles; flooding in wet seasons, irrigation in dry seasons, supplementary irrigation mainly in wet seasons, protection of saline water intrusion in coastal areas, proper drainage both in wet and dry seasons, protection of river bank erosion and safeguard measures of water-related hazards (storm surge/ cyclone) in the coastal belt. In the 8<sup>th</sup> FYP, the overall objective of the water resource sub-sector is to provide a comprehensive picture of water resources, goals, performances, opportunities, challenges, policies and strategies. For highlighting the present status of the sub-sector the following points have been addressed: (i) implementation status of 7<sup>th</sup> FYP; (ii) implementation and effectiveness status of policies, strategies, laws and plans to support water resources management (WRM); (iii) capacity development of institutions for implementation of activities in WR sub-sector; (iv) assess availability of surface water, including rainfall and ground water extraction; (v) current trends in research and innovation; (vi) water use pattern; water needs (industry, consumption, irrigation, fisheries, navigation etc); (vii) key achievements; (viii) management instruments; and (ix) implementation and financing for water resources development and management. The action plan on Water Resource Sub-sector

could provide direction to all agencies working within the water sector and institutions (both public and private). The plan could also guide for the development, maintenance, and delivery of water and water related services by private users and developers of water resources.

**Irrigation sub-sector:** Irrigation sub- sector is to deal with issues related to adequate availability and improved management of irrigation water for optimum crop production over the year. Bangladesh receives annually about 7.5 meters of water over the country from surface flow and rainfall, which is enough for year-round use. However, distribution pattern of the huge water volume over the year makes a complex water environment in the country and causes flooding almost every year, sometimes in June to September and affects crop production due to water shortage during November to May. Under the too much and too little water environment the country faces problems of managing water resources for sustainable irrigation. Climate change influences crop productivity and resources (land and water) use pattern. Therefore, water management for enhancing crop production under climate change scenario will require additional care for better utilization of land and water resources. All efforts should also be made to increase surface water flow in the trans-boundary rivers so that a minimum water level is assured during dry months in rivers flowing through Bangladesh.

Feasibility study of Ganges Barrage project indicates that it can resolve water availability problem in dry months in Ganges depended area (GDA). The project on completion will ensure surface water for most part of GDA and will push salinity towards the Bay of Bengal in the coastal area. Conservation of excess water received during rainy season and effective use of rainwater and irrigation and FCDI infrastructure development could play an important role in improving water availability in dry season. At present, comprehensive uses of irrigation and FCDI facilities development providing irrigation facilities to about 65% of cultivable land. Promotion of improved water saving technologies developed by the researchers for the crop production systems at the field level can minimize irrigation water shortage during dry season.

However, irrigation efficiencies of its potential are low in most cases, (below 50%) needs to be increased. Therefore, improved operation and management of Irrigation sub-sector is required at local and national levels. Government and social interventions can solve the problem and irrigation efficiencies can be increased to 70% -75%. GO-NGO partnership arrangement may take lead in this area immediately with supports from GOB and the donors.

The SAP preparation exercise involves literature review, key informant interview, consultative meeting; and six levels stakeholder workshops. They mainly used primary and secondary sources of data and interacted with the policy makers, administrators, researchers and implementers of different sectors. Relevant policy and planning documents were reviewed like: Seventh Five Year Plan; Eighth Five Year Plan, agriculture policy; livestock and fisheries policy, food policy, input policy, irrigation and land use policy, water policy and various reports/papers from on-line sources. The SDGs, and the progress and achievement of SDGs in the context of Bangladesh etc were also reviewed.

Major challenges were identified for all the sub-sectors and thematic area wise action points and projects have been proposed to diversify and intensify safe food and nutrition for growing population of Bangladesh in the context of climate change, decreasing cultivable area and commercialization of agriculture.



# Table of Contents

Executive Summary	xv
Acronymes and Abbreviations	xxv
<b>Chapter 1: Introduction</b>	<b>3</b>
1.1 Background	3
1.2 Rationale	4
1.3 Objectives	4
1.4 The Scope of Services (TOR)	4
<b>Chapter 2: Methodology</b>	<b>9</b>
2.1 The Assignment	9
2.2 The SAP Study Design	9
2.3 Sources of Data and Respondents	9
2.4 Information Processing and Analysis	9
2.5 Work Plan and Deliverables	10
<b>Chapter 3 Sub-sectors Action Plan Crops</b>	<b>11</b>
<b>3.1 Crops Sub-sector Action Plan</b>	<b>13</b>
3.1.1 Introduction	13
3.1.2 Situation Analysis	13
3.1.3 Vision, Mission, Overall Objectives & Targets	17
3.1.4 Policies/Strategies/Laws Supporting the Sub- sector	20
3.1.5 Institutional Capacity and Coordination of Crops Sub-sector Development	21
3.1.6 Challenges for Crops Sub-sector Development	22
3.1.7 Addressing the Cross-cutting Issues	26
3.1.8 The Indicators for Sustainable Development Goals	27
3.1.9 Identification and Intervention for Crop Sub-sector Development	27
3.1.10 Estimating resource allocation/requirement	31
3.1.11 Action Plan Framework for Crop Sub-sector Development and its implementation	32
3.1.12 The Way Forward	66
<b>Forestry</b>	<b>71</b>
<b>3.2 Forestry Sub-sector Action Plan</b>	<b>73</b>
3.2.1 Introduction	73
3.2.2 Situation Analysis	73
3.2.3 Major Constraints of Forestry Sub-sector	76
3.2.4 Opportunities for Forestry Development	77
3.2.5 Vision, Mission, and Objectives	77
3.2.6 Policies/Strategies/Laws Supporting the Forestry Sub- sector	78
3.2.7 Institutional Capacity and Coordination of Forestry Sub-sector Development	82
3.2.8 Coastal Afforestation	83
3.2.9 Social Forestry and Community Engagement	85

3.2.10 Challenges for Forestry Sub-sector	86
3.2.11 Addressing the Cross-cutting Issues	90
3.2.12 Alignment with Sustainable Development Goals	91
3.2.13 Development Funding for Forestry Subsector	92
3.2.14 Estimating Resource Allocation and Gap Analysis	92
3.2.15 The Indicators, Targets of Sustainable Development Goals	94
3.2.16 Theory of Change	96
3.2.17 Action Plan Framework for for Forestry Sub-sector Development	97
3.2.18 Towards a result based M&E Framework	97
3.2.19 The Way Forward	109
<b>Fisheries</b>	<b>113</b>
<b>3.3 Fisheries Sub-sector Action Plan</b>	<b>115</b>
3.3.1 Introduction	115
3.3.2 Situation Analysis	115
3.3.3 Vision, Mission, Objectives and Targets	124
3.3.4 Policies and Strategies for Supporting Fisheries Sub-Sector	126
3.3.5 Institutional Capacity and Coordination of the Fisheries sub-Sector	136
3.3.6 Challenges of Fisheries Sub-sector	138
3.3.7 Linkage and Cross-cutting Issues between Institutions and Agencies	139
3.3.8 The Indicators for Sustainable Development Goals	139
3.3.9 Identification of Programmes for Intervention	143
3.3.10 Estimation of Resource Allocation/Requirement	148
3.3.11 Action Plan Framework	149
3.3.12 The Way Forward	151
<b>Livestock</b>	<b>155</b>
<b>3.4 Livestock Sub-sector Action Plan</b>	<b>157</b>
3.4.1 Introduction	157
3.4.2 Situation Analysis	157
3.4.3 Vision, Mission, Overall Objectives and Targets	159
3.4.4 Policies and Strategies for Supporting Livestock Sub-Sector	160
3.4.5 Institutional Capacity and Coordination of Livestock Sub-sector	163
3.4.6 Gaps Identification	164
3.4.7 Challenges of Livestock Sub-sector	167
3.4.8 Projects and Programme for Intervention	169
3.4.9 Linkage and Cross-cutting Issues between Institutions and Agencies	171
3.4.10 Estimating Resource Allocation and Gap Analysis	171
3.4.11 Livestock Sub-sector Action Plan with Priority and Intervention	172
3.4.12 The Way Forward	178

<b>Water Resources</b>	<b>181</b>
<b>3.5 Water Resources Sub-sector Action Plan</b>	<b>183</b>
3.5.1 Introduction	183
3.5.2 Situation Analysis	184
3.5.3 Vision, Mission, and Overall Objectives	196
3.5.4 Theory of Change	197
3.5.5 Policies and Strategies for Water Resources Sub-sector Development	199
3.5.6 Institutions Coordination and Capacity of Water Resources Sub-sector	204
3.5.7 Challenges of Water Resources Sub-sector	204
3.5.8 How to Overcome the Challenges	209
3.5.9 Addressing the Cross-Cutting Issues between Institutions and Agencies	209
3.5.10 The Indicators of Water Resources Sub-sector	210
3.5.11 Identificatoin of program for interventions & Target for 8FYP	211
3.5.12 Action Plan Framework of Water Resources Development	215
3.5.13 The Way Forward	228
<b>Irrigation</b>	<b>233</b>
<b>3.6 Irrigation Sub-sector Action Plan</b>	<b>235</b>
3.6.1 Introduction	235
3.6.2 Situation Analysis	235
3.6.3 Present Status of Irrigation and Potential Area Coverage	238
3.6.4 Irrigation Demand	238
3.6.5 Water Demand for Non Agriculture Sectors	239
3.6.6 Monthly/Seasonal Water Availability (both surface and ground water)	239
3.6.7 Water Availability throughout the Seasons	240
3.6.8 Vision, Mission, Overall Objectives and Targets	240
3.6.9 Policies for Irrigation Sub-Sector	241
3.6.10 Strategies for Irrigation Sub-Sector	242
3.6.11 Institutional Coordination and Capacity of Irrigation Sub-sector	245
3.6.12 Major Challenges for Irrigation Sub-sector	246
3.6.13 How to Overcome the Challenges	252
3.6.14 Climate Change	253
3.6.15 Addressing the Cross-cutting Issues	259
3.6.16 The Indicators for Sustainable Development Goals	259
3.6.17 Prioritizing the Programme for Interventions by Ministry/Division	259
3.6.18 Estimation of Resource Allocation/Requirement	260
3.6.19 Theory of Change	260
3.6.20 Irrigation Sub-sector Action Plan Framework and Investment Plan	261
3.6.21 The Way Forward	275
<b>References</b>	<b>281</b>

## List of Figures

Fig. 1: Theory of Change	19
Fig 2: Yield potential of HYV rice in different season (source: Ali, 2014)	24
Fig. 3: Process for developing the Criteria and Indicators for Sustainable Forest Management (Derived from Victoria, Australia)	95
Fig. 4: Theory of Change	96
Fig. 5: Last 39 years sector-wise fish production trend (lakh MT) (DoF, FRSS, 2022)	116
Fig. 6: Contribution of inland capture, culture and marine fisheries to total fish production (since 1983-84 towards 2010-21)	117
Fig. 7: Last 39 years, source-wise fish production of capture fisheries (Lakh MT)	118
Fig. 8: Fish production diversity of inland cultured waterbody in 2021-22	119
Fig. 9: Last 39 years source-wise inland aquaculture fish production (Lakh MT)	119
Fig-10: Trends of fish production (in lakh MT) over last 37 years	121
Fig-11: Hilsa (shad) production trends over last two decades	122
Fig-12: Last two decades export trends of fish and fishery products and corresponding oreign earnings	124
Fig.13: Domestic Water Demand of Bangladesh (km3)	186
Fig.14: Industrial Water Demand of Bangladesh (km3)	186
Fig. 15: Theory of Change	198
Fig. 16: Theory of Change	261

## List of Tables

Table 1: Activities and Deliverables	10
Table 2: Bangladesh major crops production progress/reduction over seven year's period (2013-14 to 2020-21)	15
Table 3: Projection of Production of Selected Crops up to 2025 (million MT, million bales for jute)	16
Table 4: Strategies taken in 7th Five Year Plan and its present status of implementation	20
Table 5: Ministry-wise ADP Allocation in 8th FYP (FY21 to FY25) under Agriculture Sector (Taka in Billion)	32
Table 6: Action Plan for addressing the challenges of Crop sub-sector	33
Table 7: Monitoring & Evaluation Framework	51
Table 8: Distribution of forest and other land (TOF) coverage within zones, 2015	74
Table 9: Forest Department ADP and Expenditure under 7th FYP	76
Table 10: Plantation under Bangladesh Climate Change Trust Fund (BCCTF)	81
Table 11: Name of the projects of coastal afforestation	84
Table 12: Name of the Social Forestry Projects	85
Table 13: Manpower of Forest Department (Existing and Proposed) (Partial)	87
Table 14: Total quantity of the five most common primary tree and forest products collected across zones, (qty /year )	88
Table 15: Timber Exploited from CHT by Free License in 5 Years	89
Table 16: Indicative Allocation and actual ADP under 7th FYP	92



Table 17: Indicative Allocation under 7th FYP and Actual ADP (Current Price)	93
Table 18: Achievement of 8th Five Year Plan Afforestation and Reforestation	93
Table 19: Achievement of 8th Five Year Plan Forest Department ADP and Expenditure	94
Table 20: Action Plan for addressing the challenges of Forestry sub-sector	99
Table 21: Monitoring & Evaluation Framework for Forestry Sub-sector	105
Table 22: Projected production and demand of fishes in the 8FYP	134
Table 23. Resources based fish production until 7th FYP, Projected in 8th FYP and achieved (until 2021-22)	135
Table 24: Implementation of Institutional Mechanism for 8th FYP Progress Monitoring Indicators	136
Table 25: Projects/Action to achieve the Targets of 8th FYP (indicative cost in lac BDT at FY 2019-20 prices)	140
Table 26: Addressing the Programme, Provision, Present Situation and Gaps of the Fisheries Sub-sector	142
Table 27: Export earnings of fish and fisheries products	145
Table 28: Project Allocation for the Year 2021-2025	148
Table 29: Fisheries Sub-sector Action Framework and Investment Plan	149
Table 30: Demand, Production, Deficiency and Availability of Milk, Meat and Eggs	159
Table 31: Projected Production and Demand of Milk, Meat and Eggs	159
Table 32: Identification of Gaps in the Sub-sector	164
Table 33: Mechanism for Capacity Development	165
Table 34 : Programs/Projects/Action to Achieve the Targets of 8th FYP (indicative cost in lac BDT)	170
Table 35: Projected requirement of meat and required number of ruminant and poultry to be slaughter in 2025	172
Table 36: Action Plan and Monitoring & Evaluation Framework	173
Table 37: Zone wise Agricultural Water Demand (km <sup>3</sup> )	185
Table 38: Monthly Water Discharge and Renewable Water Resource Senarios in Bangladesh	187
Table 39: Water Demand vs. Availability Scenario	187
Table 40: Navigability loss due to Farakka Barrage	194
Table 41: Sharing of the Ganges waters at Farakka	195
Table 42: River erosion and accretion, 1973 - 2013 (CEGIS Erosion Prediction, 2014)	195
Table 43: Action Plan for Addressing the Challenges of Water Resources Sub-sector	217
Table 44: Water Resources Sub-sector Monitoring & Evaluation Framework	223
Table 45: Irrigation coverage	238
Table 46: Status of irrigation coverage per unit of equipment during last ten years 2009-10 to 2019-20	248
Table 47: Trends in Irrigated Area during 2009-10 to 2019-20	255
Table 48: Ministry-wise ADP Allocation in 8th FYP (FY21 to FY25) under Agriculture Sector	260
Table 49: Irrigation Sub-sector Action Plan Framework	263
Table 50: Monitoring & Evaluation Framework for Irrigation Sub-sector	268



## Acronyms and Abbreviations

ACIAR	Australian Centre for International Agricultural Research
ADP	Annual Development Program
AIG	Alternative Income Generation
AWRRID	Agriculture, Water Resources and Rural Institutions Division
BADC	Bangladesh Agriculture Development Corporation
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
BBS	Bangladesh Bureau of Statistics
BDP2100	Bangladesh Delta Plan 2100
BFD	Bangladesh Forest Department
BFDC	Bangladesh Fisheries Development Corporation
BFDC	Bangladesh Fisheries Development Corporation
BFRI	Bangladesh Fisheries Research Institute
BFRI	Bangladesh Forest Research Institute
BIDS	Bangladesh Institute of Development Studies
BINA	Bangladesh Institute of Nuclear Agriculture
BINA	Bangladesh Institute of Nuclear Agriculture
BIWTA	Bangladesh Inland Water Transport Authority
BLRI	Bangladesh Livestock Research Institute
BMDA	Barind Multipurpose Development Authority
BMDA	Barind Multi-Purpose Development Authority
BRRI	Bangladesh Rice Research Institute
BRRI	Bangladesh Rice Research Institute
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CCIL	Creative Consultants International Limited
CGIAR	CGIAR Research Program on Climate Change, Agriculture and Food Security
CIMMYT	International Maize and Wheat Improvement Center
COVID-19	Corona Virus Diseases-2019
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAE	Department of Agriculture Extension
DFID	Department of International Development
DLS	Department of Livestock Services
DLS	Department of Livestock Services
DoE	Department of Environment
DoF	Department of Forest
EEZ	Exclusive Economic Zone

ERD	Economic Relations Division
FAO	Food and Agriculture Organization
FSP&CD	Formulation of Sectoral Plan and Capacity Development
FYP	Five Year Plan
GAP	Good Agriculture Practice
GDP	Gross Domestic Production
GED	General Economic Division
GoB	Government of Bangladesh
HORTEX	Horticulture Development Foundation
ICT	Information and Communication Technology
IFPRI	International Food Policy Research Institute
IRRI	International Rice Research Institute
IWM	Institute of Water Modelling
JICA	Japan International Cooperation Agency
LGED	Local Government Engineering Department
LGRD	Local Government, Rural Development and Co-operatives Division
MDG	Millennium Development Goals
MFA	Marine Fisheries Academy
MOA	Ministry of Agriculture
MoA	Ministry of Planning
MoCHTA	Ministry of Chittagong Hill Tracts Affairs
MoDMR	Ministry of Disaster Management and Relief
MoEFCC	Ministry of Environment, Forest and Climate Change
MoFL	Ministry of Fisheries and Livestock
MoLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MoWR	Ministry of Water Resources
NAP	National Adaptation Plan
NARS	National Agricultural Research System
NRCC	National River Conservation Commission
SAP	Sector Action Plan
SDGs	Sustainable Development Goals
SIDA	Swedish International Development Agency
SRDI	Soil Resource Development Institute
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WB	World Bank
WFP	World Food Programme
World Fish	World Fish Center

# Chapter 1

## Introduction



# Chapter 1: Introduction

## 1.1 Background

Bangladesh is mainly depends on agriculture for her economy. About 70% people directly or indirectly depends on agriculture as their professions. It comprises about 15% of the country's GDP and more than 40% of the total labor force. About one third of annual income and the 15% of the total annual exports items come from agriculture. At present, agriculture sector is significantly driven by private entrepreneurship. The role of private sector is considered to accelerate the process of transformation from already existing semi-subsistence farming to commercialization of agriculture. In this regard, it has been mentioned that productivity gains, diversification, value addition and agro-processing commensurate with national environmental protection, climate change adaptation strategies will be required to achieve.

Despite impressive growth still challenges in ensuring food and nutrition security, climate change has serious impact on food production. Increase salinity in the coastal areas alters the nutritional contents of foods. The wake of Covid-19 global pandemic, role of agriculture and its sustained growth in ensuring food security received a renewed attention (8<sup>th</sup> FYP, p.153). The crisis impeded farmers' market access for procuring raw materials and hiring labour, destroyed underdeveloped productive capacities in poultry and dairy sub-sector, and hindered selling products - resulting food loss and waste to cause concern for nutrition and food security. The crisis and the recovery process could take several years (OECD, IMF and World Bank, P. 154). Therefore, shielding the agriculture for the vulnerabilities arising from COVID-19 crises is pivotal to cope with the immediate shocks as well as for the medium to long term food security. Thus, a short to medium term policies and strategies needed to meet the challenges and to restore food security.

Focus on agriculture, a key determinant of food security and nutrition from the supply side, and the all important issues of water resources management, which are the most important inputs to agriculture, but has much wider ramifications linked to climate change and natural disasters. Proper management of water resources is critical to lower vulnerability of the rural poor and protect their livelihood.

The share of agriculture has been declining for the past few decades because of the structural transformation that is taking place in the economy. During the 7<sup>th</sup> Five Year Plan, the share has contracted by 2.35% to reach 13.65% in 2018-19. According to the labor force survey 2016-17, the sector, however, still accounted for more than 40% cent of total employment in the country. Most of the people involved in agriculture production are marginal or landless farmers. Around 60% of the women were engaged in agriculture (8<sup>th</sup> FYP, p. 155).

Sector Divisions of the Planning Commission should primarily be responsible for the preparation of their own Sector Action Plan as a leaf out of the national Plan through a process of active stakeholder (Ministries/Divisions/Agencies) consultation and participation. Concerned Section Division and General Economics Division of Planning Commission should work in close partnership for ensuring consistency and coherence between the FYP and Sector Action Plans. Sector Action Plans will, however, be approved by the Executive Committee of the National Economic Council (NEC), Programming Division will allocate resources based on approved Sector Action Plan.

Sector Divisions and concerned Line Ministers/Divisions should be responsible for monitoring and reporting on the implementation of Sector Action Plans and report to GED on the progress of the

approved Sector Action Plans. GED will accumulate all reports set by the sector division and publish yearly monitoring progress report for policy feedback and place the same to the NEC. Association of all stakeholders in preparation of the Sector Action Plan is important as implementation relies on the Action Plan formulation deepens its ownership and acceptance of the Plan, and thus increases chances of effective assimilation and implementation of Plan objective and targets.

## 1.2 Rationale

In 7<sup>th</sup> Five Year Plan, the economy of Bangladesh has been classified into 14 sectors. The plan document expressed the government's commitment to prepare sector action plan for each of the 14 sectors. The government of Bangladesh (GOB) through Agriculture, Water Resources and Rural Institutions Division (AWRRID) of the Planning Commission has undertaken a process of preparing the Sector Action Plan on 'Agriculture' to achieve the goals to be set in the 8<sup>th</sup> Five Year Plan (2021-25). A provision of preparing the Sector Action Plan is kept in the project title "Formulation of Sectoral Plan and Capacity Development of Concerned Officials for more Effective Public Investment" which is being implementing by Agriculture, Water Resources and Rural Institutions.

The government of Bangladesh uses perspective plan and Five-Year Plan to achieve the long & medium-term goals of socio-economic development. These plans, by definition, are the goals and objectives have been implemented by Annual Development Program (ADP). There is a missing link between Five Year Plan and ADP. The sector action plan will fill-up the missing takes. In order to attain the objectives of the national plans the country requires sector plans/strategies/intervention measure which are directed in a summarized form in Five Year Plans. Hence, Sector Action Plans are needed to guide the sectoral implementation way forward.

## 1.3 Objectives

The objective of the Sector Action Plan on 'Agriculture' is to provide:

- A comprehensive picture of sectoral goals
- Performances of the sector
- Opportunities and challenges
- Identify policies and strategies with elaborate actions and
- Tentative budget that support the 8<sup>th</sup> Five Year Plan and visions of the government.

This Plan will provide the framework for the identification of public policy initiatives and projects for the public sector intervention, including the role of government agencies in developing the 'Agriculture' sector in partnership with other government institutions, private sector development partners, local government bodies and non-government organizations.

## 1.4 The Scope of Services (TOR)

The Sector Action Plan will includes the following issues:

- Introduction/situation analysis
- Overall and specific objective(s) and planning impact of interventions
- Policies/strategies/laws supporting the sector/ministries/divisions
- Sector institutions, coordination and capacity



- Scopes, challenges and way forward
- A clear path from the national policy to the action (link the Plan with implementing)
- Prioritizing the intervention actions by the ministries/divisions
- Addressing the cross-cutting issues (establish the links with other sectors)
- Identifying indicators for monitoring in line with the FYP and SDGs
- Identifying of projects and programmes for the interventions; and
- Estimating resource requirement of the sector.



## **Chapter 2**

# **Methodology**



## Chapter 2: Methodology

### 2.1 The Assignment

The Agriculture, Water Resources and Rural Institutions Division (AWRRID) of Planning Commission expected to prepare a high quality professional document on Sector Action Plan on Agricultural (SAP) determining and analyzing sub-sector-wise goals, performances, opportunities, challenges. They also identified policies and strategies with elaborate actions and tentative budget for resource allocation in the 8<sup>th</sup> Five Year Plan as per vision of the government. The Consultants Team carefully reviewed the objectives and TOR. According to the need of the AWRRID the Consultant Team has developed an action plan framework demonstrating the role of the government agencies in developing the ‘Agriculture’ Sector Action Plan in consultation with AWRRID.

In order to accomplish the above task, situation analysis of the sector, set overall and specific objective(s) and planned impact of interventions. They also reviewed the existing policies/strategies/laws/act that support linking the plan with prioritizing implementing the interventions/actions by the ministries/divisions, addressing the cross-cutting issues, identifying indicators for monitoring in line with the FYP and SDGs. For delivery the tasks, the Consultants Team consists of seven experienced and highly qualified specialists drawn from the fields of Agriculture, Forestry, Fisheries, Livestock, Water Resources, Irrigation and Agricultural Economics.

### 2.2 The SAP Study Design

The consultant team followed the qualitative methodology to prepare a well informed high- quality Sector Action Plan on Agriculture (SAP). The SAP preparation study involves: (i) Literature Review; (ii) Key Informant Interview; (iii) Consultative Meeting; and (iv) Six Levels Stakeholder Workshops. They mainly used primary and secondary sources of data and interacted with the policy makers, administrators, researchers and implementers of different sectors. At the primary source, KII conducted with Senior Officials of the concerned ministries and departments/agencies. Both quantitative and qualitative observations and analysis were done in the SAPA study.

### 2.3 Sources of Data and Respondents

Both primary and secondary types of information/data were used for the SAP development. Secondary data have been collected from various sectors and sub-sectors policy and strategy reports/documents. Primary data collected mainly from KIIs, Consultative Meeting, Stakeholder Workshop. About 21 Ministries/Departments/Divisions/Research Institutes/Private Sectors/NGOs/International Organizations were selected for conducting KIIs and consultative meeting. Relevant policy and planning documents were reviewed like: 7<sup>th</sup>; 8<sup>th</sup> Five Year Plan, Agriculture Policy; Livestock and Fisheries Policy, Food Policy, Input Policy, Irrigation and Land Use Policy, Water Policy and various reports/papers from on-line sources. The SDGs, and the progress and achievement of SDGs in the context of Bangladesh etc were also reviewed.

### 2.4 Information Processing and Analysis

The collected data/information from secondary sources and interaction with the policymakers and implementers of the different sectors analyzed following quantitative and qualitative analytical tools. For better understanding and presentation of data/information, tabular, graphical, percentages and ratios etc were done and incorporated in the Plan. Based on discussions with key persons of the

ministries/departments and stakeholders meetings, the six sub-sectors: Crops, Forestry, Fisheries, Livestock, Water Resources and Irrigation have been prepared. The diagnostic reports analyzed potential frameworks for development of agricultural programs in Bangladesh. In order to develop SAPA, the consultant established inter-link between government achievement SDGs targets and global indicators. The 7<sup>th</sup> FYP allocation and ADP expenditure for each action/activity analyzed and predicted 8<sup>th</sup> FYP allocation and ADP expenditure. It also provides recommendations/suggestions for strategies/policies changes related to actions/activities.

## 2.5 Work Plan and Deliverables

The assignment were a period of four months (120 calendar days), which is started from 1st October 2020. The execution dates for each task (without allowing for disruptions) are shown below, with 120 working days suggesting an achievable final date was 31<sup>st</sup> January 2021. The entire work was divided into a number of tasks performed by the study team. The tasks were broken down to a set of activities are shown in the Table-1.

**Table 1: Activities and Deliverables**

Phase	Duration in Days	Major Tasks and Output
Phase 1: Inception Phase	20 days	<ul style="list-style-type: none"> <li>• Preliminary discussion with FSP&amp;CD Project officials and meeting with the team members</li> <li>• Mobilization of team and establishment of separate office cell with all equipment and logistics</li> <li>• Collection of existing literature and available secondary data</li> <li>• Finalization of methodology and work program</li> <li>• Development of draft tools/guidelines for information collection</li> <li>• Development of draft structure for each sub-sector;</li> <li>• Orientation/Kick-off workshop and</li> <li>• Preparation and submission of draft inception report.</li> </ul>
Phase 2: SAPA Preparation	70 days	<ul style="list-style-type: none"> <li>• Situation Analysis;</li> <li>• Visit to the offices of stakeholders and conduct KIIs;</li> <li>• Conduct consultative meeting;</li> <li>• Preparation of sector action plan; and</li> <li>• Conduct four levels stakeholder workshops.</li> </ul>
Phase 3: Reporting	30 days	<ul style="list-style-type: none"> <li>• Preparation and submit of draft SAP to the TSC/PSC and get feedback;</li> <li>• Incorporation of feedback to the SAP; and</li> <li>• Submission of Final sector action plan.</li> </ul>



**Chapter 3  
Sub-sectors  
Action Plan**

**Crops**







## 3.1 Crops Sub-sector Action Plan

### 3.1.1 Introduction

Driven by the government favorable policies, coupled with budgetary allocation and rising market demand Bangladesh has made significant progress in domestic food production, which almost doubled during the last two decades. Availability of food grains per capita declined slightly compared to the level of 2010-11, but it was accompanied by a sharp rise in the per capita availability of fish, meat, milk, potato, oilseeds, fruits and vegetables, indicating diversity in the diet, which promotes more healthy lifestyle. Bangladesh in fact is self-sufficient in rice production and surplus in potato production. Domestic production and per capita availability of pulses declined significantly between 2010-11 and 2020-2021. Possible reasons could be production of pulses in marginal area having lower yield per unit area compared to other non-cereals; further pulses production are often badly affected by biotic and abiotic factors. Moreover, because of long practiced food habit of common people of Bangladesh first try to ensure rice security which is their staple food by engaging more potential land for rice production. Bangladesh has long been dependent on import of pulses and oilseeds (edible oil) as domestic production constitutes a small share in the availability of those important nutrient-dense food items. Also, the relative prices of other crops could have also resulted in lower acreage allocation in favour of pulses.

However, in recent years, this sector has faced various challenges. The current major challenges of agricultural development are: cultivable land loss, deterioration of soil resources base, population growth, climate change, dearth in capacity development of agricultural scientists-extension professionals, quality seed and other input supply, soft-credit facility, and marketing constrains; additionally COVID-19 pandemic crisis has aggravated the situation. However, it is possible to apply modern scientific tools for breaking the current stagnation in productivity, through developing more high yielding market-demand crop varieties, reduction of yield gap and post-harvest loss, quality input supply and farm mechanization, deployment of climate smart agriculture and crop zoning, research-extension-farmers capacity development, fair marketing along with soft-credit availability and restoring of natural resource bases.

The Sector Action Plan (SAP) for the Crop sub-sector is an effective step toward meeting the challenges. For meeting the challenges in the crop sub-sector 24 thematic categories, 65 specific action plans are being suggested mentioning its link to 8<sup>th</sup> five year plan strategy, base line, target, indicative budget, implementation period, SDG target, BDP2100 measures, expected outcome, responsible agency, and assumption. For addressing the challenges of crop sub-sector, diverse actions have been proposed in the Action Plan Framework (Table 5).

### 3.1.2 Situation Analysis

Livelihoods and economy of Bangladesh are largely dependent on the performance and growth of the agricultural sector. While facing triple challenges of an expanding population of 170 million in a country of only eight million hectares of cultivable land, gradual loss and soil deterioration of crop land and devastating effect of climate change. The recent Covid-19 pandemic has added a further challenge. The agricultural sector includes: crops, livestock, fisheries and forestry and contributes 14.7% to the country's GDP and provides employment for 41% of the labor force. Moreover, agriculture is the source of wide range of consumer demanded agricultural commodity markets, especially in rural areas, along with increased foreign currency income through exports. Half (about 7.5%) of agricultural GDP

derives from the crop sector and provides employment for millions directly and indirectly. Bangladesh has succeeded in attaining self-sufficient in rice and potato production. About 70% of calories come from the cereal crop rice. However, the country is lagging far behind in production of pulses, wheat, oilseeds, vegetables, fruits and spices rendering serious dietary nutritional imbalances. However, by reducing yield-gap of rice and other crops through application of different modern technologies including gene-editing, nanotechnology application in pest management and packaging, developing higher yielding climate-smart varieties more rice could be produced in a smaller area. This would spare land for production of high value crops in short supply, which would help the farmers to significantly increase their income, paving the way for accelerated poverty reduction and improvement of overall livelihoods.

The Government of Bangladesh (GoB) through AWRRI Division of the Planning Commission has undertaken a Sector Action Plan on “Agriculture” to achieve the goals set in the 8<sup>th</sup> Five Year Plan (2021-25). Government uses Perspective Plan and Five-Year Plan to achieve the long-and medium-term goals of socio-economic development. These Plans by definition are the philosophical directions and guidelines for the economy to attain focused broad goals. The plan goals and objectives have been implemented by Annual Development Program (ADP). There is a missing link between Five Year Plan and ADP. The sector action plan is intended to fill up the missing tasks. The Crops Sub-sector Action Plan may provide a comprehensive picture of sectorial goals, performances, opportunities, challenges, and above all identify policies and strategies, underpin actions and tentative budget that support the 8<sup>th</sup> Five Year Plan and SDGs. The Plan could provide the framework for the identification of public policy initiatives and projects for public sector intervention, including the role of government agencies. The Crop Sub-sector in partnership with other government institutions, private sector development partners, local government bodies and non-government organizations would thereby contribute to agricultural development.

Crop Scenario: Growth of Bangladesh agricultural production in the crop sector is tremendous since independence. It has achieved self-sufficiency in rice and potato production. Maize production has increased from few thousand tons to 5.4 million tons in 2019-2020 with a deficit of just one million ton from yearly demand. Per hectare maize production is around 9 t/ha, which is the highest in Asia. But wheat production has decreased from 1.9 million ton to 1.3 million ton due to competition from other crops, climate change (high temperature in winter) and recent wheat blast disease. Though oilseeds, pulses and spices production has slightly increased it cannot meet demand. Through crop diversification program, fruit production has increased in the case of mango, banana, citrus (Malta), and guava. However national demand is more for off season foreign fruits like apple, grape and pomegranate. The crop subsector, which comprises more than half of agricultural GDP (14%), expanded annually at 1.7% on average against the target rate of 1.4%. during 2014-15 to 2019-20 period (BBS and 7FYP) Despite its impressive progresses, Bangladesh still faces formidable challenges in ensuring food and nutrition security for its growing population.

**Significant achievement in crop sub-sector over the successive years (2013-14 to 2020-21):** Bangladesh has made sustainable progress in increasing its major crop production despite continuous decrease of cultivable land, detrimental effect of climate change (Table 2). However exception is decrease of wheat and sugar crop production. Total rice production increased by 9.46 %, among it T.Aus production enhanced by 41.22 %, T. Aman by 10.86 % but Boro production increased only by 4.42%. Possibly Boro area is facing competition from potato, mustard and Rabi maize, thus after harvesting of those crops rice are grown in Aus season (Kharif-I) that’s why T. Aus production has increased significantly. Among all

crops maize production has tremendous growth (154.35 % increases over seven years period) because of high yield from hybrid maize along with good market demand and remunerative price compared to all other crops. Onion production also increased by 63.59% due to high market demand over the years along with favourable market price coupled with scientific production technology. Fortunately pulses (20.73%) and oilseeds (17.45%) production also increased for which Bangladesh mostly depend on import. For balanced nutrition and economic return vegetables and fruits are important. Production of those two crops has increased by 14.87% and 11.92 % respectively over seven years period. Potato production was enhanced by 10.49 %, which is important for food and nutrition security of common masses. But jute production increased marginally only by 3.88 %.

**Table 2: Bangladesh major crops production progress/reduction over seven year's period (2013-14 to 2020-21)**

Crop	Area ('000'acres)		Production ('000'MT)		Yield (kg/acre)		Production increase (+)/decrease (-) in 2020-21 over 2013-14 (%)
	2013-14	2020-21	2013-14	2020-21	2013-14	2020-21	
T. Aus	2598	3225	2326	3285	895	1018	41.22
T. Aman	13666	11319	13023	14438	952	1042	+10.86
Boro	11837	11828	19007	19885	1605	1681	+4.62
<b>Total rice</b>	<b>28101</b>	<b>28912</b>	<b>34356</b>	<b>37608</b>	<b>1222</b>	<b>1301</b>	<b>+9.46</b>
Wheat	1062	813	1303	1085	1226	1335	-16.73
Potato	1141	1158	8950	9887	7850	8538	+10.49
Jute (bales)	1645	1686	7436	7725	4.52	4.58	+3.88
Maize	259	1482	2123	5400	2797	3644	+154.35
Pulses	823	919	352	425	427	462	+20.73
Oilseeds	1071	1234	848	996	793	807	+17.45
Onion	373	480	1387	2269	3718	4725	+63.59
Vegetables	992	1121	3993	4587	4409	4110	+14.87
Sugar crops	268	385	5064	3807	14982	988	-24.82
Fruits	338	996	4595	5143	13595	-	+11.92

Date Source: BBS. Year Book of Agricultural Statistics of Bangladesh, 2016 and 2022. Maize area and production data from BWMRI website

Wheat area and production (16.73 %) has reduced due to competition with Boro rice (same growing period) and environmental reason (increase of winter season temperature). In the near future it will be difficult to raise wheat production if suitable climate smart varieties and technologies are not developed along with remunerative price compared to Boro rice and maize. Sugar crop production, particularly sugarcane production reduced (24.82%) markedly because of long growth duration, excessive production cost and staggered harvesting cum long deferred payment from sugar mills.

These challenges are inter alia, continuing population growth, deceleration in the growth of agricultural productivity, increasing income inequality, increasing rate of urbanization and growing concern about food safety. While increasing income and urbanization have led to some dietary diversity, cereals still account for about 70% of the dietary intake suggesting that a rapid diversification in agricultural production is needed. The now accelerating process of climate change can also have serious impact on food production in Bangladesh. Increased salinity in the coastal areas may also decrease crop yield

and alter the nutritional contents of foods including rice which may become deficient in zinc and other micronutrients (8<sup>th</sup> Five Year Plan).

Except potato and vegetables Bangladesh imports most of the other essential food items including edible oil, pulses, spices, wheat, maize, cotton, fruits, soybean, potato seed, hybrid seed, vegetable seed, even some portion of rice, fertilizers, pesticides, agricultural machinery and many other products costing billions of dollars. It imports rice in many years, when flood or cyclones occur. Bangladesh exports different agriculture products, mainly jute, tea and small amount of vegetables, some fruits, potato, spices, cotton, and tobacco etc. For reducing the import-export imbalance, Bangladesh has to invest a significant amount in agricultural research, education, infrastructures-laboratory development, adaptation and extension for long term food and nutrition security.

The main constraints for agricultural development are: (i) Rapid decrease of agricultural land; (ii) Population growth; (iii) Climate change and variability; (iv) Degradation of natural resources (soil, water, environment) and poor soil management; (v) Rapid urbanization; (vi) Inadequate value addition/food processing/products preservation; (vii) Availability of quality seed, fertilizers, manure, pesticides and agricultural machinery at fair price; (viii) Sub-optimal investment in agricultural research and extension; (ix) Poor marketing system and excessive transport cost; (x) Dearth of easy term loan for all categories of farmers and entrepreneurs; and (xi) Agricultural mechanization still in rudimentary stage.

The opportunities for agricultural development include: (i) Industrious small and marginal farmer; (ii) Huge labor force; (iii) Good and established research and extension network across the country; (iv) Agricultural education system; (v) Moderate quality soil and congenial climate (semi-tropical) where various multiple crops could be grown around the year; (vi) Yield of most crops could be uplifted through innovation, variety development and packages of modern technology deployment; (vii) Good surface and underground sources of water for irrigation; (viii) Huge internal market for increase of food consumption through income elevation; (ix) Scope of export to foreign countries by adopting GAP as production cost is competitive; (x) Educated entrepreneurs are investing to agriculture as finding it profitable than the other enterprises(business, informal jobs) through growing High Value crops; (xi) Private companies are investing for commercialization of agriculture particularly in value addition of products; and (xii) Newly surfaced huge char lands are potential for future agriculture production and expansion of area at least in rabi season (winter months).

**Table 3: Projection of Production of Selected Crops up to 2025 (million MT, million bales for jute)**

Major crops	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
Rice	39.29	39.89	40.49	41.11	41.73
Wheat	1.29	1.32	1.37	1.41	1.46
Potato	11.23	11.54	11.86	12.20	12.54
Oil seed	1.18	1.21	1.23	1.26	1.29
Vegetables	19.44	20.48	21.58	22.74	23.96
Maize	5.67	5.95	6.25	6.56	6.89
Spices	4.03	4.11	4.19	4.28	4.36
Pulses	1.09	1.13	1.17	1.21	1.25
Jute	8.01	8.02	8.02	8.02	8.03

Source: 8<sup>th</sup> Five Year plan

### 3.1.3 Vision, Mission, Overall Objectives & Targets

#### **Constitutional obligation**

(i) The provision of the basic necessities of life, including food, clothing, shelter, education and medical care; and (ii) Rural Development and Agricultural Revolution. The State shall adopt effective measures to bring about a radical transformation in the rural areas through the promotion of an agricultural revolution. It should also have the provision of rural electrification, development of cottage and other industries, improvement of education, communication and public health to remove disparity in the standards of living between the urban and the rural areas.

#### **Vision**

Promotes Climate Smart Agriculture ensuring sustainable, safe and profitable food production for zero hunger population.

#### **Mission**

Ensure food and nutrition security by increasing productivity and production of major crops, value addition and modernizing market system, as well as intensification and diversification of high value and nutrition dense crops.

#### **Overall objectives**

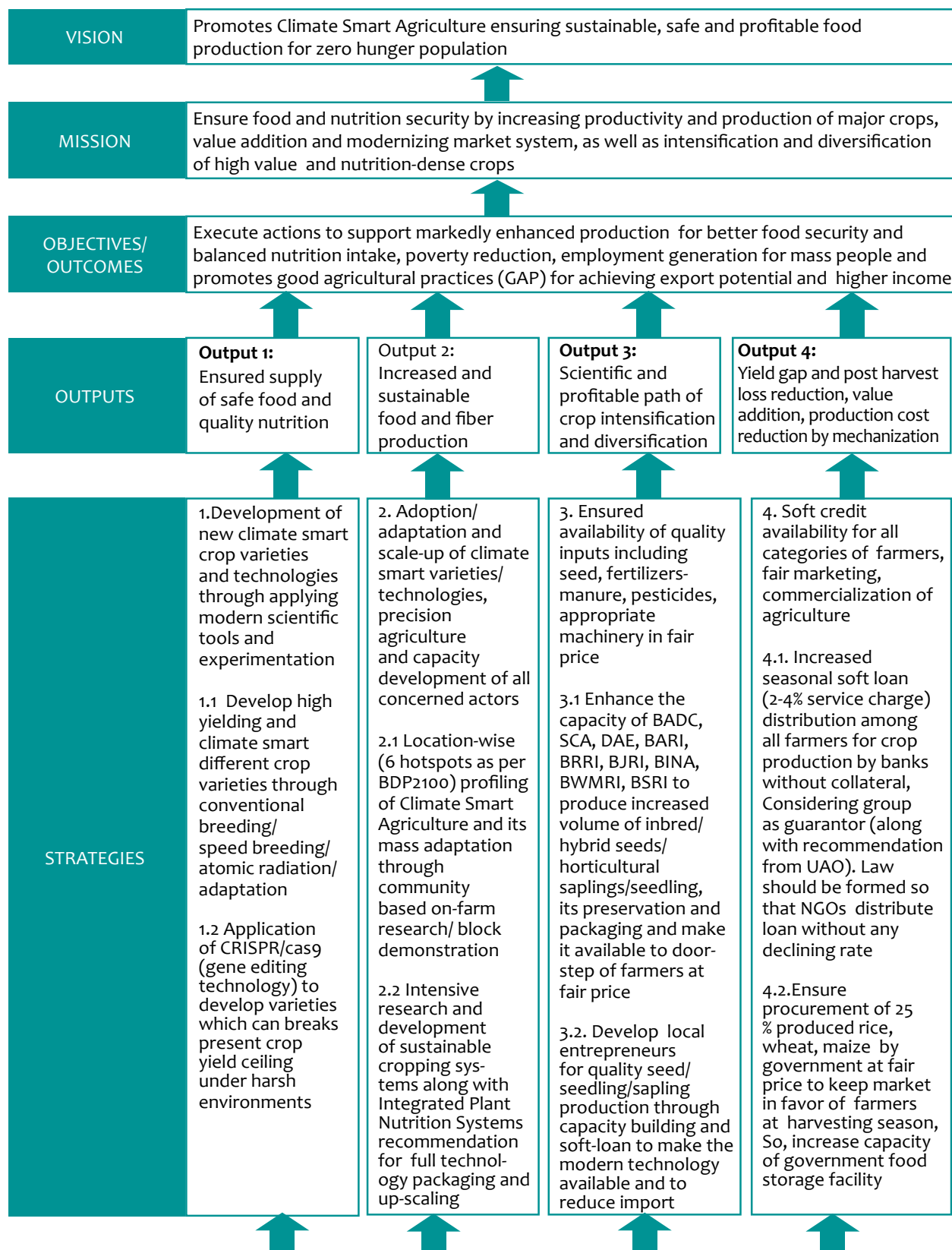
Execute actions to support markedly enhanced production for better food security and balanced nutrition intake, poverty reduction, employment generation for mass people and promotes good agricultural practices (GAP) for achieving export potential and higher income .

#### **Target**

Table 4 shows the target of 8<sup>th</sup> Five Year Plan which is to increase food production for major food and fiber crops.

#### **Theory of Change**

A Theory of Change (ToC) of a project describes why change is needed and how it will happen. In simple terms, this involves identifying how you would like the current situation related to an identified problem to change, and how you think you can help that change to come about through your project. Defining a Theory of Change for your project helps you to ensure that your inputs and activities lead to tangible results that add up to the desired change. There were different output, strategies and interventions. Each intervention was aligned with the related strategies and outputs.



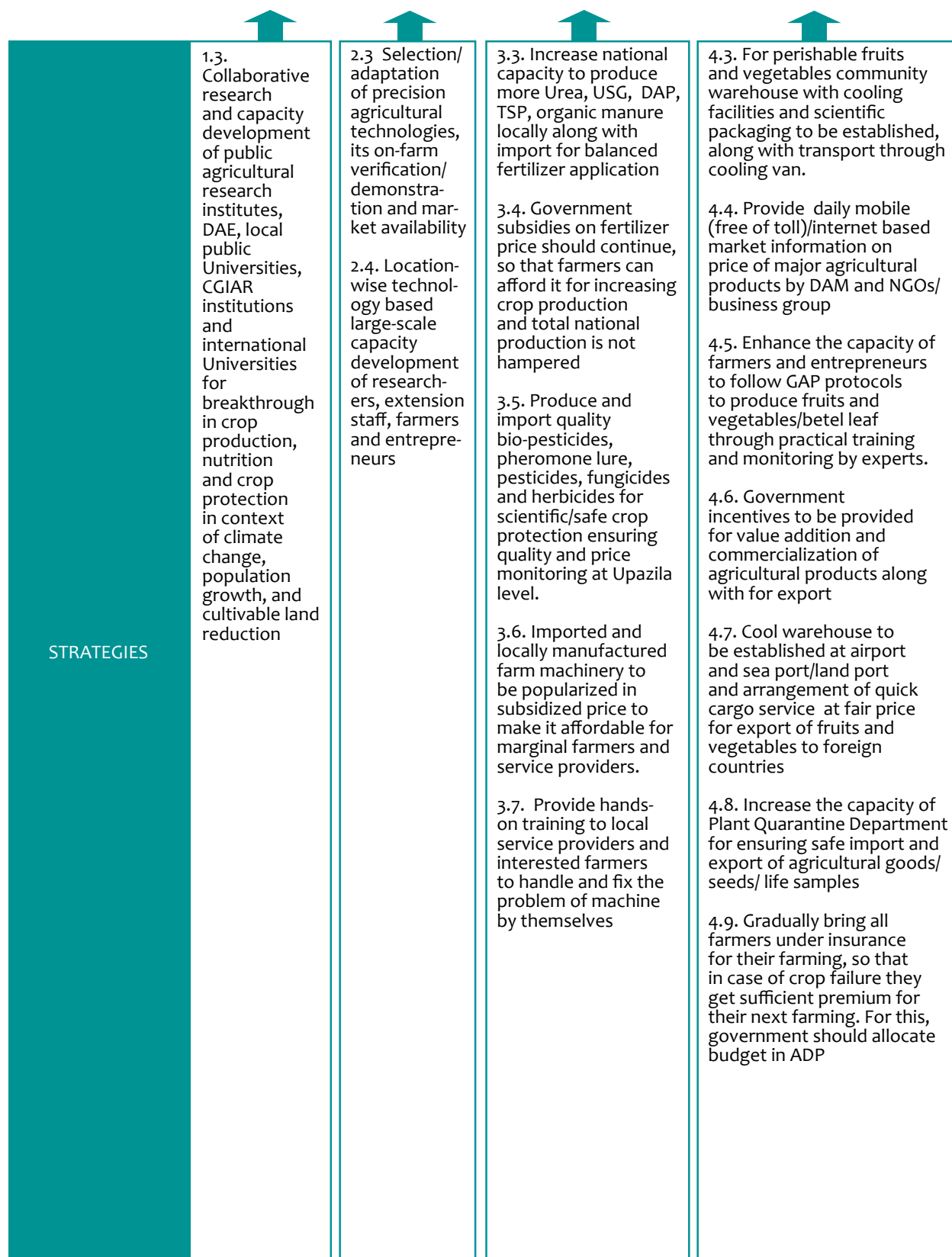


Fig. 1: Theory of Change

### 3.1.4 Policies/Strategies/Laws Supporting the Sub-sector

As per last 7<sup>th</sup> Five Year Plan, crop sub-sector has progressed at the rate of 1.7%, surpassing the population growth (8<sup>th</sup> Five Years Plan; Page 154). This success is mainly due to increase of rice, potato, maize, oilseeds, vegetables and fruit production. However, wheat, pulses and jute achieved negative growth due to biotic and abiotic stress factors along with comparative unfair market price. Moreover, production increase often does not always translate into increased farmer income due to high production cost, including labor wage, and price volatility through the crop season and at the farm gate. The progress and implementing strategies planned in 7<sup>th</sup> Five Years Plan shows lack of progress (Table 4).

**Table 4: Strategies taken in 7<sup>th</sup> Five Year Plan and its present status of implementation**

Strategies taken in 7 <sup>th</sup> five years plan	Implementation status	Apparent responsibility	Comments
Creating Opportunities for Sustainable Agriculture.	Little progress.	GOB (MOA and others).	More emphasis is needed in 8 <sup>th</sup> FYP.
Application of Science and Technology for higher levels of Food Production	Some progress for rice, maize, fruit, vegetables, spices, oilseeds etc.	NARES, DAE, BADC, NGOs, private sectors.	Should be continued.
Agricultural Research	Some progress in developing climate-smart varieties/technologies.	NARES (BARI, BRRI, BINA, BJRI).	Budget for field, lab. research, front-line demonstration and verification trials is very little.
Crop Zoning and Land Use Planning.	Presently Govt. restricted to convert 3 cropped land into industrial use.	MOA (NARES/DAE).	Need immediate step to save natural resources like land, water etc.
Agricultural Inputs- Seeds and Fertilizers.	Small improvement in quality seed supply. Inorganic fertilizers supply satisfactory. Maize and vegetable seed supply is dependent on import having high price.	BADC/DAE/Private sectors	But for pesticide and organic fertilizer quality was not maintained.
Promotion of Precision Agriculture.	Very little progress Buried pipe used for underground irrigation drip and sprinkler, hydroponic culture, bed planting, use of USG and IPM.	NARES/BADC/DAE/ BMDA	Precision agriculture is needed for economic or judicious use of natural resources.
Promoting Agricultural Diversification and Expansion of Horticultural Crops.	Apparently good success in fruit (mango, malta, guava, water melon, orange and strawberry).	BARI/DAE/BADC/BRDB, Private sectors.	Need quality products for export.



Strategies taken in 7 <sup>th</sup> five years plan	Implementation status	Apparent responsibility	Comments
Use of Water Resources and Water Economy.	Little progress in using surface water for irrigation and conjunctive use of water.	BARI/BIRRI/BADC/BMDA/DAE/private sectors.	Solar power use is still limited for irrigation.
Introduction and Popularization of Good Agricultural Practices (GAP).	Apparently little progress, though some work on protocol development.	MOA (BARI/DAE/Hortex Foundation)	Still no practical model of GAP in any fruits or vegetables.
Farm Mechanization and Commercialization.	Get impetus at later stage of 7 <sup>th</sup> Five Year Plan but not significant.	MOA/DAE/BARI/BIRRI/BADC/Private sector.	Need back-up of quality spare parts supply and efficient service-providers.
Boosting-up Agro-Processing Industries.	Very little progress in agro-processing.	GOB/Private sector.	Immediate need of mango, pineapple, guava, jackfruit tomato, rice bran oil processing plants.
Value Chain Development.	Apparently little progress at national level.	DAM/DAE/private sectors.	Expansion of agro-processing and market development.
Agricultural Credit.	No apparent progress.	BB/ Banks/NGO (micro-credit).	High interest rate (formal and informal).
Agricultural Extension.	Little progress in increasing number of SAAO for reaching each farmer. Need increase of crop variety/technology demonstration at farmers field.	MOA/DAE/NGOs	Budget for demonstration is less than 1% of allocation and needs improvements.
Rural Human Resources Development.	Very little scope for the HR development for both research-extension-farmers and service provider.	MOA/Respective organizations/NGOs.	Need regular program in addition to project related training.
Technology based weather prediction and forecasting.	Flood forecasting has improved a bit, but weather forecasting still not farmer/user friendly.	BMD/BWDB/DAE.	Need to link with crops season and crops.

### 3.1.5 Institutional Capacity and Coordination of Crops Sub-sector Development

The advancement of agricultural sectors in Bangladesh is largely governed by continuous emphasis on the development of new crop varieties, agronomic technologies, availability of quality seeds, and application of optimum irrigation, fertilizer and appropriate management. Thus, agricultural research and extension is important for ensuring food security and nutrition for the rapidly increasing population despite decrease of cultivable land. Agricultural research has been a neglected area with low budgetary allocation and comparatively lower research and financial facilities for scientists. The

extension service positioned in the middle of the research-extension-farmer trio receives limited budget of which the lion's share (about 84%) is spent for administration (i.e. salaries of staffs) and only a marginal share (1.5%) is available for extension programs (e.g. training, demonstrations, etc.) (Birner et al., 2010). A Sub-Assistant Agricultural Officer (SAAO) serves on an average 1,162 farm holdings, which is an impossible target (BBS, 2019; DAE, 2017).

Increased spending on research and extension is needed along with promoting good governance and accountability of the public institutions for promoting productivity. At least 3 to 4 % of national GDP should be invested in agricultural sector for enhancing research and development in crop sector in response to devastating climate change effect and increasing demand of high value crops and cereals for growing population. Service facilities and research environment for scientists should be improved in association with collaborative research with CGIAR institutions and universities of advanced countries.

Capacity building with changing climate, market demand and technology development is crucial for breaking the present bottleneck in boosting agricultural production. But systemic and continuous knowledge and technology development scope is very limited both for scientists and extension officers and staff. Moreover, for laboratory based work (such as; DNA, plant physiology lab, electron microscope lab, toxicology, soil-plant-water test, plant pathology lab, seed pathology IPM, IT/GIS lab etc.) a set of scientists and technicians must be specifically trained for it and their posting-promotion should be linked to this specialized lab work. Improving the writing skills of scientists is important but such effort is almost absent. This needs manpower development; in-country and foreign country including in CGIAR institutions and foreign universities. Now such training is rare and only project-based.

Farmers training are also project based, but there should be constant program for capacity development of lead farmers, service providers, women farmers, market actors, business entrepreneurs on different aspects through practical oriented training such as; high value crop introduction, yield-gap minimization, seed/plant materials production; soil-less culture, homestead vegetable-fruit gardening, farming systems/cropping systems, integrated crop and pest management, nutrient management, safe food production, consumption and marketing. Agricultural education (both graduate and diploma) should be re-oriented with the changing situations, along with more emphasis on gaining expertise on high-tech through internships with advanced farmers/research institutions.

### **3.1.6 Challenges for Crops Sub-sector Development**

#### **Ensure food and nutrition security for growing population**

In the global and modernizing world, agriculture faces a myriad of problems, both natural and synthetic. The two most common problems are loss of agricultural land and decreased varieties of crops. As the amount of available agricultural land decreases, the quantity of food available to consumers reduces. This harms not only the economy but also the level of health in the population. Decreased varieties of crops result in a reduction in the ability of crops to withstand natural disasters and issues. The major challenges are as follows:

Bangladesh has made remarkable growth in food production since independence. It has achieved self-sufficiency in rice and potato production, has done tremendous stride in vegetable production along with fruit production (mango, banana, guava, and berand citrus). But it lags far behind to fulfill the national requirements of pulses, oilseeds (edible oil) and spices. The country is rapidly fulfilling the requirement of maize (mainly for animal and fish feed). Per unit yield of maize is the highest in

Asia. However, wheat production has decreased due to competition with other crops and climate change effect. On the other hand, wheat import has largely increased (>6 million ton/year) over the years due to food habit changes of urban population and industrial use for wheat based food. Supply of nutritious and balanced food should get importance along with cereal food security. But gradual cultivable land loss has become a concern for production of increased food for growing population. Decade-wise land utilization of Bangladesh has been analyzed. The shifting rate of agricultural land to non-agricultural use is said to be about 1% per year. Availability of agricultural land of Bangladesh is gradually declining. According to BBS statistics annual decline of agricultural land is about 0.38% during 1980 to 2007 (27 years average), 0.75% during 1983 to 1994 (10 years average) and 0.40% during 1993 to 2004 (10 years average). Average shifting of agricultural to non-agricultural land is about 0.73% or 68,760 hectares annually during 2000 to 2010. Major agricultural land shifted to rural settlement. Considerable shifting also occurred to urbanization, industrialization and other structures (Bangladesh Delta Plan 2100, Base line studies, volume 4, page 5). It is losing land due to civil works including road, housing, offices, schools, industry, river bank erosion, industrial and municipal pollution. To reduce the loss of productive agriculture land, multi-storied housing may be constructed in village and peri-urban areas making it community based planned villages. Moreover, newly accredited char land should be brought under cultivation by making cross-dams, afforestation and other agronomic means, though the area may have to face the challenges of climate related shocks like sea level rise, cyclone and excessive rainfall within short time. Through making provision/law, restriction may be made so that two or three crops land is not used for constructing factories and other works.

### **Wake of COVID-19 global pandemic and its consequences**

The entire food supply chain and input supply chain have been hampered by the COVID-19 pandemic, resulting in economic crisis that occurred from mid-March 2020 to the present and has reduced the income of informal workers (farm, non-farm, service sectors). About 49.2% and 11.8% are facing moderate food insecurity and severe insecurity, respectively (FAO, 2020). Vegetable and fruit farmers did not get appropriate price because of less demand resulting in devastating loss of income, and marketing problems along with restrictions on operation (lockdown) and transport. Input supply was also hampered due to break-down of supply chain. However, rice and potato farmers got more income during April-May and after 2020 period because of hoarding and fear of scarcity. Labor crisis hampered farming as movement was restricted during lock-down. The COVID-19 pandemic once again proved the prime importance of agriculture in the Bangladesh economy, food security and livelihoods. The export-import dependent sector like the garment/prawn/crab/leather industry was severely affected because of global lock-down and severe reduction of demand.

### **Yield gap minimization and breaking yield ceiling through frontier research**

Optimum productivity of a crop depends on cumulative effects of several factors; viz. crop suitability, crop variety, time of planting, soil properties, supply of balanced nutrition, appropriate soil moisture/irrigation, agronomic management and environment. Except maize per unit area yield of most of all the crops are low compared to many Asian countries. The low rate of yield improvement may be attributed to slow diffusion of modern technology, non-availability of quality planting materials, poor socio-economic conditions and lack of incentive due to price volatility of products at farm gate. In many cases through existing crop varieties yield ceiling could not be broken as it was once broken through IR8 in rice, BRRI dhan29 or BRRI Dhan11 or hybrid maize variety Pacific11. For significantly increasing yield level, new cultivars with higher yield potential would be developed using modern gene technology application of nanotechnology and IoT along with conventional breeding and adaptation.

It is also observed that yield potential (Figure 2) of different HYV is very optimistic, 9.1 t/ha in Boro rice, 6.5 t/ha in T.aman and 5 t/ha in T. Aus rice, respectively (Ali, 2014). By contrast average farmers yield compared to best farm yield is 33% lower (2.2) in Boro, 35% lower in T. Aman (1.79 t/ha) and 35 percent lower (1.4 t/ha) in T. Aus rice (Satter, 2007). However, Ferdous et al. 2021 found 19-28 % yield gap in Boro rice and 16-28 % yield gap in T. Aman rice at Rangpur region in controlled experiments. Physical and socio-economic factors responsible for these large yield gaps are: (i) low levels of management; (ii) lack of price stability; (iii) loss of farmers' interest in investment due to an unbalanced land tenure system; and (iv) other socio-economic factors. The low-level management factors include: low quality seed, excessive seedling age, high plant population density, imbalanced fertilizer use, improper irrigation management, delayed weed management, delayed or improper pest-disease management, and delayed harvest. Soil factors associated with low farm level rice yield are reduced organic matter content and widespread occurrence of sulphur and zinc deficiencies. Among the other physical factors that often affect rice yield are unfavorable temperature, flood and drought.

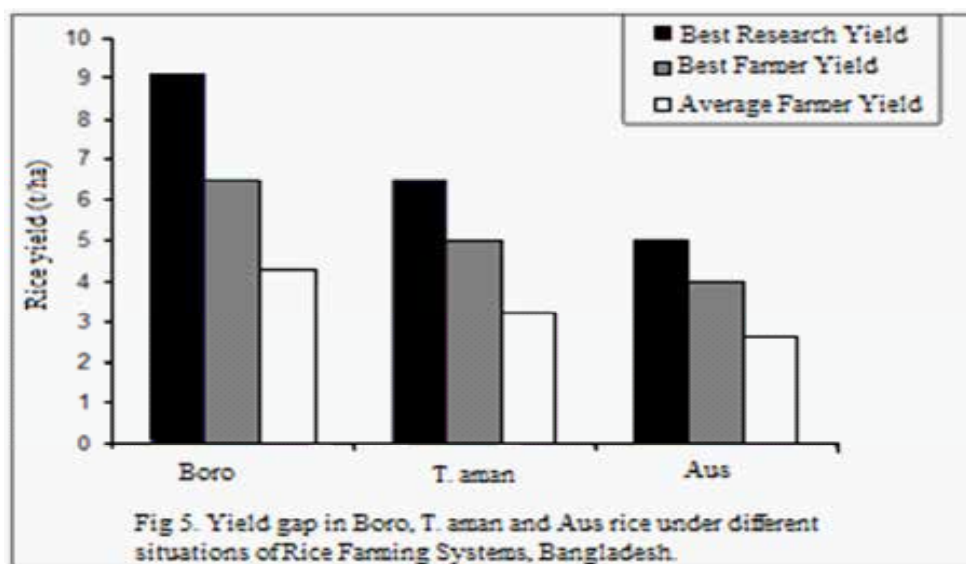


Fig 2: Yield potential of HYV rice in different season (source: Ali, 2014)

### Climate-smart agriculture and Crop-zoning

Climate change and climatic variations have profound effects on agriculture and livelihoods. The impacts of climate change are likely to result in huge economic, social, and environmental damage to South Asian countries including Bangladesh, compromising their growth potential and poverty reduction efforts (ADB, 2014). Higher temperatures eventually reduce yields of desirable crops while encouraging weed and pest proliferation. Changes in precipitation pattern (timing and amount) increase the likelihood of short-run crop failures and long-run production declines, posing a serious threat to food security. Although there will be gain in some crops in some regions, the overall impacts of climate change on agriculture are negative and need to be much better understood. Moreover, increased salinization of water and soil in coastal belt from sea level rise and intrusion of saline water through recurrent cyclones seriously retard crop growth and more cultivable land may be lost due to river bank erosion, sand filling, and permanent water logging. Excessive rainfall in summer may cause more flooding of crop land and households. On the contrary less rainfall in winter will cause water crisis for irrigation and livelihoods. Thus, climate change affects ongoing SDG achievement, poverty reduction and ensuring safe food and nutrition supply.

Existing climate smart technology of Bangladesh has been documented by CIAT in 2017 (Ali and Hossain 2019) and many other authors and institutions. Those should be promoted through hands-on training, result demonstration and by providing critical input like seed/seedling/sapling. Crop-zoning with GIS technology (preferably mobile phone based software) will help to grow suitable and profitable crops in appropriate locations. Such as Boro rice should be cultivated in surface water rich areas (like southern part), haor, bill areas and low lying areas to reduce cost and to save underground water. High land, medium high land and drought prone, hilly and char areas should be devoted for low water requiring non-rice crops and high value horticultural crops.

### **Technology development for hotspot areas (BDP2100)**

Hot spot is a broad grouping of districts and areas facing similar risks resulting from by hydrology, climate change and natural hazards. Six hotspot areas have been identified (source: BDP2100 hotspot map-ppt presentation). These are: (i) Coastal Zone (27,738 sqkm); (ii) Barind and Drought Prone Areas (22,848 sqkm); (iii) Haor and Flash Flood Areas (16,574 sqkm); (iv) Chattogram Hill Tracts (13,295 sqkm); (v) River Systems and Estuaries (35,204 sqkm); and (vi) Urban Areas (19,823 sqkm). Targeting the above hotspots, agricultural technology in crop sector would be developed, identified, adapted and adopted. Some of the technology may be localized as per socio-economic conditions, food habit and local market demand.

### **Sustainable soil fertility management**

Organic matter is the life force of a soil. It is not only source of different nutrients, but helps to conserve soil moisture, increase soil microbial activity, improves soil physical conditions and aeration. A good soil should contain 2.5% organic matter. However, most of Bangladesh soils have less than 1.5% and some have even less than 1% organic matter content. Moreover, imbalanced application of chemical fertilizer (excessive N fertilizer, inadequate amounts of other elements like P, K and S) is hampering achievement of potential yield at farmers level. Micronutrient deficiencies like zinc and boron also cause yield reduction in many crops, as a limited number of farmers knows about these deficiencies and take remedial action. The continuous cropping of rice, either singly or in combination has brought about a decline in soil health through nutrient deficiencies, nutrient toxicity, salinity and overall physical deterioration of the soil (Cassman et al. 1997).

### **Use of Quality Seeds**

By supplying of quality seed; crop yield can be increased by 10% or more. BADC can supply only 33% of required seed of rice and wheat. It also supplies some pulses, oilseeds, vegetables and potato seed. However, less than 50% farmers can use quality seeds and the rest cannot avoid use of poor quality seeds. Public and private organizations supply 60% of the total requirement of quality cereal seeds of rice, wheat and maize. The rest is produced traditionally by farmers, and those seeds are considered informal ones and not up to the required standard causing lower per unit production. There are a number of causes of inadequate supply of quality seeds by public sector, as follows: (i) Despite increasing demand of quality seed, infrastructure and technical manpower in the public sector have not been enhanced as expected. Presently, manpower at BADC seed wing is half the sanctioned posts; (ii) Required quantity of Breeder Seeds of desired varieties are not obtained from research institutes. Without sufficient quantity of Breeder Seeds of desired varieties, seed multiplication program cannot be undertaken; and (iii) Seed certification Agency (SCA) has regulatory functions to control seed quality, but due to less capacity it is unable to carry out the function duly. It is assumed that public

seed sector cannot fulfill the huge need of farmers, so promote farmer education programs on how to best preserve their own seed. Reliance on public or private sector for bulk of seed supply is never likely to effectively meet demand.

Vegetable seed supply mostly depends on Bangladesh private seed companies and mostly import from foreign countries. Hybrid maize seed is imported from India, either small quantity produced locally. Imported seed price is normally high, sometimes not affordable for bulk farmers. Other planting materials (Seedlings/saplings): Mostly addressed by private nursery owners where quality of fruit sapling is rarely maintained, rendering poor performance of garden with some exception. However, some portion of quality sapling is produced and supplied by BARI, DAE, BADC, BAU from their farms.

Other major problems are:

- Insufficient farm mechanization
- Ensuring fair price for farmers products and market management
- Post-harvest loss
- Soft credit for all categories of farmers
- Biological pest/weed control(IPM/ICM)
- Crop diversification and intensification
- GAP protocol development
- Capacity development of manpower
- Institutional capacity development
- Index based insurance and
- Food and nutrition security for urban/women population.

### **3.1.7 Addressing the Cross-cutting Issues**

Cross-cutting issues are those whose effect encompasses all or nearly all spheres of life and livelihoods. For Bangladesh in the context of the crop sector the following areas are considered as cross cutting issues: (i) Food and nutrition security (SDG-2, SDG-1); (ii) Climate change effect (including flood and drought), adaptation and mitigation (SDG-13) and (iii) Gender equality (SDG-5) and reducing inequality (SDG-10) such as role of women agriculture. Major cross-cutting issues include environment, gender mainstreaming, community empowerment, sustainability, equity and inclusion, and social accountability. Cross-cutting issues like the environment and gender equality are relevant to all aspects of development. Environment and development should be seen as one and the same thing. Long term development is not possible if rivers are polluted, the climate is changing, soil depleted and biodiversity destroyed as a result. For crop sector the major cross-cutting issues are: weather prediction and forecasting research, gender, HRD, pest disease management, credit and extension, agro-processing, value-chain development and Good Agricultural Practices (GAP). (Source: Bangladesh Strategic Plan on Agricultural and Rural Statistics -2016-2030)

The 8<sup>th</sup> FYP and proposed sector action plan on agriculture (SAPA) specially addresses those issues and proposes to undertake several action projects to solve those problems. For addressing the cross-cutting issues inter-ministerial and inter-departmental efforts will be needed, which includes agriculture, fisheries, livestock, forestry and environment, water development, food, LGRD, health, safe food authority, public representatives and others.

### 3.1.8 The Indicators for Sustainable Development Goals

At present the goal of the crop sub-sector is to ensure production and supply of quality food and nutrition to all walks of life over the years in affordable price.

The main indicators for the performance measurement of the SDG goals are cited below as per FAO:

- Zero hunger across the population round the year
- Complete reduction of food insecurity across location and population
- Increase of productivity for small-scale food producers/small holders farmers
- Gradual increase of income of smallholders farmers
- Sustainable agricultural production over the years
- Conservation of plant genetic resources for agricultural production and food supply
- Increase public investment in agricultural sector matching with the growing population
- Reduce food price volatility through government policy and intervention
- Women ownership and involvement in agricultural production
- Improve the water use efficiency in agricultural production
- Formulate and execute action plan strategy to combat water stress particularly in dry season.

In other ways, the major indicators of Sustainable Development Goals in crop sector are: water, climate change, land conversion, soil health, and pollution. We identified three generic stages of the “causal chain” of action that indicators can represent or seek to influence. These stages are public policy, farmer practice, and biophysical performance (source:Reytar, K. et al. 2014. “Indicatorsof Sustainable Agriculture: A Scoping Analysis.” Working Paper, Installment 6 of Creating a Sustainable Food Future. Washington, DC: World Resources Institute. Available online at <http://www.worldresourcesreport.org>.)

### 3.1.9 Identification and Intervention for Crop Sub-sector Development

#### Farm Mechanization and Commercialization

Bangladesh has made progress in mechanization of tillage mainly through 2-wheel tractors (called power-tiller). It was estimated that in 2009 about 90% of land was cultivated by power-tiller (Ali et al., 2018) and about 05 lakhs power tiller and 41,500 tractors are now used for tillage, carrying goods, threshing and other works (CIMMYT Prediction, 2012). Irrigation is mostly done by shallow tubewell and partly by deep tubewell along with government irrigation projects like G-K and Mohuri. But it is lagging far behind for rice planting, harvesting, threshing and drying. Those are mostly done manually, costing more money, and taking more time and delaying rice plantation and harvesting. Increased agricultural wages particularly during the harvesting season has become a major concern in recent times. Agricultural mechanization boosts up productivity, reduces cost and contributes to farm efficiency (8<sup>th</sup> five year plan, page 301). Strategies for credit and technical support will be developed to support the local machinery producers. Collaborative efforts are needed by public and private sectors in technology continued and its diffusion. Technological progress needs to be supported by public and private investment for irrigation, flood control and drainage, and farm mechanization. However, more emphasis should be given to manufacture of light agricultural machinery locally to save money and create more jobs.

Small scale farm mechanization progressed a lot in soil tillage mainly through 2-wheel tractor and for irrigation. But it is lagging far behind in mechanization for rice seedling planting, weeding, pesticide spraying, harvesting, threshing, cleaning, grading, drying, packaging and storing. It requires excessive labor which is currently in short supply and costly. Moreover due to lack of mechanization, post-harvest loss is rampant. The overall result is that production cost of crop becomes more expensive. However, recent government efforts to provide farm machinery at reduced price would help to reduce this chronic problem. However, local manufacturers should get preference for producing our own major farm machinery. But tax on imported spare parts (but not on imported whole machine), local products remaining as an obstacle. This should be immediately addressed by inter-ministerial efforts (Ministry of Commerce, Finance and MOA). Moreover, local service providers and mechanics must be trained about the technology and subsidy so that they can efficiently take care for the machines. It would also create large number of employments along with scope of multiple cropping along, reduced production cost and reduction of post-harvest loss.

### **Soil and Fertilizer Management**

Soil fertility of average Bangladesh soil is fragile. Major nutrients depletion is continuously occurring along with intensification of high yielding cereal crops. Nutrient balances of major nutrients (NPKS) are negative in most soils along with increase of soil micronutrient deficiency (Zn, Mo, B). Organic matter content of major soils of high and medium high land is less than 1% against ideal 2.5% (BARC, 2018). Moreover, balanced fertilizers are not used at farmer's level rendering further imbalance in soil nutrients situations. More nitrogenous fertilizers are used compared to recommended phosphorus, potash and sulfur fertilizers. Excess nitrogen use may enhance mineralization of organic matter, which may decrease carbon content in soil and increase CO<sub>2</sub> emission along with pollution of surface and underground water.

### **Crop Price, Market Development and Value Chain**

Most of the farmers are landless, marginal and small in category, and are forced to sell their agricultural products just after harvest. They even sell their products much before harvesting and get nominal prices. Appropriate marketing systems by the government minimum market price should be ensured for most crops like rice, jute, wheat, maize, oilseeds and pulses. So, market systems and infrastructures, cool room, cold storage, warehouse, cool van and cheap transport system should be made available. Government organizations like agriculture marketing and local administrations should help farmers and businessmen to establish value chains for all perishable products. There has been a substantial expansion of road communication over the past years. However, existing roads, railways, waterways and related infrastructures, particularly in rural areas, remain insufficient and inefficient, posing an unfavorable impact on the growth of perishable high-value products.

### **Post-harvest loss reduction and value addition**

By minimizing post-harvest loss (PHL) of fruit, vegetables, tuber crops, sugarcane and cereals more than 10% total production and income could be saved. The highest post-harvest loss is found in vegetables (30%), fruits (25%), tuber crops (20%), sugarcane (20%), 15% in pulses, oilseeds and spices while 12-13% in rice, wheat and maize. It is estimated that total loss due to PHL is 10.61 million ton products, which is valued up to 81,594 million BDT (source: NMFPP, 2010). PHL occurs in all stages of production to marketing; such as; harvesting, transport, grading, threshing, storing, consuming, marketing. Value addition of products and commercialization is still at initial stages due to low incentive, lack of quality assurance, inadequate technology, creation of market demand (local and foreign) and unfavorable business environment.



## **Market development and ensuring fair price to farmer's products**

Lack of incentives often deters farmers from investing optimum level of input and management for their crops. As often farm gate price at harvest time is low to very low which brings marginal benefit/loss to the growers. This is due to mal-functioning of marketing system of Bangladesh where major profit goes to middlemen. Moreover, poor logistic market facilities, excessive market toll, and inefficient and costly transport facilities along with informal toll in case of inter-city road/river transport make the products costly to end user of city. Loss of perishable products (like vegetables, fruits, spices) due to jams, river crossing, political unrest, strikes and COVID-19 like situation make both the growers and businessmen also losers and market chain is seriously disrupted.

## **Ensuring soft loan to farmers and entrepreneurs**

Agricultural credit is really a sore matter for medium, small, marginal and share-croppers. Available credit is correlated to higher production, crop diversification, value-addition, food processing, storage and marketing resulting in enhanced income generation and poverty reduction. However, formal credit requires so many papers, collaterals and often speed money. On the contrary NGO micro-credit is costly where interest rate is around 24-30%. This sucks most of farmers' profit, sometimes even asset. According to data of Bangladesh Bank, around 25% total disbursement of rural credit is delivered by the public sector. The remaining 75% has been delivered by micro-finance institutions (MFI) including NGOs and the Grameen Bank. Additionally a good number of farmers take informal loan from local mohajon and dadonder with high interest (around 100%), but the loan is easy to get.

## **IPM/ICM technology development and dissemination**

To ensure safe and nutritious food supply every citizen of the country is crucial to achieve SDG-2 and NSSS. However, by practicing Integrated Pest Management (IPM) robustly at farmer's level, it can be achieved. Through IPM technology, disease and pest of crops could be managed without jeopardizing safe food production. On the other hand, by practicing Integrated Crop Management (ICM) technology, pollution from fertilizers and amendments/herbicides could be avoided. Thus, not only in vegetable but for all crops and fruits IPM/ICM technology must be developed, adapted and adopted. It is also important components of GAP.

## **Implementation of GAP Protocol**

Good Agricultural Practices (GAP) is crucial for production of safe and nutritious food. As food related diseases has become great concern for all walks of people, particularly children, women and vulnerable people are affected most. Moreover, export to any foreign country depends on GAP and phytosanitary certificates. But till today no protocol has been formulated. Moreover, indiscriminate use of excessive nitrogenous fertilizer, polluted irrigation water, pesticides/fungicide, use of harmful chemicals/preservatives in fruits and processed food making many food items poisonous or detrimental for human and animal health. Hence from field to plate at all level GAP, should be followed. This needs serious and immediate short and long term action program to re-orient the whole agricultural production systems.

## **Crop diversification and intensification through high value crops**

High value crops are those which provide more return than Boro rice. Generally different vegetables, fruits, maize, spices, potato etc. are regarded as high value crops. Suitable lands for those crops must be flood free, i.e. high land, which is only 32.7% (BARC, 2018). But use of high land is diverse

(factory, road, housing, permanent forest, bamboo clumps, permanent fruit garden to 3-4 crops rice-vegetable pattern). About 0.73% high land is lost due to above civil works. So, scope of diversification and intensification is limited. However, a part of medium high lands (36.7%) could be used for crop intensification (increasing cropping intensity) and for diversification. Moreover, for growing high value crops/fruit, there is need for more investment, extra labor, knowledge of technology, quality planting materials and ensured irrigation. Unfortunately, those are scarce for a majority of farmers (small and marginal). Additionally, there is a limitation of available irrigation supply in dry season in some areas (such as, High Barind Tract, hilly areas, some chars, parts of greater Sylhet) which also hampers crop intensification and diversification. Bangladesh imports more than six lakh tons of fruit per year from different countries costing around 2,500 crore BDT. Through producing different fruits round the years farmers' income could be increased significantly, helping in reduction of poverty and malnutrition along with decrease of fruit import cost. Also multiple types of vegetable production round the year helps farmers to increase their income within a short time with the elevation of national income, rapid urbanization and increased disease susceptibility, food habit is changing for healthy life style through intake of more vegetables, fruits and whole grains.

### **Capacity development of manpower**

Bangladesh agricultural scientists and extension personnel both require capacity development for catering to the needs of the present day on different aspects such as, climate change adaptation/mitigation, nanotechnology, modern crop breeding, farming systems, technology dissemination, IPM/ICM etc. Farmers and entrepreneurs' capacity should also be developed to address present day challenges and needs.

### **Institutional capacity development**

For implementing modern physiological study/crop breeding/ toxicology study/Nano technology development, IPM/ICM/pathological study, soil/fertilizer analysis, seed processing and other scientific study modern lab facilities should be developed. For supplying quality seeds, other inputs, its preservation and storage required civil construction is needed along with farm development.

### **Continuous loss of cultivable land**

Bangladesh has total cultivable land area is only 7.955 million hectares (BBS, 2020) which is serving a mammoth population of 170 million, i.e. each person has only 0.047 ha (11.76 decimal/head) of land. Among this total cultivable land high land and medium high land is the most productive where two/ three even three/four crops are grown in a single year. High land area is 32.71 % and medium high land area is 36.71%. So, total high and medium high land area is 69.42 % of total cultivable land (BARC, 2018). It is estimated that about 0.73% of cultivable land is lost each year (Bangladesh Delta Plan 2100) due to different types of developments, such as; factory, power station, road, railways, housing, drain, public and private offices, irrigation channel, river erosion etc. Therefore, it is a serious concern for producing enough food for the growing population on a decreasing area of productive land.

### **Index based insurance for farmer's crop loss**

Farmers often totally or partially lose their crops due to flash flood, cyclone, storm, tidal bore, river erosion, drought and pest-diseases. As majority farmers are small, marginal and landless categories,

crop loss makes them vulnerable to dire poverty; they are even forced to migrate to cities for survival. Gradually all categories of farmers should come under insurance, so that they have way of recovery. Delta insurance and OXFAM has initiated it in haor areas. Government should take initiatives urgently with sufficient budget at least in the four hot spot areas.

### **Food/nutrition security for urban/women population**

Bangladesh urban population is rapidly increasing. At present about 34 % of total population lives in city areas. It is estimated that more than one third of them lives below poverty level. It is further predicted that in the coming years urban poverty would be more than rural poverty rate. So, to provide them food and nutrition would get importance.

#### **3.1.10 Estimating resource allocation/requirement**

Increasing resources should be allocated to create the supply of locally developed innovation targeting the competitiveness of productive activities, whether for export or domestic consumption. Incentives should also be given to integrating those innovations in productive activities so that producers succeed at improving quality and reducing cost simultaneously. It's high time that Bangladesh changed the focus of resource allocation so that the country continues to enjoy increasing competitiveness by strengthening the local market of innovation. Otherwise, the country runs the risk of suffering from slowing down of the economy, losing jobs and missing the economic targets of 2030 and 2041. Share in ADP allocation has declined marginally for Agriculture sector, from 4.1% in FY21 to 3.4% to FY22 at a time when ensuring food security remains a high priority. Physical infrastructure-related sectors have continued to dominate with inadequate attention to Health, Agriculture, Social Welfare and Labor & Employment sectors. Given the importance of agriculture production and food security, subsidy in the agriculture sector has been increased by 17.4% vis-a-vis RFY21:

- Despite the improvement in subsidy utilization in recent years, a considerable share (9.5%) tends to remain unutilized;
- Efficient and full utilization of subsidy will help reducing production costs and contribute to enhanced production.

Budget allocation for Agriculture Sector is quite reasonable in 8<sup>th</sup> FYP (Table 5). However, the gap in utilization of allocated budget and expenditure for Agriculture (crops), Fisheries and Water Resources varies are 25.20 %, 4.95 % and 6.54 % respectively. Therefore, capacity for fund utilization needs significant improvement in Agriculture Sub-sectors and concerned Ministries for achieving targets fixed in the 8<sup>th</sup> FYP. But to make a real breakthrough in crop sector (as 60 % of agricultural GDP) sufficient fund should be continuously allocated for frontier/advanced research along with capacity development of research and extension personnel in association with soft credit to small farmers/entrepreneurs and competitive marketing of farm products.

**Table 5: Ministry-wise ADP Allocation in 8<sup>th</sup> FYP (FY21 to FY25) under Agriculture Sector (Taka in Billion)**

Sector	FY21		FY22		FY23		FY24		FY25	
	Current Prices	Constant Prices	Current Prices	Constant Prices	Current Prices	Constant Prices	Current Prices	Constant Prices	Current Prices	Constant Prices
Ministry of Agriculture	41.2	41.2	46.1	43.8	47.9	43.2	49.7	42.8	59.6	49.0
Ministry of Fisheries & Lives	9.0	9.0	11.1	10.6	12.8	11.6	15.0	12.9	18.0	14.8
Ministry of Water Resources	108.6	108.6	156.9	149.0	228.7	206.6	276.2	237.8	346.4	284.6
Total	158.8	158.8	214.1	203.4	289.4	261.4	340.9	293.5	425.0	384.4

Source: 8<sup>th</sup> FYP (page 338)

### 3.1.11 Action Plan Framework for Crop Sub-sector Development and its implementation

For addressing challenges of crop sub-sectors diverse actions would be taken for short term, medium term and long term basis starting from the launching of 8<sup>th</sup> five year plan (2021-2025). The following Action plan (Table 6) along with base line, target, implementation period, SDG target, BDP2100 measures, expected output, responsible agency and assumption is given. In 24 major thematic areas 64 action plans have been proposed to diversify and intensify crop sector for providing safe food, fiber and nutrition to growing population of Bangladesh in the context of climate change, decreasing cultivable area and commercialization of agriculture.

**Table 6: Action Plan for addressing the challenges of Crop sub-sector**

Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
1. Develop crop varieties for rice and non-rice	1. Develop crop varieties for rice and non-rice	1. Strengthening conventional breeding and application of speed breeding technique/other techniques (such as, introduction, radiation, AI). Undertaking of frontier research for genotype development by applying CRISPR/cas9 technology, biotechnology/tissue culture and other means (such as; increasing photosynthetic efficiency, nutrient efficient, photosensitive year round genotype, export quality variety, stress tolerance (salinity, drought, water logging), pest- disease tolerant, identify selection tools etc.) for multiple crops for different AEZ and its management technology in collaboration with relevant national and international universities, CGIAR institutions and advanced countries. Initially starting with few crops in one lead institution in a coordinated program with multi-institutions. Depending on success expand crops and institutions.	-	Manpower training (including short training, PhD, MS) and lab construction completed within three years. At least two superior cultivar per designated crop applying CRISPAR/cas9 technology /speed breeding/ other methods by 2032	10,000	July 23 to June 32	2.1, 2.2, 2.3, 2.4, 2a	CCI Agriculture, food security and livelihood	At least one potential high yielding cultivars of each crop developed at the end of the projected year (2022-32)	BARI, BIRRI, BINA, BWMRI, BSRI, BJRI, Universities which have advanced lab facilities	Manpower development, lab facility and equipment and chemicals- long time continuous plan
2. Efficient utilization of natural resources, surface water availability	T2. Conservation agriculture (CA)	1. Promotion of conservation agriculture (zero/ minimum tillage, bed planting, straw retention, crop rotation, AWD, smart and precision agriculture, laser leveling, mulching), judicious application of agro-chemicals, for different crops (dry land Aus rice, maize, wheat, pulses, soybean-500 on farm trial and demo for each year; and its comparison with modern agricultural practices.	May be at 1% land under CA	Another 9% increase of cultivable land under CA	July 22 to June 27	500	2.4	CCI- Agriculture, food security and livelihood	10% area of the country come under CA	BARI, BIRRI, BINA, BWMRI, BSRI, SRDI	Traditional thinking of tillage and crop husbandry

Strategic Goal of 8FYP 4.3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
2. Efficient utilization of natural resources, surface water availability	TA2. Conservation agriculture (CA)	2. Development and fabrication of suitable conservation agriculture (CA) machinery (PTOS/tractor based attachment, others) for tillage/ seeding- at least three prototypes in first year in collaboration with private companies/ machine developers or improve the existing proto-types (if viable)	Most of the machine imported except bed planter	At least three technically and commercially viable machine CA machine to be developed and adopted by service providers	20	July 23 to June 25	9b	CCI- Agriculture, food security and livelihood	Two CA tillage/ planting machine become commercially viable	BWMRI	Quality materials
		1. Development/ fabrication/import of Axial Flow Pump (AFP) for surface water irrigation for boro rice and other dry land crops -2 prototype; and Solar powered irrigation pump introduction with prepaid meter (where possible)	1 AFP prototype by BARI	2 years	10	July 23 to June 25	6.4 6.5		CCI- Agriculture, food security and livelihood	One AFP becomes commercially viable. Environment friendly irrigation	BARI, BIRRI, BWMRI, BADC, DAE, Private company/ NGO
2. Efficient utilization of natural resources, surface water availability (contd...)	TA3. Water management	2. Rainwater harvesting through re-excavation of canal, khari, hillychara, pond, dighi, constructing cross-dam, rubber dam, in suitable location, small river etc. and digging of dug well-300 items; and	Major work at Barind region by BMDA but still lot of scope. In other areas very small initiative	3 years	2000	July 23 to June 25	6.3, 6.4, 6.5, 6.6	Goal-2, 6	In 20% irrigated area surface water used in dry season/ supplementary irrigation in T. aman rice	BADC, BMDA, BWDB, LGED, RDA, DAE, CHTB	Local involvement

Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
2. Efficient utilization of natural resources, surface water availability (contd...)	TA3. Water management	3. R&D on farm water use efficiency through introduction of sprinkler, drip irrigation system, buried pipe for fruit garden/high density fruit garden, vegetable and other crops.	Buried pipe only in Barind area	3 years	500	July 23 to June 25	4-3, 6.4, 6.5	Goal-2, 6	Major private and government fruit and vegetable field will adopt water saving irrigation devices	BARI, DAE, BADC, BMDA, BWDB, LGED, RDA	Traditional thinking of flood irrigation, electricity charge policy
		4. Arrangement of widespread supplementary irrigation facility for Haor rice crop in Boro season through deployment of SWT, LLP and other means. As it suffers at late crop growth stages due to shortage of surface water /soil moisture	-	3 years	100	Nov. 22 to March 2025	6.4, 6.5	Goal-2, 6	Yield of Haorboro rice may increase up to 20%	BADC, DAE, BRRI, BINA, BWDB	-
		05. Polder and sluice gate management in coastal areas must be safe and functional so that year round suitable crops could be grown	-	3 years	-	2025	6.4, 6.5	Goal-2, 6	Safe and enhanced crops production	BWDB, BRRI, BARI, BINA, DAE	-
3. Introduce organic fertilizer, fertilizer management along with synthetic fertilizers	TA4. Soil fertility management	1. Promotion of quality compost/ bio- gas residue/ vermi-compost/ green manure/bio- fertilizer production and application in soil for improving soil fertility along with other synthetic nutrients and comparative testing in vegetable, fruit and other crops at least one ideal village for each union. Ensure crop growth stage-wise (need based) fertilizer application at field level. To be done in areas where organic material is available and scope of application (such as high value fruit /vegetable garden). Commercial production of compost to be initiated for sustaining soil fertility initially at pilot basis- 8 number for eight division	Assumed used in 10% land	3-5 years	3,000	July 23 to June 27	2-4, 13-2, 15-3	20% farm land will largely apply organization amendments along with other synthetic fertilizers	DAE, BARI, BRRI, BINA, BWMRI, BSRI, SRDI NGOs, lead farmers, private companies	Scarcity of quality organic matter/ compost	

Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
3. Introduce organic fertilizer, fertilizer management along with synthetic fertilizers	TA4. Soil fertility management	2. Promotion of IPNS (integrated plant nutrient system) for major cropping systems of the country for ensuring soil fertility as well higher production-500 on- farm trials;	Some studies by different Res. Institute need updated study. need base study	Full packages of IPNS for major cropping systems tested widely	100	July 23 to June 25	42-3, 2-4, 2a	CCI- Agriculture, food security and livelihood	Balance fertilizer application by 30% farmers	BARI, BARRI, BINA, BJRI, BSRI, BWMRI, SRDI	Farmers cooperation
		1. biological pest/weed management (IPM/IDM/ICM) for major crops including vegetable and fruits; and	Assumed about 10% veg and fruit production are adopting IPM	Strengthen on-going IPM research activities with more crops/fruits	500	July 23 to June 27	15-5	CCI- Agriculture, food security and livelihood	25% fruit and vegetable field will adopt IPM/ICM	BARI, BARRI, DAE, BINA, BWMRI, BSRI, BJRI, NGOs	Manpower shortage
3. Introduce organic fertilizer, fertilizer management along with synthetic fertilizers	TA5. Biological Pest/ weed management/ Quarantine	2. Strengthening proper quarantine measure to prevent invasive pest/disease/weed through food /plant import through air/sea/land ports including modern equipment and training to Quarantine officers and formation of Quarantine Authority	Primary equipment is available at station but trained manpower crisis	Strengthening work will begins from 2023	100	July 23 to June 26	15-8	CCI- Agriculture, food security and livelihood	Well- equipped Quarantine stations in all ports	DAE	Manpower training and authority development
		1. Existing law/provision should be strengthened against soil, water, air, environment pollution and existing law should strictly be applied (land owner would get sufficient compensation if his land is polluted by anybody/factory among local industrialists/city corporation/municipal corporation/ local residents/farmers	Some environmental law remains need to link with Agriculture/ Fisheries	Revised law to be drafted within 2023 and passed	10	July 23 to June 24	6-3, 11-6, 15-1, 15-5	Goal-4	Revised Law/ provision to be adopted within 2023	MOEFCC, MOA, MOL, WDB, BADC, BRTA, MIWT, DAE, SRDI, DOE, LGED	Law enforcement and local pressure on industrialists
TA5. Research on harmful effect of agro- chemical, heavy metals	TA6. Pollution management										



Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions	
							SDG's Target	BDP 2100 Measures				
TA6. Climate resilient varieties, crop management	TA7. Climate Smart Agriculture	1. Profiling existing Climate Smart Agriculture (CSA) (researchers developed and innovative farmers practice, such as floating agriculture, sorjon method) locations and it's up-scaling/out-scaling in appropriate locations particularly in coastal, char and drought prone areas	Separately documented by different authors need compiling	Documented and compiled CSA and location specific up scaling of potential CSA through piloting	50	July 23 to June 26	13-1, 13-2, 13-3	Goal-6	Mater document of existing's by 2023 describing details and piloting of 100 front-line demonstration	BARI, BARRI, BINA, BJRI, BWMRI, BSRI, DAE, NGOs	Abnormal high rainfall/ cyclone/ drought	
		2. HY Boro rice variety developed for higher(>12 dS/m) soil and water salinity conditions (05 number);	Most developed variety can endure 6-8 dS/m at reproductive stage	Within three years potential variety will be tested for release	100	July 23 to June 2028	2-4	CCI- Agriculture, food security and livelihood	At least two potential variety at the end of 2026-27	BARI, BARRI, BINA, BJRI, BWMRI, BSRI, DAE, NGOs	Abnormal high rainfall/ cyclone/ drought	
		3. Saline tolerant variety and its management options development for maize, vegetables, sesame, mustard, potato, water melon, spices (at least 2 varieties for each crop), soybean;	Few cultivars of above crops are saline tolerant	Within three years potential variety will be tested for release	200	July 23 to June 2028	2-4	CCI- Agriculture, food security and livelihood	CCI- Agriculture, food security and livelihood	At least one potential variety for each crop at the end of 2026-27	BARI BINA, BWMRI, SRDI	Yield and quality of crops
		4. Drought tolerant short duration Aman rice, variety development for HBT and similar areas (at least 3 varieties) with management technology;	Few cultivars of T. Aman are drought tolerant up to 3-4 weeks	Within three years potential variety will be tested for release	100	July 23 to June 2028	2-4	CCI- Agriculture, food security and livelihood	CCI- Agriculture, food security and livelihood	At least one potential variety for each crop at the end of 2026-27	BARRI, BINA, Seed companies	Yield and quality of rice

Strategic Goal of 8YFP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
T46. Climate resilient varieties, crop management (contd...)	T47. Climate Smart Agriculture (contd...)	5. Agroforestry system (fruit/forest-crops)development for CHT, Barind, Madhupur tract, other hilly and similar region (2-3 models) and scaling- up existing technologies replacing/ modifying existing Jhum cultivation at CHT hill to minimize soil erosion;	One MATH model of BARI	With two years potential model will be tested for scaling-up	100	July 22 to June 25	2-4	Goal-6	One viable model for agroforestry system of CHT, Madhupur, Barind and other hilly areas	BARI, BFRI, BSMRAU, BAU, DAE, SRDI, CHTB, NGOs	Traditional Jhumcultivation at CHT
		6. Yield and profit maximization for greater system (fish- rice-vegetable) of greater Khulna, Barishal, Gopalgoni, Narail and similar areas. Studygher sys- tem environmental and social aspects	No whole system research approach	Report will be finalized within two years	100	July 22 to June 24	15-1, 15-5	Goal-6	Science based findings result within 2 years	BARI, BIRRI, DAE, DOF, NGOs	Multi-discipline
		7. Development of deep root systems, low water requiring, heat tolerant, short duration high value crops like pulses(lentil, chickpea), mustard, linseed, wheat, potato, sugarcane, millets, mango, citrus, jujube(ber), sorghum, maize, peanut, black cumin and hull less barley varieties and its management technology (at least 02 varieties for each crop) for drought prone –High Barind Tract, other areas and chars;	Few cultivars developed	With three years potential variety will be tested for release	100	200 July 22 to June 26	2-4	CCI- Agriculture, food security and livelihood	At least one potential variety for each crop at the end of 2025	BARI, BINA, BWMRI, seed companies	Yield of crops
		8. Developing models for ecosystems based Haor agricultural farming consisting of short duration Boro rice-fish/ duck and adapted tree planting at border (Hijol, Koros etc.). Develop 120-130 day short duration boro rice. Finding other short duration crops option (such as mustard, leafy vegetables, homestead gardening following BARI model, pit based vegetable, zero tillage of different rabi crops) before Boro rice planting at upper catena of Haor. Threshing floor construction, mechanization; and	Some BAU/ BARI/ BIRRI study but not holistic	Farming systems to be tested for recommendation within two years	100	July 22- June 25	15-1, 15-4	Goal-4, CCI- Agriculture, food security and livelihood	Research based complete packages of technology for haor farming by 2025	BIRRI, BARI, BAU, some NGOs such as CNRS	Multi-discipline

Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
T46. Climate resilient varieties, crop management (cont...)	T47. Climate Smart Agriculture (cont...)	9. Finalize and commercialize sea weed cultivation technology at coastal regions as part of Blue economy in the context of sea level rise along with other options (community based up-scaling)	Primary work by BARI/NATP, CVU/ECO-Fish project and some commercial farms	Within three years potential variety will be tested for release along with component technology	10	July 22- June 27	2-1, 2-3, 14-7	Goal-6	Recommend species and its packages of technology along with processing by 2027	BARI, CVU, DOF, NGOs, Commercial farms	Adoption and marketing
		1. Updated on-farm research on major cropping pattern based balanced fertilizer recommendation and management- select three cropping pattern for each AEZ and conduct research. Application of nanotechnology in fertilizer management;	Nanotechnology still to be used	Ideal trial/ demo to reduce yield gap with major crops to be tested widely	1000	July 22- June 25	CCI- Agriculture, food security and livelihood	2-3, 2-4, 2a	Potential and newly developed adopted varieties adopted by more than 80% farmers	DAE, BRRI, BARI, BINA, BJRI, BSRI, BWMRI, NGOs	Full package of technology
T47. Crop and fertilizer management, transfer modern crop tech	T48. Yield gap reduction and production/profit maximization	2. Large scale adaptive trial and demonstration for reducing yield gap at farmers field through applying whole packages of recommended technology in major crops (Boro, T.Aman, T.Aus rice, maize, wheat, oilseeds, lentil, potato, selected vegetables, jute, cotton, onion, garlic, sugarcane, tomato, banana- should cover all upazilas for major crop(s). Large scale farmers training on yield gap minimization in different crops;	Some studies in different crops; need widespread trial / demo	Ideal trial/ demo to reduce yield gap with major crops to be tested widely	1000	July 22- June 25	2-3, 2-4, 2a	CCI- Agriculture, food security and livelihood	Potential and newly developed adopted varieties adopted by more than 80% farmers	DAE, BRRI, BARI, BINA, BJRI, BSRI, BWMRI, NGOs	Full package of technology
		3. Yield and profit maximization trial for high yielding crops under resource non-limiting conditions (Boro rice, maize, sugarcane, tomato, banana, potato, onion, mustard, cassava) (targeting at least 20% yield increase)-100 trials for each crop per year	Few study for some crops need marked increase	Trial would be finished with 3 years for analysis	200	July 22- June 27	CCI- Agriculture, food security and livelihood	2-3, 2-4, 2a	Need study in both research stations and all AEZ	BRRI, BARI, BSRI, BWMRI, BADC, Seed companies	Timely fund and seed/ technology availability

Strategic Goal of 8YFP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
T48. Ensure affordable price of products-market linkage	T49. Market management	1. GOB would purchase 25 % of Boro,T. Aman rice and wheat at harvest time directly from farmers with a remunerative price to create market demand;	Govt. purchase about 10% through dealers	Increase of rice purchase at least 5 % more per year	1000	July 22- June 25	2c	CCI- Agriculture, food security and livelihood	25% produced rice will be purchased by 2026	MOF, DAE, DAM	Government policy
		2. Develop/improve infrastructure of model marketing farmers product marketing facility, preservation facility, cooling van, fair transport cost and minimal toll (including prohibition of unofficial toll by miscreant); at least one big market per Upazila. CCMC market model of NATO-2 DAE may be examined and. Effectiveness of DAM constructed 16 wholesale market activities may be observed;	-	Work started gradually from 2023 and finished within 2027	1000	July 22- June 27	2a	CCI- Agriculture, food security and livelihood	At least one market per each upazila with suggested facilities	DAM, DAE, BADC, LGED, selected farmers group, market committee, NGOs	Undertake project
		3. Creation of farmer's production group for major products particularly for marketing of perishable goods such as vegetables/ fruits including finding better market across the country- each union basis. Farmers hub model of Syngenta foundation be examined. DAM sponsored 500 farmers marketing groups effectiveness may be examined; and	Some formed through project but few viable	Institutional-marketing systems in major hub by 2024	100	July 22- June 25	2a	CCI- Agriculture, food security and livelihood	For all major vegetable fruit growing area-at least one group per union	DAE, DAM, BADC, Selected NGOs, Farmers group	Local politics
		4. Regular price determination of major agricultural products of farmers and market price information using ICT tools (mobile/internet based) for farmers/traders. Creation of awareness among farmers on pricing of their products- including information on minimum selling price.	On-going work of DAM	Strengthening farm products information dissemination through mobile phone apps	-	July 22- June 25	2a	CCI- Agriculture, food security and livelihood	For all major crops	DAM, DAE, HORTEX Foundation	-

Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA9. Crop management, post-harvest storage, location specific technologies	TA10. PHL reduction, value addition/processing/commercial agriculture	1. Conduct hands-on training on fruit, vegetable proper harvesting time and methods, cleaning, grading, packaging, storing/including application of nanotechnology, transport and marketing based on developed technology- 1000 training per year. 30 participants per training; and	Almost absent, only few project based	Training would start from 2023	200	July 22- June 27	2a	CCI- Agriculture, food security and livelihood	More than 5000 trained farmers by 2027 having knowledge to reduce PHL	BARI, DAE, HORTEX Foundation, BADC, DAM selected NGOs, Local business association	Quality trainers
		2. Conduct research on developing technology on safe and cost-effective methods for reducing PHL of perishable crops (vegetables, fruits-mango, jackfruit, pineapple, banana, malta (Citrus), sapota, guava, litchi)-at least one technology per crop; and its up-scaling.	For some fruit products at experimental stage and some recommended	Package of technology developed within 2025	200	July 22- June 27	2a	CCI- Agriculture, food security and livelihood	Reduce PHL by 20% in fruit and vegetable from 30% and 15% for rice from 20%	BARI, DAE, Hortex Foundation, BADC, business group,	Multi-stakeholders
TA10. Develop seed production system	TA11. Seed production	1. Develop and disseminate smart technology for production, storage of seeds of different crops (rice, wheat, maize, groundnut, potato, mustard, onion seed, jute, selected vegetable seed (non-hybrid/hybrid)- at least two technologies per crop; and	Technology to be updated	Process start from 2023 and recommended within 2025	300	July 22- June 27	2a	CCI- Agriculture, food security and livelihood	Application of Nano technology in seed packaging adopted -20%	BARI, BARRI, BINA, BSRI, BJRI, BWMRI, seed companies	Modern technology
TA11. Develop market linkage	TA12. Market linkage	01. Construct cool chamber at community level for vegetable and fruit growing hubs (on crop cluster basis) for storing perishable good for few days/ months at reduced fees-64 number at 64 district (crop cluster based) as pilot (along with refrigerated delivery van);	-	Pilot construction start from 2023	400	July 22- June 26	2a	CCI- Agriculture, food security and livelihood	At least one cool chamber and one delivery van per Union	DAE, DAM, LGED, NGOs, local farmers/ business association	Plan and budget

Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA11. Develop market linkage	TA12. Market linkage	02. Promote construction of inter-national quality juice, pulp, jam jelly factories at major fruit growing areas-at least one model factory for each location mentioned (Mango juice factory-Rajshahi, Jashore, Rang- pur,CHT region, pineapple- Modhu- pur, CHT, Guava-Barishal /Rajshahi region, lemon/lime juice- Sylhet,CHT, Tomato-Rajshahi, Banana-Norshindhi and Cobindaganj, elsewhere); and	-	At least one mango and one pineapple and one guava juice factory work started within 2024	1,000	July 22- June 27	9b, 9-5	CCI- Agriculture, food security and livelihood	At least one international standard juice factory per crop	BB, Commercial Bank, MOI, MOA, Businessmen/ industrialist/ FDI	Government attracting policy
		3. Strengthening support services for entrepreneurs for market access, value addition and commercial agri- culture. Development of ICT based user friendly data base of agricultural- al entrepreneurs/innovative farmers (smart card with bar code).	-	Within December 2023 listing of data base will be completed	10	Dec 2022 to Dec 2023	2a	CCI- Agriculture, food security and livelihood	Smart card with bar code of entrepreneurs with 2023	-	DAE, BARI, Hortex Foundation, BADC, DAM, AIS
TA12. Extend credit facilities to farmers	TA13. Soft credit availability	1. Allocation of sufficient amount to disburse loan to all categories of farmers including small, marginal, landless, sharecroppers and lease farmers at 2% service charge through group formation (it will act as collective responsibility) in collaboration with UAO; and	Not available to all categories for collateral and official document	Disbursement at @ 2% started from 2023 at least for high value crops in selected areas	1000	July 22- June 27	1.4, 1.a, 1.b, 10.2	CCI- Agriculture, food security and livelihood	All agricultural loans at 2% service charge	GOB, MOF, BB, Commercial bank, DAE, BRDB, farmers group, NGOs	Strict policy execution at local level
		2. Micro-credit to farmers should be disbursed with single digit service charge. No declining rate to be applied.	Microcredit available mostly with declining rate	Rate finalized within 2023	200	July 22- June 27	2a	CCI- Agriculture, food security and livelihood	Prohibition of declining rate- interest single digit.	BB, PKSF, Grameen Bank, BRAC, BRDB, and NGO micro-credit, DAE	Agreement with NGOs and supervision

Strategic Goal of 8YFP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
T13, Crop management, location specific technologies	T14, Crop diversification/intensification	1. IncreasedUp-scaling and Out-scaling program on diversification of existing cropping systems of high land areas through modern high value crops like fruit gardening, vegetable, maize, oilseed and other crops-one model fruit gardenper upazila; and	Progressed through different projects and private entrepreneurs need thrust	One model fruit/veg garden per upazila started from 2023	2000	July22-June 27	2.1, 2.2, 2-3, 2.4, 2.5	CCI- Agriculture, food security and livelihood Goal-6	One model fruit/ veg. garden per union	DAE, BARI, BWMRI, Commercial farmers, Businessmen	Inbuilt budget allocation/ new project
		2. Enhanced research on sustainable Intensificationof cropping systems of high and medium high land through short duration high value crops through growing 3, 4 crops per year-100 trial per year;	Some research in few areas	Systematics work start from 2023 in pilot locations	100	July 22-June 25	2a	CCI- Agriculture, food security and livelihood Goal-6	100 trial per year	BARI, BARI, BINA BWMRI	Program and budget
		3. Ensuring short duration T.aman - rice cultivation in areas potential for Mustard/oilseed production., Or after Jute/T. aus rice, so that land is released within 15 Oct-15 November for optimum time mustard/oilseed/ wheat/spices/rabi crops sowing;	-	Area and production doubled within 3 years	1000	Oct 22-June 25	2a	CCI- Agriculture, food security and livelihood Goal-6	Area and production increased by 70% within 3 years	BARI, BINA, BARI, BJRI, BWMRI, DAE	Program and budget
		4. Shifting cultivation of Boro rice by - HYV/ hybrid T. Aus and short duration T. Aman rice of high/medium high land for releasing the land to high value different rabi crops including pulses, wheat, maize, oilseed, spices (including onion)	-	Area and production increased by 40% within 3 years	500	Oct 22-June 25	2a	CCI- Agriculture, food security and livelihood Goal-6	Area and production increased by 30% within 3 years	BARI BINA, BARI, BJRI, BWMRI, DAE	Program and budget

Strategic Goal of 8YFP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA14. Research Extension	TA15. Strengthening Research-Extension-Farmers/Entrepreneur linkage	1. Strengthening of official linkage institutes and extension agencies should be mandatory for quick delivery of developed varieties/technology and getting field level feed-back of researchable problems; Along with budget provision NATC (national level), RATC (regional level) and DATC (District level) could be formed/ re-designed to quickly transfer agricultural technologies at field level. For ensuring action program there should have a SOP. Mobile/ internet based ICT tools to be used.	Have ATC but to be strengthened- should be problem solving oriented	Guidance from NTC to strengthen ATC/DTC	1000	July 22- June 32	2-3, 2.4	CCI- Agriculture, food security and livelihood	Strong official linkage established	DAE, BARI, BRRI, BINA, BJRI, BWMIRI, BSRI, SRDI, AIS, DAM, NGOs Lead farmers/ entrepreneur	Multi-stakeholders
TA15. Dissemination of Technologies	TA16. Promotion of location specific technologies	1. Promotion of location specific adaptive research and extension for solving local problem depending on ecosystems and socio-economic conditions with the help of ICT tools (CD, Mobile/ internet based Apps, U-Tube video)	Have some work by different institutes but to be extended	Problems to be identified by 2023 and work started from 2023-24 ahead (continuous process)	500	July 22- June 26	2-3, 2.4	CCI- Agriculture, food security and livelihood Goal-6	5000 trial/ demo per year	BARI, BRRI, BINA, BJRI, BSRI, BWMIRI, DAE, AIS	Plan and budget
		2. For quick delivery of developed varieties/ technologies establishment of Community Farming systems Re-search and Development (FSRD) sites/ Multi- location Testing sites (MLT) targeting hot-spots (as per Delta Plan 2100) and other problematic areas at least-30 FSRD sites;	FSRD site few functional through NATP with some component but not widely across the country	Extended work of FSRD sites started from 2023 at least in 6 hotspots	5000	Oct 22- June 27	2-3, 2.4, 13.2	CCI- Agriculture, food security and livelihood Goal-6	Establishment of 30 FSRD sites within 2023	Plan, budget and coordination	BARC, BARI, BRRI, BINA, BJRI, BSRI, BWMIRI



Strategic Goal of 8YFP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA15. Dissemination of Technologies	TA16. Promotion of location specific technologies	3. Increase number of SAAOs (now one SAAO for 1162 families) and Extension Officers(AEO) for extensive delivery of modern agricultural technologies (SAAO number to be doubled); relevant number crop Scientists to be increased for facing modern challenges; and	One SAAO per 1162 families	Start the process of recruitment by 2023	500	Oct 22- June 25	2a	CCI- Agriculture, food security and livelihood Goal-6	Finish recruitment of SAAO, AEO and Scientist within 2027	GOB, MOA, DAE, NARS	Post creation and budget
		4. Linkage with farmers to be enhanced through hands-on training on modern technology, adaptive trial and demonstration setting at farmers field, field visit, fielddays, mobile workshop, village level workshop, research farm visit, farmers fieldschool-10,000 events per year, including promotion of e-agriculture (production technology video, problem solving tips etc.). Mobile /internet based ICT tools to based including U-Tube video (picture/action based video)	Mainly through projects only	Panned work start from 2023	300	Oct 22- June 27	2-4, 4-7	CCI- Agriculture, food security and livelihood.	At least 10,000 events per year by all Res. and Extn. NGOs, lead farmer entrepreneurs	Plan, Budget allocation	DAE, BARI, BRR, BINA, BWMRI, BJRI, BSRI, AIS, NATA, NGOs, lead farmer entrepreneurs
TA16. Ensure supply of agricultural inputs	TA17. Input availability and mechanization	1. Infrastructure of research farms, DAE manpower, and equipment to be improved/increased for supply of quality breeder seed/fruit saplings to BADC and private seed company/nursery;	Need new infrastructures and renovation, equipment, to supply more quality breeder seed	Infrastructure construction started from 2023 by phase	1000	July 22- June 27	2-3, 2-4, 2-5, 2a, 9:a	CCI- Agriculture, food security and livelihood	Can ensure supply of 50% quality seed/ seedlings/ sapling by 2027	BARI, BRR, BINA, BJRI, BSRI, BWMRI, DAE, Agricultural Universities, seed companies	Plan approval and allocation

Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA16. Ensure supply of agricultural inputs	TA17. Input availability and mechanization	2. Capacity of SCA/ BADC, DAE to be improved (with infrastructure, manpower and equipment) for supply of major crops foundation seed/ certified seed; plus private seed companies;	Related to supply more quality seed (presently around 40% rice seed, other seed small amount)	Infrastructure construction, equipment procuring and training started from 2023 by phase	1000	Oct 22- June 25	2-3, 24, 2-5	CCI- Agriculture, food security and livelihood	Upgraded SCA/BADC, DAE by 2025	SCA-DAE, BADC	Plan approval and allocation
		3. Supply and distribution of quality chemical fertilizers and organic manure/ pesticide/fungicide to be ensured by BADC, BCIC, DAE, SRDI, Private agencies along with monitoring; and	Quality not always ensured for TSP, MoP and other micronutrients, pesticides, fungicides	Regular store and market monitoring begins from 2023	2000	Oct 22- June 25	2-3, 2-4	CCI- Agriculture, food security and livelihood	Become routine work to enforce quality of input procured/ marketed by importer/ dealers	BADC, BCIC, entitled private importer, DAE, SRDI	Supply and Quality monitoring
		4. Rapid farm mechanization for tillage, rice planting, harvesting, drying, conservation agriculture, processing, value- addition through local research and development and import along with follow-up services by model workshop and service providers- at least one model workshop cum training center per upazila.	For tillage and irrigation in 99% cause machine is used, but for other operation in small area machine is used	Increased quality service provision for planting/ harvesting/ processing along with hands-on training	5000	July 22- June 25	2-3, 2-4, 4-4	CCI- Agriculture, food security and livelihood	30 % rice planting and harvesting by machine	MOA, MOC, DAE, BARI, BRR1, BWMRI, BAU, Private agriculture engineering manufacturing farms, importers	Tax withdrawal for local manufacturing, continuation government subsidy

Strategic Goal of 8FYP 4-3-3	Thematic Category/ Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA17. Capacity building on modern technologies	TA18. Education and training of R&D staff	1. Need robust capacity building of Scientist/ Extension Officers in the field of Agronomy, breeding, molecular breeding, Farming systems, horticulture, Postharvest management, climate change adaptation and mitigation, soil fertility, precision agriculture, conservation agriculture, Nano technology, ICM, IPM, mechanization, technology transfer, Safe food and nutrition security and ICT in agriculture in-country and foreign country; and	Capacity building exists mostly project based but all are not appropriate for current situation and modern technology	Process of capacity building/ higher education start from 2023 by phase	1000	July22- June 30	2-3, 2-4, 2a, 9-5	CCI- Agriculture, food security and livelihood	Professional training-2000, MS-500, PhD 100, Post-Doc-20 Will make the staff more capable to handle current problem and opportunities	BARI, BRRRI, BINA, BWMIRI, BJRI, BSRI, BARC, SRDI, DAE, BADC, BMDA DAM	Plan approval and budget allocation for long term
		02. Professional training and capacity building of seed producers and SAO-1000 events on PHL reduction, IPM, balanced fertilizer/manure management and climate change adaptation.	Do	Process of capacity building start from 2023 by phase	200	Oct 22- June 26	2-3, 2-4	CCI- Agriculture, food security and livelihood	1000 person got training per year	DAE, BADC, SCA, NATA, Seed company technical officers	Plan approval and budget allocation
TA18. Capacity building training	TA19. Training and awareness of farmers on modern technologies	1. Strengthening lead farmers training including women farmers on location specific technology, home/roof gardening, crop diversification, PHL, seed production and preservation, value addition, safe food production, value addition, yield-gap reduction, IPM, marketing-10,000 farmers per year.	Only meager number-project basis	Process of capacity building start from 2023 by phase	200	July22- June 27	2-3, 2-4	CCI- Agriculture, food security and livelihood	10,000 farmers training per year	DAE, BARI, BRRRI, BINA, BWMIRI, BJRI, BSRI	Plan approval and budget allocation
		2. Re-visit the curriculum of agricultural universities (except BAU-it has already done) for agriculture graduate program for catering the need of present days problems like climate change, yield gap minimization, yield level increase, safe and nutritious food production, IPM, GAP etc. including provision of internship for graduates. Farmers oriented/ need based practically applicable teaching is important	Only meager number-project basis	Process of capacity building start from 2023 by phase	200	July22- June 27	2-3, 2-4	CCI- Agriculture, food security and livelihood	10,000 farmers training per year	DAE, BARI, BRRRI, BINA, BWMIRI, BJRI, BSRI	Plan approval and budget allocation

Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA18. Capacity building training	TA19. Training and awareness of farmers on modern technologies	3. Redesigning the curriculum of ATI, emphasizing farm mechanization and climate change adaptation and modern agricultural technology dissemination	Not updated syllabus for mechanization and climate change	Curriculum updating start in 2023 by a group of experts	5	Oct 22- June 24	2-3, 2-4, 4-4	CCI- Agriculture, food security and livelihood	Updated curriculum of ATI by 2023 and implementation by 2024	DAE, BTEB, MOA	NTEB and DAE initiative
TA19. Efficient utilization of natural resources	TA20. Land management	1. Framing provisions/enact law for discouraging the use of three/ two cropped land (High/medium high land) other than cropping/ agriculture	-	Framing provisions within one year	10	July 22- June 23	1-5, 2-3, 2-4, 2-5	Goal-6	Provision within 2023	MOA, BARC DAE	Timely committee formation
TA20. Location specific crops/technologies	TA21. Location specific crops/technologies	1. Crop zoning using modern techniques (GIS, remote sensing etc.) and traditional survey within one year and its implementation at field level for major crops: Boro rice, T. Aman, T. Aus, jute, maize, wheat, potato, pulses, oilseeds, onion, other spices, Sugarcane and Fruit garden, water bodies (activities going on in 495 upazila-lead by BARC)	-	Completion of land zoning with location map per upazila by 2022	-	Completed within December 2022	1-5, 2-3, 2-4, 2-5, 6-4, 6-5	Goal-6	Land zoning completed and circulated within June 2023	BARC, SRDI	GIS based robust recent data
		2. Reclamation of problem soils, acid soils, char land, saline soils, pit soils, hilly soil (eroded soil)	-	3 years	100	July 22- June 25	2-4, 13-2, 15.	Goal-6	20% problem soils reclaimed	SRDI, BARI, DAE, BRRI BINA	-
		3. Current fallow land /char or other permanent fallow land to be brought under cultivation including land of Expatriate citizens with the help of local agriculture office/ Upazila administration/LGED. Upazila-wise survey to be done to find out cultivable fallow/char land	-	Survey complete within June 2023. Fallow land under cultivation within June 2024	20	Oct 22- June 25	Goal-6	Fallow/char land under cultivation within June 2024	DAE, Upazila Parishad, LGED	Manual survey	

Strategic Goal of 8FYP 4-3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA20. Location specific crops/ technologies	TA21. Location specific crops/ technologies	4. Discouraging cultivation of tobacco in main fertile land (such as, Kushtia, Meherpur, Jhenidah, Chuadanga, Lalmonirhat, Rangpur, Nilphamari, Mianikganj, Bandarban, Khagrachari) through growing awareness of farmers/smokers about detrimental effect of tobacco on human health, soil fertility and environments. Allocation of monetary incentives for alternative high value rabi crops cultivation	-	Reducing tobacco area by 50% from main land (20 thousand hectare)	100	2023-2025	1.5, 2-3, 2.4, 2.5, 3.1	Goal-6	Tobacco land to be released for food crop production. Human health and environment to be saved	DAE, upazila parishad, CHTDB, Health department, Environment department	NTEB and DAE initiative
TA21. Good Agricultural Practice	TA22. GAP implementation	1. Draft protocol finalization and Implementation of Good Agricultural Practices(GAP) for safe food production catching of export market (mainly vegetable, fruit, potato, spices). Development of skilled manpower for protocol drafting and certification. Provision of GAP certification to selected growers may be provided by proper authority after due inspection of crops/products. Accredited laboratories to be developed/ modification of existing labs for testing of products for export - at least three lab as pilot basis	Drafting at initial stage	Gap finalized for different crops by 2023	60	July23- June 25	2.1 2.4 12.4	CCI- Agriculture, food security and livelihood	GAP finalized and implemented for exporting major veg/ fruit	MOA/BARC (protocol development) BARI, BADG, DAE, Hortex Foundation and selected commercial farmer will pilot GAP	Multi-stakeholders
TA22. Inputs and cash resource availability to farmers	TA23. Crop insurance and Government subsidy	1. Review the protocol of Index based insurance of Green-Delta Insurance and Oxfam/Syngenta, IWMI, IFC and start insuring farmers of major natural calamity affected areas like Kurigram, Sirajgonj, Sunamganj, Borguna, Patuakhali, Pirojpur, Bagerhat, Khulina, Satkhira, Coxes bazar etc. - within 1st year rules drafted and passed; and	No government agency involved and only tiny number farmers covered privately as project basis	Draft rule completed within 2023-24	800	July23- June 28	1.5, 1.b, 10.4	CCI- Agriculture, food security and livelihood	Insurance policy by Gov. within 2023 and implemented as pilot in 64 blocks of 64 districts	BB, Sadharan Bima Company, Green Delta Insurance, BMD, WDB, DAE	Government policy and allocation

Strategic Goal of 8YFP 4.3-3	Thematic Category/Thematic Area	Action	Base line	Target	Indicative budget (Million BDT)	Implementation period	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA22. Inputs and cash resource availability to farmers	TA23. Crop insurance and government subsidy	2. Creation of ICT based special NID for real farmers to deliver government subsidy, compensation and soft loans among the farmers/commercial farms	-	Process begins from 2023-25	100	2023-2025	1.5, 1.b, 10.4	CCI- Agriculture, food security and livelihood	Finalized by 2 years	DAE, ICT ministry, BB	Plan approval and allocation
TA23. Food based nutrition, increase awareness and improve health reducing malnutrition problem	TA24. Urban/rural areas food production targeting poor community/women	1. Research and promotion of urban/rural food production, vertical agriculture, roof gardening, home gardening, mushroom culture, hydroponics, vertical farming, hydroponics, aquaponics, safe and nutritious food processing and intake-10,000 farmers training per year	Some sporadic activities going on project basis	On-going work will be strengthened with proper training manual and training and piloting from 2023	900	July23- June 27	1.4, 1.5, 1.b, 2.2, 2.4	CCI- Agriculture, food security and livelihood	5000 farmers training and pilot demo. in each upazila	BARI, DAE, NGOs, Agricultural Universities, City Corporation, Town Federation, Farmers group	Multi-stakeholders and allocation

**Note:**

CCI - Cross-Cutting Issues of BDP2100

PHL - Post-harvest Loss

NARES - National Agricultural Research Extension System (i.e. all research institutes/council) In-built program - Similar project is in ADP of 2021-22 and some in-built program of Agricultural Research Institutes.

4.3.3 - Strategies for Agriculture and Water Resources Management. Chapter 4.8<sup>th</sup> Five Year Plan

**Table 7: Monitoring & Evaluation Framework**

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA1. Enhanced food production by applying modern tools	Strengthening conventional breeding and application of speed breeding technique/ other techniques (such as, introduction, radiation, AI). Undertaking of frontier research for genotype development by applying CRISPR/cas9 technology, biotechnology/ tissue culture and other means (such as; increasing photosynthetic efficiency, nutrient efficient, photo insensitive year round genotype, export quality variety, stress tolerance (salinity, drought, water logging), pest- disease tolerant, identify selection tools etc.) for multiple crops for different AEZ and its management technology in collaboration with relevant national and international universities, CGIAR institutions and advanced countries. Initially starting with few crops in one lead institution in a coordinated program with multi-institutions. Depending on success expand crops and institutions.	Work started, variety developed	2023-25	-	Develop at least three varieties by conventional breeding/ speed breeding/ adaptation for each crops (Boro, T.Aus, T. Aman, jute, wheat, maize, mungbean, mustard, lentil, chickpea, onion, vegetables and fruit) etc. At least one variety of each crop developed by applying CRISPR technology.	Seven climate smart and high yielding varieties of each crop developed by conventional breeding/ speed breeding/ radiation/ adaptation as well as adoption by farmers	Variety scaled-up across the country	BARI BIRRI BINA BWMRI BSRI BJRI	Manpower development, lab facility and equipment and chemicals- long time continuous plan
TA2. Conservation agriculture (CA)	1. Promotion of conservation agriculture (zero/minimum tillage, bed planting, straw retention, crop rotation, AWD, smart and precision agriculture, laser leveling, nanotechnology, mulching), for different crops (dry land Aus rice, maize, wheat, pulses, soybean-500 on farm trial and demo for each year; advanced international universities, CGIAR institutions and advanced countries.	10% area adopted CA technologies	2023 - 2024	May be at 1% land under CA	5% area adopted CA	9% area adopted CA	20% area adopted CA	BARI BIRRI BINA BWMRI BSRI	Traditional thinking of tillage and crop husbandry

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions	
			Year	Status	2025	2030	2035			
TA2. Conservation (A)	2. Development and fabrication of suitable conservation agriculture (CA) machinery (PTOS/tractor based attachment, others) for tillage/ seeding- at least three prototypes in first year in collaboration with private companies/ machine developers	CA machinery manufactured in Bangladesh and adopted	2023 - 2024	Nil (all imported) except bed planter	Bangladesh made CA machines developed and adopted by LSP/farmers along with imported one	Bangladesh made CA machines largely adopted by LSP/Farmers	Meeting country demand also exported	BARI BIRRI BWMRI	Quality iron/ materials	
					AFP developed and commercialized	AFP scaled up for surface water irrigation	AFP is accepted by 50% farmers	BARI BIRRI BWMRI	Quality iron/ materials	
					AFP developed and commercialized	AFP scaled up for surface water irrigation	AFP is accepted by 50% farmers	BARI BIRRI BWMRI	Quality iron/ materials	
TA3. Watermanagement	1. Development/ fabrication/import of Axial Flow Pump (AFP) for surface water irrigation for Boro rice and other dry land crops - 2  2. Rainwater harvesting through re-excavation of canal, khari, hilly chara, pond, dighi, constructing cross-dam, rubber dam, in suitable location, small river etc. and digging of dug well-300 items; and	Homemade AFP developed and adopted  More than 26.91 % area of irrigated area	2023-24	1 AFP prototype by BARI	Major work at Barind region by BMDA but still lot of scope. In other areas very small initiative. Presently 26.91 % of irrigated area is from surface water	32 % area of irrigated area	37 % area of irrigated area	45 % area of irrigated area	BADC BMDA BWDB LGED RDA DAE CHTB	Local involvement
				AFP developed and commercialized	AFP scaled up for surface water irrigation	AFP is accepted by 50% farmers	BARI BIRRI BWMRI	Quality iron/ materials		
				AFP developed and commercialized	AFP scaled up for surface water irrigation	AFP is accepted by 50% farmers	BARI BIRRI BWMRI	Quality iron/ materials		
TA3. Watermanagement	3. R&D on farm water use efficiency through introduction of sprinkler, drip irrigation system, buried pipe for fruit garden, vegetable and other crops	Sprinkler and drip irrigation (smart irrigation) applied in 20 % of vegetable/fruit farm	2023 - 2024	Buried pipe only in Barind area and few other areas	Buried pipe only in Barind area and few other areas	10 % vegetable/ fruit farm under smart irrigation system	20 % vegetable/ fruit farm under smart irrigation system	30 % vegetable/ fruit farm under smart irrigation system	BARI DAE BADC BMDA BWDB LGED RDA	Traditional thinking of irrigation, electricity charge policy
				Buried pipe only in Barind area and few other areas	Buried pipe only in Barind area and few other areas	10 % vegetable/ fruit farm under smart irrigation system	20 % vegetable/ fruit farm under smart irrigation system	30 % vegetable/ fruit farm under smart irrigation system	BARI DAE BADC BMDA BWDB LGED RDA	Traditional thinking of irrigation, electricity charge policy
				Buried pipe only in Barind area and few other areas	Buried pipe only in Barind area and few other areas	10 % vegetable/ fruit farm under smart irrigation system	20 % vegetable/ fruit farm under smart irrigation system	30 % vegetable/ fruit farm under smart irrigation system	BARI DAE BADC BMDA BWDB LGED RDA	Traditional thinking of irrigation, electricity charge policy



Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA3. Watermanagement	4. Arrangement of wide spread Supplementary irrigation facility for Haor rice crop in Boro season through deployment of SWT, LLP and other means. As it suffers at late crop growth stages due to shortage of surface water/soil moisture	At least in 30 % area of haor supplementary irrigation facility developed and used	2023 - 2024	Nil (all imported) except bed planter	20 % area have the facility of supplementary irrigation	30 % area have the facility of supplementary irrigation	40 % area have the facility of supplementary irrigation	BADC DAE RDA	Drought and water stress at later stage of crop
	5. Polder and sluice gate management in coastal areas must be safe and functional so that year round suitable crops could be grown	At least 30 % sluice gate and polders are well managed	2023 - 2025	Some are functional but all old polders are un-protected	30% polder have good management of sluice gate and safe	60% polder have good management of sluice gate and safe	70% polder have good management of sluice gate and safe	BWDB LGED DAE	Proper budget allocation and good local involvement
TA4. Soil fertility management	1. Promotion of quality compost/ biogas residue/ vermi-compost/ green manure/bio-fertilizer production and application in soil for improving soil fertility along with other synthetic nutrients and comparative testing in vegetable, fruit and other crops-at least one ideal village for each union. Ensure crop growth stage-wise (need based) fertilizer application at field level. To be done in areas where organic material is available and scope of application (such as high value fruit /vegetable garden). Commercial production of compost to be initiated for sustaining soil fertility initially at pilot basis- 8 number for eight division	Soil organic matter of high and medium high land improved by at least 0.2 % and / or applied in 20 % of land	2023 - 24	Assumed used in 10% land	Quality compost applied in at least 15% land	Quality compost applied at least in 20% land	Quality compost applied at least 30 % land	DAE BARI BRRI BINA BWMRI BSRI BJRI SRDI NGOs Private companies	Scarcity of quality organic matter/ compost
	2. Promotion of IPNS (integrated plant nutrient system) for major cropping systems of the country for ensuring soil fertility as well higher production-500 on- farm trials;	AEZ based Mapping of major cropping systems and conduct research to develop IPNS at least for 30 % cropping system	2023 - 24	Assumed 20 % cropping systems have IPNS package	At least 30 % major cropping systems have IPNS package	At least 30 % major cropping systems have IPNS package	At least 70 % major cropping systems have IPNS package	DAE BARI BRRI BINA BWMRI, BSRI BJRI, SRDI. NGOs Private companies	Coordinated plan to implement by all concerned organization

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
T45. Pbiological Pest/ weed management	1. Intensive R&D activities on biological pest/ weed management (IPM/IDM/ ICM) for major crops including vegetable and fruits; and	Adoption of IPM/IDM/ICM by at least 15% farmers	2023 - 24	Assumed about 10% veg and fruit production are adopting IPM	Adoption of IPM/IDM/ICM by at least 20% farmers	Adoption of IPM/IDM/ ICM by at least 30% farmers	Adoption of IPM/IDM/ ICM by at least 45% farmers	BARI, BRRI, DAE, BINA, BWMRI, BSRI, BJRI, NGOs	Manpower shortage
	2. Strengthening proper quarantine measure to prevent invasive pest/disease/ weed through food /plant import through air/sea/ land ports including modern equipment and training to Quarantine officers and formation of Quarantine Authority	Trained manpower, equipment and quarantine authority formation	2023 - 24	Primary equipment is available at station but trained manpower crisis. No quarantine authority	Manpower trained having proper equipment in all major ports. Quarantine authority formation completed	Full capability to perform quarantine like all imported goods/ plant/ seed and applied	Capability of quarantine like modern countries	DAE	Manpower training and authority development
T46. Pollution management	1. Existing law/provision should be strengthened against soil, water, air, environment pollution and existing law should strictly be applied (land owner would get sufficient compensation if his land is polluted by anybody/factory effluent) within year.	Pollution free water bodies, soil and air	2023 - 24	Some environmental law remains need to link with Agriculture	At least 50% city and factory adjoining area become pollution free	75% area become pollution free	98% area become pollution free	MOEFCC MOA MOL WDB BADC, BRTA,,MIWT, DAE, DOE	Law enforcement and local pressure from industrialists
T47. Climate Smart Agriculture (CSA)	1. Profiling existing climate- smart agriculture (CSA) (researchers developed and innovative farmers practice, such as floating agriculture, sorjon method) agriculture practices for specific locations and it's up- scaling/out-scaling in appropriate locations particularly in coastal and drought prone areas	Profiling completed and location specific CSA scaled out	2023 - 24	Separately documented by different authors need compiling	Location specific CSA selected and adopted by at least 40% farmers	CSA practiced by 70% farmers	CSA practiced by 95% farmers	BARI, BRRI, BINA, BJRI, BWMRI, BSRI, DAE, NGOs	Abnormal high rainfall/ cyclone
	2. HYBoro rice variety developed for higher(8-12dS/m) soil and water salinity conditions (05 number);	Boro rice variety can endure > 8 dS/m soil salinity at reproductive stage having good yield	Most developed variety can endure 6-8 dS/m at reproductive stage	Higher Saline tolerant 2-3 varieties developed and adopted	Higher saline tolerant 4-5 varieties scaled out	80% of high salinity area is covered by saline tolerant varieties	BRRI, BINA, Seed companies	BRRI, BINA, Seed companies	Yield and quality of rice

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TAY. Climate Smart Agriculture (CSA)	3. Saline tolerant variety and its management options development for maize, wheat, vegetables, sesame, mustard, potato, water melon (at least 02 varieties for each crop);	Variety of each crop developed which can endure at least 8 dS/m soil salinity higher good yield and quality	2023 - 24	Few cultivars of above crops are saline tolerant	Variety largely scaled out in coastal area	In 80% area improved variety adopted	BARI, BINA, BWMRI, SRDI	Yield and quality of crops	
	4. Drought tolerant short duration T.aman rice ,variety development for HB Tand similar areas (at least 3 varieties) with management technology;	At least three short duration and drought tolerant good yielding variety developed	2023 - 24	Few cultivars of T.aman are drought tolerant up to 3-4 week	Few potential variety developed and demonstrated	Potential variety adopted and scaled out	At least 20 % T.aman farmers adopted those varieties	BRRI, BINA, Seed companies	Yield and quality of rice
	5. Agro-forestrysystem (fruit/ forest-crops) development for CHT, Barind, Madhupur tract, other hilly and similar region(2-3 models) andscaling- up existing technologies replacing / modifying existing Jhum cultivation at CHT hill to minimize soil erosion;	Jhum cultivation virtually stopped and farmers involve in environment friendly agro-forestry systems	2023 - 24	One MATH model of BARI	Adoption of modern agro-forestry system at least in 25% hill	Adoption of modern agro-forestry system at least in 40% hill	Adoption of modern agro-forestry system at least in 80% hill	BARI, BFRI, BSMRAU, BAU, DAE, SRDI, CHTB, NGOs	Traditional Jhum cultivation at CHT
	6. Yield and profit maximization for gher system (fish- rice-vegetable) of greater Khulna, Barisal, Gopalganj, Narail and similar areas. Studygher system environmental and social aspects;	Scientific study completed and recommendation is given	2023 - 24	No whole system research approach	Improved gher systems adopted	Improved gher system scale out	Improved gher system largely adopted	BARI, BRRI, DAE, DOF, NGOs	Multi-discipline
	7. Development of deep root systems, low water requiring , heat tolerant, short duration high value crops like pulses (lentil, chickpea), mustard, linseed, wheat, potato, sugarcane, millets, mango, citrus, jujube(ber), sorghum, maize, peanut, black cumin and hull less barley varieties and its management technology(at least 2 varieties for each crop) for drought prone –High Barind Tract , other areas and chars;	At least one potential variety of desired traits is developed	2023 - 24	Few cultivars developed	Scaling up of drought tolerant variety of each crop- adopted by 30% farmers	Scaling up of drought tolerant variety of each crop- adopted by 30% farmers	Scaling up of drought tolerant variety of each crop- adopted by 70% farmers	BARI, BINA, BWMRI, seed companies	Yield of crops

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA7. Climate Smart Agriculture (CSA)	8. Developing models for ecosystems based haor agricultural farming consisting of short duration Boro rice-fish/duck and adapted tree planting at border (Hijol, Koros etc.). Develop 120-130 day short duration boro rice. Finding other short duration crops option (such as mustard, leafy vegetables) before Boro rice planting at upper catena of Haor; and	2-3 models developed and recommended	2023 - 24	Some BAU/BARRI study but not holistic	Developed model demonstrated and adopted by 20% farmers	Developed model scaled up and adopted by 40% farmers	Developed model scaled out and adopted by 70% farmers	BARRI, BARI, BAU, some NGOs such as CNRS	Multi-discipline
	9. Finalize and commercialize sea weed cultivation technology at coastal regions as part of blue economy in the context of sea level rise along with other options (community based up-scaling)	3-4 variety selected and recommended for cultivation	2023 - 24	Primary work by BARI/NATP, CVU/ECO-Fish project and some commercial farms	Selected variety demonstrated and adopted by 20% farmers	Scaled up and adopted by 40% farmers	Scaled out and adopted by 70% / or new variety developed	BARI, CVU, DOF, NGOs, Commercial farms	Adoption and marketing
TA8. Yield gap reduction and production/profit maximization	1. Updated on- farm research on major cropping pattern based balanced fertilizer recommendation and management- select three cropping pattern for each AEZ and conduct research. Application of nanotechnology in fertilizer management;	Updated fertilizer recommendation along with application of Nano technology	2023 - 24	Nanotechnology still to be used	Trial begins for major cropping pattern including application of Nano technology	20% farmers follow recommended fertilizer dose along with Nano tech	50% farmers follow recommended fertilizer dose along with Nano tech	BARI, BARRI, BWMRI, BINA, BJRI, BSRI	Nano technology expertise
	2. Promotion of IPNS (integrated plant nutrient system) for major cropping systems of the country-500 on- farm trials;	Updated IPNS for major crops/cropping pattern	2023-24	Some studies by different Res. Institute need updated study. need base study	At least 20% farmer follow full recommendation	At least 40% farmer follow full recommendation	At least 70% farmer follow full recommendation and updating of IPNS	BARI, BARRI, BINA, BJRI, BSRI, BWMRI, SRDI	Yield and quality of rice
	3. Large scale adaptive trial and demonstration for reducing yield gap at farmers field through applying whole packages of recommended technology in major crops (Boro, T. aman, T. aus rice, maize, wheat, oilseeds, lentil, potato, selected vegetables, jute, cotton, onion, garlic, sugarcane, tomato, banana- should cover all upazilas for major crop(s); and	Average yield gap reduced at least by 20%	2023 - 24	Some studies in different crops, need widespread trial /demo.	Average yield gap reduced at least by 20%	Average yield gap reduced at least by 30%	Average yield gap reduced at least by 40%	DAE, BARRI, BARI, BINA, BJRI, BSRI, BWMRI, NGOs	Full package of technology

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TAg. Yield gap reduction and production/profit maximization	4. Yield and profit maximization trial for high yielding crops under resource non-limiting conditions (Boro rice, maize, sugarcane, tomato, banana, potato, onion, mustard, cassava) targeting at least 20% yield increase)-100 trials for each crop per year	At least 20% yield increase of major high yielding crops in selected area	2023 - 24	Few study for some crops need marked increase	At least 25% yield increase of major high yielding crops in selected area	At least 20% yield increase of major high yielding crops in selected area	At least 40% yield increase of major high yielding crops in selected area	BRRI, BARI, BSRI, BWMRI, BADC, Seed companies	Timely fund and seed/technology availability
	1. GOB would purchase 25% of Boro, T. Aman rice and wheat at harvest time directly from farmers with a remunerative price to create market demand;	Farmers income at least 30% over production cost at harvest time	2023 - 24	Govt. purchase about 10% through dealers	20% products purchased by government agencies	25% products purchased by government agencies	Review of farmers return and decision on government purchase	MOF DAE DAM	Government policy
	2. Develop/improve infrastructure of model market having farmers product marketing facility, preservation facility, cooling van, toll fair transport cost and minimal toll (including prohibition of unofficial toll by miscreant)- at least one big market per upazila. CCMC market model of NATO-2 DAE may be examined and. Effectiveness of DAM constructed 16 wholesale market activities may be observed	Market with modern facilities developed per upzila	2023-24	Almost nil	At least construction modern market at 30% upazila	At least construction modern market at 70% upazila	Construction modern market at 100% upazila and in other big market	DAM, DAE, BADC, LGED, selected farmers group, market committee, NGOs	Undertake project
	3. Creation of farmer's production group for major products particularly for marketing of perishable goods such as vegetables/ fruits including finding better market across the country- each union basis. Farmers hub model of Syngenta foundation be examined. DAM sponsored 500 farmers marketing groups effectiveness may be examined; and	Viable farmers group with govt./NGO backing	2023 - 24	Some formed through project but few viable	Running farmers group at least in 20% Upazila	Running farmers group at least in 40% upazila	Running farmers group at least in 80% upazila	DAE, DAM, BADC, Selected NGOs, Farmers group	Local politics
4. Regular price determination of major agricultural products of farmers and market price information using ICT tools (mobile/internet based) for farmers/traders. Creation of awareness among farmers on pricing of their products-including information on minimum selling price	Mobile/internet used by lead farmers/businessmen to know present sell price of agricultural commodity	2023 - 24	20% businessmen/lead farmer uses mobile phone to know sell price	30% businessmen uses mobile phone to know sell price	60% businessmen/lead farmer uses mobile phone to know sell price	90% businessmen/lead farmer uses mobile phone to know sell price	DAM, DAE, NGOs, Business society	Mobile network and internet will be cheaper and available across the country	

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA10. PHL reduction, value addition/ processing	1. Conduct hands-on training on fruit, vegetable proper harvesting time and methods, cleaning, grading, packaging, storing including application of nanotechnology, transport and marketing based on developed technology- 1000 training per year-30 participants per training;	PHL of fruits and vegetables reduced to 20% form present 30%	2023 - 24	Almost absent, only few project based	PHL of fruits and vegetables reduced by 10%	PHL of fruits and veg- etables reduced by 15%	PHL of fruits and vegetables reduced by 20%	BARI, DAE, HORTEX Foundation, BADC, selected NGOs, Local business association	Quality trainers
	2. Conduct research on developing technology on safe and cost-effective methods for reducing PHL of perishable crops (vegetables, fruits-mango, jackfruit, pineapple, banana, malta (Citrus), sapota, guava, litchi)-at least onetechonlogy per crop; and its up-scaling	At least one effective technology developed for reducing PHL for each crop	2023-24	For some fruit products at experimental stage and some recommended	At least one effective technology developed for reducing PHL for one/ two crop(s)	At least one effective technology developed for reducing PHL for each crop	At least two effective technology developed for reducing PHL for each crop	BARI, DAE, Hortex Foundation, BADC, business group, NGOs	Multi-stakeholders
TA11. Seed production	1. Develop and disseminate smart technology for production, storage of seeds of different crops (Rice, wheat, maize, groundnut, potato, mustard, onion seed, jute, selected vegetable seed(non-hybrid/hybrid)-at least two technologies per crop;	Modern Seed production and storage at least by 50 % of demand	2023 - 24	Technology to be updated	Modern Seed production and storage at least by 30 % of demand	Modern Seed production and storage at least by 50 % of demand	Modern Seed production and storage at least by 70 % of demand	BARI, BRRI, BINA, BSRI, BJRI, BWMRI, seed companies	Modern technology
TA12. Market infrastructure development	1. Construct cool chamber at community level for vegetable and fruit growing hubs for storing perishable good for few days/ months at reduced fees-64 numberat 64 district as pilot (along with refrigerated delivery van);	At least one modern storage per district for perishable vegetable/fruit	2023 - 24	Still Nil	At least one modern storage for 20% Upazila for perishable vegetable/ fruit	At least one modern storage for 40% upazila for perishable vegetable/ fruit	At least one modern storage for 85% Upazila for perishable vegetable/ fruit	DAE, DAM, LGED, NGOs, local farmers/ business association	Plan and budget
	2. Strengthening support services for entrepreneurs for market access, value addition and commercial agriculture. Development of ICT based user friendly data base of agricultural entrepreneurs/innovative farmers (smart card with bar code)	At least 30% entrepreneurs brought under ICT data base	2023 - 24	Still nominal	At least 40% entrepreneurs brought under ICT data base	At least 70 % entrepreneurs brought under ICT data base	At least 80% entrepreneurs brought under ICT data base	DAE, DAM, BARI, BARI, BINA, BJRI, BWMRI, BSRI	ICT data based project is initiated and implemented

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA13, Soft credit availability	1. Allocation of sufficient amount to disburse loan to all categories of farmers including marginal, landless share croppers and lease farmers at 2 %service charge; and	Farmers get loan without collateral	2023 - 24	Not available to all farmers for collateral	PHL of fruits and vegetables reduced by 10%	PHL of fruits and vegetables reduced by 15%	PHL of fruits and vegetables reduced by 20%	BARI, DAE, HORTEX Foundation, BADC, selected NGOs, Local business association	Quality trainers
	2. Micro-credit to farmers should be disbursed with single digit service charge. No declining rate to be applied.	Micro-Credit for one year with single digit interest	2023-24	Micro credit available mostly with declining rate	Microcredit for one year with single digit interest	Micro-Credit for one year with single digit interest	Microcredit for one year with single digit interest	BB, PKSF, Grameen Bank, BRAC, BRDB, and NGO micro-credit, DAE	Agreement with NGOs and supervisor
TA14, Crop Diversification/ intensification	1. Increased Up-scaling and Out-scaling program on diversification of existing cropping systems of high land areas through modern high value crops like fruit gardening, vegetable, maize and other crops- one model fruit garden per Upazila in 8 years;	Development of model fruit garden following GAP	2023 - 24	Progressed through different projects and private entrepreneurs need thrust	Development of model fruit garden in 100 Upazila following GAP	Development of model fruit garden in 400 Upazila following GAP	Development of at least model fruit garden in all Unions following GAP	DAE, BARI, BWMRI, Commercial farmers, Businessmen	Inbuilt budget allocation/ new project
	2. Enhanced research on sustainable Intensification of cropping systems of high and medium high land through short duration high value crops through growing 3, 4 crops per year-100 trial per year;	Sustainable intensification of high and medium high land having higher productivity	2023 - 24	Some research in few areas	Sustainable intensification for higher productivity-100 trials/year	Sustainable intensification for higher productivity -500 trials/year	More than 50 % Farmers largely adopted 3-4 crops pattern	BARI, BRRI, BINA BWMRI	Program and budget
	3. Ensuring short duration T.aman rice cultivation in areas potential for Mustard/oilseed production., Or after Jute/T.Aus rice, so that land is released within 15 Oct-15 November for optimum time mustard/oilseed/ wheat/spices/rabi crops sowing	At least 30 % high and medium high land is released timely for oilseed/pulse / wheat/spice cultivation	2023 - 24	20% high land released within November for oilseed/pulse/ wheat/spice cultivation	30% high land released within November for oilseed/ pulse/ wheat/spice cultivation	60 % high land released within November for oilseed/ pulse/ wheat/ spice cultivation	80% high land released within November for oilseed/ pulse/ wheat/ spice cultivation	BARI, BRRI, DAE, BWMRI, BINA, BSRI, NGOs	Production of pulse, oilseed, spice and wheat will be more remunerative than long duration T. Aman rice

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA14. Crop Diversification/ Intensification	4. Shifting cultivation of Boro rice by HYV/ hybrid T-Aus and short duration T-Aman rice of high/medium high land for releasing the land to high value different rabi crops including pulses; wheat, maize, oilseed, spices (including onion)	At least 20 % rice area covered by hybrid rice varieties	2023 - 24	10-15 % rice area covered by hybrid rice varieties	At least 30 % rice area covered by hybrid rice varieties	At least 40 % rice area covered by hybrid rice varieties	80% high land within November for oilseed/ pulse/ wheat/ spice cultivation	BARI, BINA, DAE, NGOs	Yield of hybrid rice varieties will be 30 % more than inbred varieties
TA15. Strengthening Farmers'/Entrepreneur Research-Extension-Linkage	1. Strengthening of official linkage between agricultural research institutes and extension agencies should be mandatory for quick delivery of developed varieties/ technology and getting field level feedback of researchable problems.	Local problem solved through Research-Extension linkage	2023 - 24	Have ATC but to be strengthened- should be problem solving oriented	Bottom-up research-extension at local level along with meeting national goal	Bottom-up research-extension at local level along with meeting national goal	Bottom-up research-extension at local level along with meeting national goal	DAE, BARI, BARI, BINA, BJRI, BWMRI, BSRI, SRDI, NGOs	Multi-stakeholders
TA16. Promotion of location specific technologies	1. IPromotion of location specific adaptive research and extension for solving local problem depending on ecosystems and socio-economic conditions;  2. For quick delivery of developed varieties/ technologies establishment of Community Farming systems Research and Development (FSRD) sites/ Multi- location Testing sites (MLT) targeting hot-spots and other problematic areas at least-30 FSRD sites;	Intensive on-station and on-farm research-extension activities for solving local problem along with national problem and opportunities	2023 - 24	Have some work by different institutes but to be extended	Intensive on-station and on-farm research-extension activities for solving local problem along with national problem and opportunities	Intensive on-station and on-farm research-extension activities for solving local problem along with national problem and opportunities	Intensive on-station and on-farm research-extension activities for solving local problem along with national problem and opportunities	BARI, BARI, BINA, BJRI, BSRI, BWMRI, DAE	Plan and budget



Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA16. Promotion of location specific technologies	3. Increase number of SAAOs (now one SAAO for 1162 families) and Extension Officers(AEO) for extensive delivery of modern agricultural technologies (SAAO number to be doubled); relevant number crop Scientists to be increased for facing modern challenges; and	One SAAO per 600 families and relevant AEO and Crop Scientists	2023 - 24	10-15% rice area covered by hybrid rice varieties	Post creation and budget allocation for increased SAAO, AEO and Scientists posting	Posting of all SAAO, AEO, Scientists to respective locations	Review of further requirement	GOB, MOA, DAE, NARS	Post creation and budget
					Strong farmers linkage at least 10000 events/year	Strong farmers linkage at least 10000 events/year	Review of need assessment and if needed increase events		
	4. Linkage with farmers to be enhanced through hands-on training on modern technology, adaptive trial and demonstration setting at farmers field, field visit, field days, mobile workshop, village level workshop, research farm visit, farmers fieldschool-10,000 events per year, including promotion of e-agriculture (production technology video, problem solving tips etc.)	Strong farmers linkage at least 8000-10000 events/year	2023 - 24	Mainly through projects only	Capacity of research farms improved significantly for supplying quality breeder seeds and other propagation materials	Capacity of research farms improved by 60%	Capacity of research farms improved by 90%	DAE, BARI, BRRI, BINA, BWMRI, BJRI, BSRI, NATA, NGOs	Plan, budget allocation
					Need new infrastructures and renovation, to supply more quality seed	Capacity of research farms improved by 20 % than previous	Capacity of research farms improved by 90%		
TA17. Input availability and mechanization	1. Infrastructure of research farms, manpower, and equipment to be improved/increased for supply of quality breeder seed/fruit saplings to BADC and private seed company/nursery;	Capacity of research farms improved significantly for supplying quality breeder seeds and other propagation materials	2023 - 24	Related to supply more quality seed( presently around 40% rice seed, other seed small amount)	Capacity of research farms improved by 20 % than previous	Capacity of research farms improved by 60%	Capacity of research farms improved by 90%	BARI, BRRI, BINA, BJRI, BSRI, BWMRI, Agricultural Universities, seed companies	Plan approval and allocation
					Capacity of research farms improved by 20 % than previous	Capacity of research farms improved by 60%	Capacity of research farms improved by 90%		
	2. Capacity of SCA/ BADC to be improved (with infrastructure, manpower and equipment) for supply of major crops foundation seed/ certified seed; plus private seed companies	Capacity of research farms improved significantly for supplying 50 % more quality seeds	2023 - 24	Related to supply more quality seed( presently around 40% rice seed, other seed small amount)	Capacity of research farms improved significantly for supplying 20 % more quality seeds	Capacity of research farms improved significantly for supplying 50 % more quality seeds	Capacity of research farms improved significantly for supplying 80 % more quality seeds	SCA-DAE, BADC	Plan approval and allocation

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA17. Input availability and mechanization	3. Supply and distribution of quality chemical fertilizers and organic manure/pesticide/fungicide to be ensured by BADC, BCIC, Private agencies along with monitoring	Capacity of BADC, BCIC and private agencies improved significantly to supply quality fertilizers, pesticides, fungicide	2023 - 24	10-15% rice area covered by hybrid rice varieties	Post creation and budget allocation for increased SAAO, AEO and Scientists and Scientists posting	Posting of all SAAO, AEO, Scientists to respective locations	Review of further requirement	COB, MOA, DAE, NARS	Post creation and budget
	4. Rapid farm mechanization for tillage, riceplanting, harvesting, drying, conservation agriculture, processing, value- addition through local research and import along with follow-up services by model workshop and service providers-at least one model workshop cum training center per Upazila.; and	Mechanization of all aspect of crop farming along with follow-up service and local produced items	2023 - 24	Establishment of at least 10 FSRD sites including hot spots	Locally or jointly produced farm equipment manufacturing increased by 20%	Locally or jointly produced farm equipment manufacturing increased by 40%	Locally or jointly produced farm equipment manufacturing increased by 70%	MOA, MOC, DAE, BARI, BRRI, BWMRI, BAU, Private agriculture engineering manufacturing farms, importers	Tax withdrawal for local manufacturing , continuation government subsidy
	5 Redesigning the curriculum of ATI, emphasizing farm mechanization and climate change adaptation and modern agricultural technology dissemination	Completion of updated curriculum and included in syllabus	2023 - 24	Not updated for mechanization and climate change	Completion of updated curriculum and included in syllabus of 2023-24	Amount of supply and quality ensured as per need	Amount of supply and quality ensured as per need	DAE, BTEB, MOA	NTEB and DAE initiative
TA18. Education and training of R&D staff	1. Need robust capacity building of Scientist/Extension Officers in the field of Agronomy, breeding, molecular breeding, Farming systems, horticulture, Postharvest management, climate change adaptation and mitigation, soil fertility, precision agriculture, conservation agriculture, Nano technology, ICM, IPM, mechanization, technology transfer, Safe food and nutrition security and ICT in agriculture in-country and foreign country; and	Capacity of Scientists and Extension agencies officers developed on modern tools as per need	2023 - 24	Capacity building exists mostly project based but not appropriate for current situation and modern technology	Start of Planned manpower development for efficient implementation of advanced agricultural projects/gro-gram	Completion of 1st phase capacity development of manpower for efficient implementation of advanced agricultural projects/gro-gram	Review of manpower need and trained for further development	BARI, BRRI, BINA, BWMRI, BJRI, BSRI, BARC, SRDI, DAE, BADC, BMDA	Plan approval and budget allocation for long term

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA18. Education and Training of R&D staff	2. Professional training and capacity building of extension officers, seed producers and SAAO-1000 events; and	Capacity development on modern technology dissemination	2023 - 24	Capacity building exists mostly project based but not appropriate for current situation and modern technology	Start of capacity development	Completion of capacity development in 1st phase- agricultural projects/gro-gram	Review of manpower need and trained for further development	DAE, BADC, SCA, NATA, Seed company technical officers	Plan approval and budget allocation
		Capacity of lead farmers to be developed on modern agricultural technology	2023 - 24	10-15 % rice area covered by hybrid rice varieties	Post creation and budget allocation for increased SAAO, AEO and Scientists posting	Posting of all SAAO, AEO, Scientists to respective locations	Review of further requirement	GOB, MOA, DAE, NARS	Plan approval and budget allocation
TA19. Training and awareness of modern technologies	2. Re-visit the curriculum of agricultural universities for agriculture graduate program for catering the need of present days problems like climate change, yield gap minimization, yield level increase, safe and nutritious food production, IPM, GAP etc. Farmers oriented practically applicable teaching is important;	Modification of syllabus emphasizing practical knowledge and expertise on solving present day problems	2023 - 24	-	De-designed syllabus as per need	Modification of syllabus	Further modification of syllabus as per time need	MOA, MOE, BARC, Agricultural Universities	Coordination, multi-stakeholders
		Completion of updated curriculum and included in syllabus	2023 - 24	-	Completion of updated curriculum and included in syllabus of 2023-24	Skilled manpower creation emphasizing mechanization and climate change	Skilled manpower creation emphasizing mechanization and climate change	DAE, BTEB, MOA	NTEB and DAE initiative
TA20. Lanad management	1. Framing provisions for discouraging the use of three/two cropped land (High/ medium high land) other than cropping/ agriculture within first one year; and	Provision circulated and enforced	2023 - 24	-	Provision enforced	Provision enforced	Provision enforced	MOA, MOL, BARC DAE	Timely committee formation

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA21. Develop location specific technologies	1. Crop zoning using modern techniques (GIS, remote sensing etc.) and traditional survey within one year and its implementation at field level for major crops: Boro rice, T. Aman, T. Aus, jute, maize, wheat, potato, pulses, oilseeds, onion, other spices, Sugar-cane and fruit garden, water bodies;	Crop zoning completed and adopted	2023 - 24	-	Crop zoning adopted	Crop zoning updated	Crop zoning updated	MOA, BARC, BARI, BRRI, BSRI, BJRI, BINA, SRDI, BWMRI, DAE	GIS based robust recent data
	2. Reclamation of problem soils, acid soils, char land, saline soils, pit soils, hilly soil (eroded soil);	Going on char and hill (30%)	2023 - 24	-	Reclamation of major problem soil (30%)	Reclamation of major problem soil (50%)	Reclamation of major problem soil (80%)	BARC, SRDI, DAE, BARI	GIS data and local survey done
	3. Current fallow land /char or other permanent fallow land to be brought under cultivation including land of expatriate citizens with the help of local agriculture office/ Upazila administration/LGED. Upazila-wise survey to be done to find out cultivable fallow/char land;	25 % char land under cultivation	2023 - 24	-	Assumed about 25% under cultivation	40% current fallow under cultivation	75% current fallow under cultivation	BARC, DAE, BARI, BRRI, BINA, BJRI, BWMRI, BSRI, NGOs	Upazila wise survey done
	4. Discouraging cultivation of tobacco in main fertile land (such as, Kushtia, Meherpur, Jhenidah, Chuadanga, Lalmonirhat, Rangpur, Niphamari, Manikgani, Bandarban, Khagrachari) through growing awareness of farmers/smokers about detrimental effect of tobacco on human health, soil fertility and environments. Allocation of monetary incentives for alternative high value Rabi crops cultivation	No serious motivation to farmers to abandon tobacco cultivation	2023 - 24	-	20% tobacco land to be released	40% tobacco land to be released	70% tobacco land released for crop cultivation	MOA, MOH&FP, MOE and CC, UAO, local administration, Elected representatives -all level	Government effective action plan to reduce significantly tobacco cultivation and smoking
TA22. Good Agricultural Practice	1. Draft protocol finalization and Implementation of Good Agricultural Practices (GAP) for safe food production and catching of export market (mainly vegetable, fruit, potato, spices)	Completion and publication of GAP protocols	2023 - 24	Drafting at initial stage	Start of implementation of farming through practicing GAP	GAP practiced farming in vegetables/ fruit and other crops become popular	GAP is widely practiced in crop/ horticulture sectors	MOA/BARC( protocol development) BARI, BADC, DAE, Hortex Foundation and selected commercial farmer will pilot GAP	Timely committee formation

Thematic Category/ Thematic Area	Action	Indicator	Base		Target			Regency	Assumptions
			Year	Status	2025	2030	2035		
TA23. Crop Insurance and government subsidy	1. Review the protocol of Index based insurance of Green-Delta Insurance and Oxfam, IWMI, IFC and start insuring farmers within 1st year rules drafted and passed; and	GOB make a protocol and take insurance program in crop sector	2023 - 24	No government agency involved and only tiny number farmers covered privately as project basis	Implementation of insurance in crop sector in selected areas as pilot	Implementation of crop insurance in major districts of Bangladesh for major crops	Crop insurance become common for all major crops across Bangladesh	BB, Sadharan Bima Company, Green Delta Insurance, BMD, WDB, DAE	Government policy and allocation
	2. Creation of ICT based special NID for real farmers to deliver government subsidy, compensation and soft loans among the farmers/ commercial farms	Completion of farmers special NID documentation and distribution	2023 - 24	Recently started	NID completed and distributed and used for giving subsidy in selected areas	NID commonly used for providing incentives/ subsidy to farmers	Review the need and update the NID for application	DAE, ICT ministry, BB	Plan approval and allocation
TA24. Urban/rural areas targeting poor community/women	Research and promotion of urban/rural food production, vertical agriculture, roof gardening, home gardening, mushroom culture, hydroponics, vertical farming, hydroponics, aquaponics, safe and nutritious food processing and intake-5,000 farmers training per year	Organized promotion of safe food production for urban/rural people having small land or roof etc.	2023 - 24	Some sporadic activities going on project basis	Own safe food production movement through training and input distribution	Own safe food production common practice among the residents/ women	Review and give further technological back-up	BARI, DAE, NGOs, Agricultural Universities, City Corporation, Town Federation, Farmers group	Multi-stakeholders and allocation

### 3.1.12 The Way Forward

Under the leadership of MOA (for NARES/NATC coordination) cell should be developed to coordinate and monitor the progress of activities (SAPA) along with timely allocation of budget and recruitment (if needed)-posting and capacity building of technical staff and supply of logistics. Ensuring appropriate hands-on training and technology (soft and hard) on timely and regular basis will be crucial for significant success. Based on primary and secondary data and information following key recommendations is suggested under three heads, which will be finalized after review and suggestions from four levels workshops:

#### **Conservation of natural resource bases (land, water, air and ecosystems):**

- Framing provision to preserve 3/2 two crops land only for agriculture purpose, not for other purposes. Form Upazila and district-wise committee to monitor and apply the provision/law;
- Strengthen law to save land, water, air and ecosystems from all types of pollution including industrial effluent, forced salinity, polyethylene, municipal waste-Form Upazila and district-wise committee to monitor and apply law; and
- Immediately complete crop zoning using satellite data, soil survey (physical and chemical properties), water availability, crop production data, crop suitability, and AEZ parameters. It can save wastage of natural resources such as, irrigation schedule, fertilizer amount/type etc. as well as to increase production.

#### **Sustainable per unit yield and profitability and safe food production:**

- Initiation of frontier research to break the present yield ceiling for significant yield increase of major crops/horticulture crops varieties though applying present genetic engineering, gene editing (CRISPR) and conventional breeding/adaptation. For implementing it, provide education and training to scientists/technicians, provide all logistic facilities(hard and soft) including building of lab facilities;
- Apply nanotechnology/precision agriculture/IoT (Internet of Things) for fertilizer, irrigation and herbicide and pesticide application in crop and fruit production and preservation of seeds/fruit. Need manpower development, all logistics including lab facilities;
- Markedly increase on-farm application of modern crop/horticulture crop varieties and component technologies through action research, on farm trial, result demonstration;
- Strengthen Farming Systems Research and Development sites across Bangladesh particularly in six hotspots (mentioned in report as per Bangladesh Delta Plan 2100) for quick delivery and adaptation of newly developed varieties and technologies (popularly designated as On-Farm Research and Development approach (on-farm R& D approach).
- Establish community based climate smart village for coastal and drought prone areas for quick dissemination and development of climate-smart agriculture. Organize hands-on training to farmers/entrepreneurs and ensure availability of critical inputs;
- Consistently increase agricultural mechanization from land preparation to harvesting/threshing/ grading/drying/storing/processing/value addition/post-harvest loss reduction and seed preservation. Along with import of farm machinery increase and improve quality of locally produced machinery and provide training for creating efficient service-providers and follow-up repairing services;

## **GAP**

- Primarily major research institutions (NARS) and DAE/BADC/BMDA should take responsibility to establish model crop field/fruit-vegetable garden through applying GAP along with advanced farmers/business entrepreneurs with the help of expert and
- Boost capacity to increase and improve quality seed production/preservation of vegetables/fruits along with cereals/pulses/oilseeds/spices/flowers.

### **Soft credit availability, marketing of farm products and export:**

- Allocation and distribution of soft loan (2-3 % service charge) among all categories of farmers /entrepreneurs as per need (supervised by bank and DAE/BRDB/selected NGO);
- Ensure marketing of farm products at fair price at harvesting time through government purchase/storing/preservation and monitoring and other logistics. Refrain from importing of agricultural foods at harvesting time (such as rice, onion, wheat, vegetables/fruits) and
- Improve capability of Hortex Foundation/private entrepreneurs/DAE/selected NGO/Advanced farmers to produce exportable items following GAP. Organize prompt cargo flight/shipping at fair price along with providing incentives for exporting agricultural goods. Enhance the promotion of vegetable and potato export for the importers.

## Annex-1: List of proposed project of Crop sub-sector with indicative budget and implementation period

Thematic Area (TA)	Name of Proposed Projects	Indicative Budget (Million Taka)		
		2024	2025	2030
TA1	Development of drought, and saline smart Boro rice varieties for different location through conventional/speed/ radiation breeding	10	15	25
TA1	Initiation of frontier research by applying CSRI/SPR/cas9 gene editing technology by improving the photosynthetic capacity of different crops	400	800	1000
TA1	Develop high yielding water logging and submergence tolerant T.aman rice varieties	2	4	6
TA1	Develop more short duration high yielding T. Aman rice varieties for Rabi crops like mustard, lentil, chickpea, field pea, wheat, maize, onion, garlic	5	7	9
TA2	Locally manufacture conservation agriculture (CA) machinery like Power-tiller/tractor operated seeder, bed planter for its mass adaptation to sustain soil quality	10	15	25
TA3	Locally manufactures and popularizes Axial Flow Pump (AFP) for surface water irrigation	2	4	6
TA4	Cluster based production of compost in large scale and its application in high density fruit garden and commercial vegetable cultivation (8 locations)	5	80	100
TA5	Large scale comparative study on biological pest management and pesticide based pest management in vegetables/fruits and its impact on vegetable/fruits quality and economic return	50	80	120
TA6	Study on the effect of industrial and municipal pollution on water quality, flora and fauna, agricultural production, human disease and livelihoods of catchment residents	10	20	40
TA7	Development/adaptation of deep rooting, low water requiring, disease/ pest tolerant and high yielding lentil, chickpea, mungbean, mustard, sesame and linseed varieties	20	40	60
TA8	Large scale on-farm trial on yield gap reduction in Boro, T. Aman and T. Aus, wheat, potato, Jute, Sugarcane and other crops across the locations	20	40	60
TA9	Market research to reduce price gap between farm gate price (at harvesting time), whole sell and retailing for introducing a justifiable market system for major agricultural commodities	10	20	30
TA10	Organize large scale community based on-farm trial and block demonstration on packages of post-harvest management of fruits and vegetables to minimize loss and increase shelf life	20	80	150



Thematic Area (TA)	Name of Proposed Projects	Indicative Budget (Million Taka)		
		2024	2025	2030
TA10	Establish different fruit based juice and pulp manufacturing plants in its growing major hubs by the local and foreign entrepreneurs for value addition and export (mango, pineapple, guava, lemon, banana, and jackfruit)	-	-	-
TA11	Organize group based/crop based soft credit availability through agent banking at low service charge and find its impact on agricultural production and livelihood of farmers	3	4	6
TA12	On-farm experimentation on AEZ based/location based sustainable crop intensification and diversification through high value crops/fruits	2	4	6
TA12	Large scale block demonstration on short duration T.aman rice for facilitating timely release of land for cultivation of high value rabi crops	100	300	400
TA13	Establish representative number of Farming system Research and Development (FSRD) sites and Climate Smart Village (CSV) in six hotspots as per BDP2100 for location specific research and development and quick delivery of climate smart and potential technologies/crop varieties	500	800	1000
TA13	Study the impact of new technology dissemination and adoption on Research-Extension-Farmer- Entrepreneurs linkage in major agricultural hubs	6	8	10
TA14	Conduct survey on availability of quality inputs (seed, fertilizer, biological pest management items, fungicide and pesticides) in fair price across the AEZ and find out drawbacks and formulate the way out process	6	8	10
TA15	Conduct survey on availability Design and formulate long term capacity building for scientists, extension officers, farmers and entrepreneurs	800	1000	1500
TA16	Formulation of strong and applicable law to save two/three cropped high and medium high land from use other than agriculture and its implementation by local UAO/upazila administration	60	80	90
TA17	GAP Protocol Development and Implementation	50	60	70
TA18	Piloting of crop insurance for different crops in naturally vulnerable zones and find it impact on crop productivity and profitability	10	15	20
TA19	Location-wise model deployments for homestead gardening, roof gardening, vertical gardening and capacity building	100	150	180
TA20	Develop location specific technologies and crop zoning using modern techniques	100	150	180





## Forestry





## 3.2 Forestry Sub-sector Action Plan

### 3.2.1 Introduction

Forest Department has started functioning from 1862 with imperial forest service, provincial forest service and the subordinate forest service. After the partition of Indian sub-continent in 1947 Forest Department worked with Senior Forest Service and the Subordinate Forest Service. Until 1971 the East-Pakistan Forest Department managed the forests with the Senior Forest Service and Subordinate Forest Service. The colonial forest policy (1894, 1955 and 1962) stressed on commercial aspect of forests, where maximum revenue by maximum harvesting was the priority. But the subsequent National Forest Policies (1979 and 1994) stressed on the benefits that nature provides in terms of ecological balance, ecosystem services, economic growth, anti-poverty measures (such as protection) and disaster protection. However, an extensive policy framework has not prevented deforestation and forest degradation. Bangladesh's commitment to protect biodiversity and habitats is at odds with reality in a population-dense developing country where competition is intensifying for land and natural resources. Forests biodiversity and wetlands are receiving increasing attention in government policies and strategy documents. For example, the perspective plan 2010-2021 sets targets to: (i) achieve tree coverage of 2.84 million hectares featuring diverse tree species aimed at sustaining the ecological balance; (ii) increase forestry employment (particularly for women) in expanded social forestry and agroforestry activities; (iii) create a 'coastal green belt' for sea protection; and increase accountability and transparency in public forest management (Perspective plan p. 31). Forests cover 14.1% of Bangladesh's land area and contribute 1.29% to the gross national income (BFI 2019). Forests help to support the livelihoods of the poor, are crucial for environmental well-being, and reduce the impact of natural disasters. In Forest Sub-sector ADP allocation in the 7<sup>th</sup> Five Year Plan was 12,543.60 million BDT. But the indicative budget was 22,962.89 million BDT (7<sup>th</sup> Five Year Plan 2015/2016-2019/2020). Actual expenditure on average was approximately 90%. Moreover, the identification of programs is also not very consistent with strategic objective of the forestry subsector.

### 3.2.2 Situation Analysis

Forestry has become the most important natural resource across the world, since climate change is now an unpredictable natural phenomenon. Among the natural resources, forest was not managed intensively in the past. Forest and their products and services are keys to the well-being of the society. They provide fuel wood for energy, timber for construction and furniture, living space and food. They also protect soil from erosion, house valuable bio-diversity, and aid sources of income for individuals and families and offer recreational opportunities. Because of these many functions, conflicts arise on how to use forest which way they can be used, who benefits and who doesn't. Forests cover 14.1% of Bangladesh's land area and contribute 1.29% to the gross national income (BFI 2019). Forests help to support the livelihoods of the poor, are crucial for environmental well-being, and reduce the impact of natural disasters. Comprehensive forest resource assessment supports effective planning, conservation, and management of this critical resource. Bangladesh Forest Inventory (BFI) 2015 assesses the biophysical and socio-economic aspects of tree and forests in Bangladesh and contributed to national plans and strategies, including the 7<sup>th</sup> Five Year Plan, as well as Country Investment Plans.

The BFI provides data to support international reporting requirements, as well as six indicators under Sustainable Development Goal 15, Life on Land. The total national above ground biomass of the country was 387 million tons. Mango (*Mangifera indica*), Sundori (*Heritiera fomes*), and Mahogany (*Swietenia mahogany*) are the top three species by biomass. The primary tree and forest products were 3.1% in

2017-18. Trees and forests provide 9% of the annual income in the Sundarbans and surrounding area. Fishery products (shrimp, fish, crab) contribute more than 50%. Based on a socioeconomic survey of 6,400 households, 65% of women are involved with collecting primary tree and forest products. About 54% of people surveyed received medicinal benefits from tree and forests. Landslides or erosion affects 16% of the forest area, while human-caused encroachment and fire each affect 5% of the forest area. Table 8 shows the distribution forest coverage and other land (TOF) cover within the zones.

**Table 8: Distribution of forest and other land (TOF) coverage within zones, 2015**

Zones	FRA land cover <sup>1</sup> Area (Ha)	Area (% of total zone area)	
Coastal	Forest	61,497	6.2
	Other Land (TOF)	925,121	93.8
Hill	Forest	1,338,807	78.0
	Other Land (TOF)	377,342	22.0
Sal	Forest	46,338	8.7
	Other Land (TOF)	488,092	91.3
Sundarban	Forest	399,900	63.2
	Other Land (TOF)	232,779	36.8
Village	Forest	37,476	0.3
	Other Land (TOF)	10,849,647	99.7
National	Forest	1,884,019	12.8
	Other Land (TOF)	12,872,981	97.2

<sup>1</sup> Other Land is used to define Trees Outside Forest (TOF) throughout the report

Source: Bangladesh Forest Inventory (BFI)-2015

According to National Conservation Strategy Report, (Rahman,2016) the area under forests in Bangladesh is estimated 2.6 million hectares, corresponding to 17.5% of the geographic area of the country. This includes

1.6 million ha of Forest Department controlled land and 0.73 million ha of Unclassified State Forests (USF), under the District Administration. Based on location and topography, forests in Bangladesh are classified as Hill forests, plain land ‘Sal’ forests, mangroves, coastal plantation forests, fresh water swamp forests and village forests. The state forests are classified as Reserved Forests, Protected Forests, Acquired Forest, Vested Forest, and Private Forest. Besides, planted trees growing in villages, on marginal farm lands, croplands (agroforestry) area under forests and the definition of forest used, is often different. The forest sector accounts for about 3% of the country’s gross domestic product (GDP) and 2% of the labor force. However, it is an underestimate of the overall economic and social importance of forests. The GDP figure does not account for the large quantities of fuel wood, fodder, small timber and poles, thatching grass, medicinal herbs, and other forest produce, extracted both legally and illegally. If the value of forest ecosystem services such as non-timber forest products (NTFPs), value of recreation and carbon locking is considered, the contribution of forestry sector could be as high as 6.4% of the national GDP in 2014 -2015 (Rahman, 2016). Owing to factors such as over exploitation, conversion of forestland into agriculture, fire and grazing, forest resources in Bangladesh have been continuously depleting in terms of both area and quality. Between 1990 and 2015, Bangladesh annually lost 2,600 hectares of primary forest (FAO, 2016). Primary forest land gradually decreased from 1.49 million hectares in 1990 to 1.43 million hectares in 2015. Thus, annual rate of deforestation in Bangladesh was 0.2% during 1990-2015 (FAO, 2016).

There was no boundary pillar of reserved forests in CHT. Main drawbacks, where the boundary pillars were either destroyed or changed by tribal people. Arbitrary, boundary with natural classification and few pillars cannot be permanent. Unfortunately, the forest department did not take any effective measure to stabilize the boundary demarcation. The tribal people are struggling for land rights for years together. It has been intensified, since the peace accord signed. The population increases and more forest were cleared for housing, bazar, primary school and upgraded Thana in 1983. All of these deforestation attempts were patronized by tribal leaders. The hill district council bill was approved in 1989. And CHT development board started working in 1978. The chairman of the board is appointed always a tribal politician or bureaucrats from tribal community. Hill district council and Chittagong Hill Tracts Development Board (CHTDB) in collaboration with district administration cleared the Reserved Forest for roads and growth center indiscriminately. Meanwhile the peace accord was signed in 1997. Except some of the retained subject, most of the department have been asked to transfer under the Hill District Councils. Despite, the repeated attempt for social forestry in CHT, the leaders of hill community including the Chakma circle chief opposed it. However, FD became successful in an attempt of watershed management project, titled “CHT Watershed Co- management Activity”. The traditional leader of CHT does not agree with the Social Forestry Rules, 2004. Chakma Circle Chief, Raja Debashis Roy expressed his concern in a letter to CCF in 2016. He emphasized on the Village Common Forest in the mouza area with the support of Headman and Karbhari. He expressed his concern in the CHT Forest Transit Rules and reservation of Unclassified State Forest during 1980-90. To overcome these challenges of forestry in CHT, reshuffling of boundary of reserved forest has become necessary. The legal obligation of Peace Accord of CHT and the importance of watershed potentials would be the basis of these reshuffling. Reforestation and assisted natural regeneration along with enrichment plantation can be started in the reserved forests. But an adaptive and inclusive participatory forestry rule is needed. Land tenure problem should be resolved by the Ministry of Land and Law, Justice and parliamentary Affairs along with the ministry of CHT affairs. Since the Unclassified State Forests have been declared as the transferred subject detailed survey and demarcation of reserved forest boundary should be completed expediently.

#### Strategic objectives of 7<sup>th</sup> Five Year Plan:

- Moratorium would continue;
- Forest would be divided into core and buffer zone;
- Assisted Natural Regeneration and Enrichment Plantation would be initiated to increase the tree density;
- Scientific Management Principle would be strictly followed;
- Intensification of coastal afforestation for climate change mitigation and adaptation;
- Multipurpose trees would get preference;
- Rehabilitation of degraded SAL forests;
- Peoples participation in marginal land and buffer zone afforestation ;
- Biodiversity conservation in Sundarbans mangrove forests;
- Emergency Tiger Response Team and Village Tiger Response Team, constituted with the local people would be continued;
- Clear cut demarcation of Reed lands;

- Establishment of union level nursery and upazila nursery would be strengthened as extension and training center;
- Local government bodies and NGO would be directly involved in the afforestation program for FD's support;
- Short and medium rotation fuel wood plantation along the marginal fallow land;
- NTFP would be developed in a systematic way;
- Rubber plantation and commercial production would be facilitated in the private sector;
- Forest land survey and demarcation to avoid unlawful encroachment ;
- Carbon assessment in all PAs and program for CDM and REDD+;
- Measures for threatened and endangered species;
- Fragile ecosystem conservation;
- Watershed management and reduction of Eucalyptus coverage in the country.

**Table 9: Forest Department ADP and Expenditure under 7<sup>th</sup> FYP**

BDT Million

7 <sup>th</sup> FYP	ADP (MTK)	Actual expenditure (MTK)
Financial year		
2015-16	2,920.40	2,691.481
2016-17	2,550.60	2,442.375
2017-18	1,740.70	1,293.150
2018-19	2,919.10	2,756.016
2019-20	2,412.80	2,114.247
<b>Total</b>	<b>12,543.60</b>	<b>11,297.269</b>

### 3.2.3 Major Constraints of Forestry Sub-sector

The major constraints of the forestry sub-sector are:

- I. Competing and conflicting land uses has engulfed potential forest landscape in the country;
- II. Pressure on forest reserves is reducing tree cover (especially in the Chittagong Hill Tracts and Chittagong- Cox's Bazar ) leading to forest encroachment. The Illegal logging and unsustainable exploitation lead to loss of biodiversity; threat on flora and fauna; and the dependency of poor farmers on forests for their livelihoods;
- III. Current levels of exploitation of state forests (mostly illegal) are beyond the forest's natural productive capacity, leading to rapid degradation;
- IV. imbalance in supply against demand for forest products;
- V. Lack of community consultation and participation is undermining development efforts in the forest sector;
- VI. Tenure issues (e.g. encroachment, the existence of multiple claims over khas land, and insecure land ownership) hinder investments in forests and provide disincentives for the sustainable management of trees and land; and



- VII. Low institutional capacities, poor governance and weak law enforcement are leading to encroachment and illegal logging; and (viii) Women and men in rural areas, who are highly dependent on natural resources for their livelihoods are especially vulnerable.

### 3.2.4 Opportunities for Forestry Development

The opportunities for the forestry development are: (i) There are opportunities for land reclamation, protection from storm surges, and carbon sequestration on newly accreted lands in coastal areas via afforestation; (ii) Opportunities exist for agroforestry, social forestry and homestead forestry for the production of food, wood and fuel. The role of homestead forests is potentially very significant in rural economies, but needs to be better understood and supported. Social forestry approaches present “win- win” solution for livelihoods and the environment; and (iii) Watershed management including management of soil, water, vegetation, wildlife and human activities at the watershed level.

The role of forest in poverty alleviation is also critical. In 2015, employment in forestry sector was about 1.5 million full time equivalents – of which 0.60 million were women. There are at least 19 million people depending on forests directly for their livelihood on forests indirectly. According to National Conservation Strategy Report, 2016 the contribution of village forests are the reservoirs of both plant and animal biodiversity. Bangladesh has realized the importance of forestry and the 7<sup>th</sup> Five Year Plan set a goal to “achieve tree cover of average 20% of the land surface (with tree density >70%) and ecologically healthy native forests are restored and protected in all public forest lands (about 16% of land)”.

### 3.2.5 Vision, Mission, and Objectives

#### Constitutional Obligation

The Government of Bangladesh has included Article 18A to ensure the protection of wildlife and biodiversity of the country. The Article 18A stated that “the state shall endeavor to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests and wildlife for the present and future citizens”.

#### Vision

Conservation of forests, environment and biodiversity and socio-economic development through modern technology and innovation.

#### Mission

Forest expansion, biodiversity conservation, poverty alleviation and wildlife conservation through active participation of people.

#### Overall and specific objectives

The overall objectives of the forestry sub-sector development are to:

- Protect the balance of environment and ecosystem;
- Follow and implement the rules and procedure of international convention, treaty and protocol related to forests, biodiversity and wildlife;
- Conserve and manage wildlife;

- Conserve biodiversity;
- Expand ecotourism;
- Manage and develop the coastal and wetland biodiversity;
- Sequesterate carbon and go for carbon trading;
- Raise climate resilient plantation, create new forest and collect and supply forest produces;
- Protect the stability of land-based production system;
- Develop natural and socio-economic condition;
- Expand forest and social forestry activities; and
- Manage all protected areas including wildlife sanctuary, national park, botanical garden, Eco Park and safari park properly.

### 3.2.6 Policies/Strategies/Laws Supporting the Forestry Sub-sector

In Forest Sub-sector, different kinds of plans other than Five-Year Plan are prepared to develop projects and programs for overall development of the sub-sector. The name of the plans is: (i) Forestry Sector Master Plan (1995-2015); (ii) Country Investment Plan for Environment, Forest and Climate Change (2016-2020); and Forest Investment Plan (FIP, 2017). The five-year plan is a medium-term plan, prepared and compiled by Planning Commission. There were 7<sup>th</sup> successive Five Year Plans implemented by different ministries and attached departments in the last 50 years of our independence. Now, the 8<sup>th</sup> Five-Year Plan (2021-2025) is under implementation process.

The Bangladesh Climate Change Strategy and Action Plan (2009); National Conservation Strategy (2016); Nationally Determined Contributions under Paris climate change agreement (NDC ); Reduced Emissions from Deforestation and Forest Degradation (REDD+) Strategy and National Biodiversity Strategy and Action Plan. Forest policy 1955 stated that “Forest should be managed under working plans”. The working plan then became main tool of forest management. The major forest divisions were managed under management plan till 1989. The Forest Resource Management Project (FRMP) prepared seven management plans for the seven forest divisions. Those management plans were valid for next ten years from 1995-96. The Forestry Sector Project (FSP) were prepared 14 participatory forest management plans for the 14 divisions. Those were also valid for 10 years from 2004-05. Except Sundarbans Forest Division, other forest divisions are managed, only by participatory forestry. However the moratorium will continue till 2025 (!).

Other strategies had introduced agroforestry and social forestry in the villages, to supplement the supply of tree products (fuel wood, timber). Social forestry is good in itself for providing certain livelihood and cash benefits to the community. It neither fulfills the criteria of sustainable forest management nor forest landscape restoration. Co-management is practiced only in small patches of forest, not in the major ones. Hence the future strategies should give more attention to fulfill an effective practice of collaborative -management to preserve natural forests.

The plantations and their management have been done on the basis development projects. The development project makes provision for plantations, infrastructure, training and study tour. The Forest Department usually follows those provisions for years together. Sometimes the donor imposes several loan covenants, e.g. legal reforms and institutional re-structuring of the Forest Department were the two loan covenants of the FSP. However, Asian Development Bank had facilitated the process of amendment of the Forest Act 1927 and the re-structuring of the Forest Department in 2001.

The National Forestry Policy, 1994 in commensurate with the Forestry Sector Master Plan, (1995-2015) could not be translated into program in its full length. Few statements were found superfluous, e.g., to attain 20% forest coverage by 2015 through public and private initiative. The practical difficulties were found, first with the availability of suitable land for reforestation due to tenure conflict, limited coastal accretion and poor institutional capacity. Moreover, forest cover is not defined in our country. Particularly, definition of forest has been changed over time. On the basis of density of trees, the classes of forests were defined by an inventory officer under a development project funded by the World Bank (Second Forestry Project ), as under : (i) scattered forest (Tree Density from 10%-30%); low forest (Tree Density from (30%-70%); and high forest (Tree Density>70%). National Tree and Forest Assessment (2005-07) classified forest into 3 classes, as follows: (i) more than 70% tree density; (ii) 30%-70% tree density; and 10%-30% tree density. But FAO defines forest having 10% tree density over 10 hectares with, 5 meter height in situ.

The environment, forest and climate change related strategies are as follows:

**Agriculture, Forestry and Other Land Use (AFOLU):** Bangladesh is a highly vulnerable country whose carbon (Co<sub>2</sub>) emission is less than 0.35% of global emissions. Bangladesh is working to follow low carbon development pathway. Mitigation options in Land Use and Land Use Change in Forestry (LULUCF) through afforestation and reforestation will be strengthened as committed in Bangladesh Climate Change Strategy and Action Plan (BCCSAP) as financial support is provided from Bangladesh Climate Change Trust Fund (BCCTF) and Bangladesh Climate Change Resilience (BCCRF). Bangladesh Forest Department has prepared Forest Investment Plan (FIP) to get further funding from Green Climate Fund (GCF). Apart from that, LULUCF is included in the conditional action-based contribution in the following item of afforestation continuation of mangrove plantation; reforestation and afforestation in the reserved forests; plantation in the island areas of Bangladesh and continuation of social and homestead forestry.

**Bangladesh Delta Plan 2100 (For 100 Years):** Bangladesh government has approved Bangladesh Delta Plan 2100 (BDP 2100) on September 4, 2018 with the aspiration of achieving safe climate resilient and prosperous delta by 2100. In other words, BDP 2100 is the plan for moving Bangladesh forward towards the end of 21st century. Efforts have been made to formulate BDP 2100 in the same way we want to build Bangladesh in the coming years of this century. BDP 2100 is indeed the combination of long-term strategies and subsequent interventions for ensuring long term water and food security, economic growth and environmental sustainability while effectively reducing vulnerability to natural disasters and building resilience to climate change and other delta challenges through robust, adaptive and intergraded strategies and equitable water governance. Delta Plan, Bangladesh 2100 realizing the perspective and SDG identified few policy issues for the forestry subsector, which has been outlined in the last section of this report

**Bangladesh Climate Change Strategy and Action Plan (BCCSAP, 2009):** The climate change Strategy and Action plan of Bangladesh is a part of the overall development strategy of our country. The climate change constraints and opportunities are being integrated into the overall plan and program involving all sectors and processes for economic and social development. The strategy could be achieved through the implementation of an Action plan, which have six pillars: (i) Food security, social protection and health; (ii) Comprehensive disaster management; (iii) Infrastructure development; (iv) Research and knowledge management; (v) Mitigation and low carbon development; and (vi) Capacity building and institutional development. The action plan is an integral part of national development policies, plans and program. The outcome of action plan is creation of climate change trust, specifically

created for the purpose, by the Ministry of Environment, Forest and Climate Change . The trust is operating under the overall guidance of the BCCT Act, 2010. However, climate change has been added with the ministry's name, as MOEFCC.

**National Conservation Strategy (NCS, 2016):** The first significant event of human civilization was in 1980 when the World Conservation Strategy was formulated. Millennium Development Goals and Sustainable Development Goals were adopted in 1990 and 2014, respectively. After endorsement of World Conservation Strategy, the government started working on developing the National Conservation Strategy document for Bangladesh. Starting from 1980, till the presentation of the NCS document in 1993, several task forces worked and prepared the documents. The draft documents were revised and presented to the cabinet several times. The cabinet directed the MOEFCC to revise the draft. Once again, it included some new areas for analysis and formulation of strategy to foster the development through the conservation and enhancements of natural resources within the framework of Sustainable Development Goals. After rationalization and merger there remain 25 compositions of NCS. The following are the major interventions described as: (i) Increasing forest cover and protection of biodiversity through strict enforcement of law and participatory management; (ii) Optimizing consumption of fuel wood, timber, and bamboos, rehabilitation of shifting cultivators , greening the Unclassified State Forests (USF) under participatory forest program; (iii) Abolition of traditional villager system through relocation; (iv) Participatory forestry program in the encroached forest land amending Forest Act 1927; and (v) Co-management of Protected Areas under Protected Area Rules, 2017.

**REDD+ Strategy:** The Country's Vision for REDD+ is : “to facilitate and catalyze transformational change in the forest sector to lower GHG emissions, enhance conservation of biodiversity and ecosystems , sustain community livelihoods and stronger long- term economic growth”.

**Strategic Area 1:** Reduce deforestation and forest degradation - 21705 Hectares per year plantation during 2016-30. The thematic areas are identified are as follows :

- Promote supply of alternate energy, energy efficient technologies and their substitute;
- Increase fuelwood supply in the forested districts;
- Improve livelihoods of forest dependent communities' forest;
- Resolve forest land issues;
- Improve institutional capacity.

**Strategic Area 2:** Enhance forest carbon stock -64020 hectares per year in 2016-30. The thematic areas are:

- Conservation of existing forests,
- Enrichment plantation of degraded forest lands,
- Reforested the deforested lands and afforestation of newly accreted coastal lands

Ref: (P 44-46/99 Bangladesh National REDD+ Strategy (BNRS) 2016-2030).

**Nationally Determined Contribution:** It is a climate action plan to cut emissions and adapt to climate impacts. Each party of the Paris agreement is required to establish an NDC and update it every five years. The Government GoB has submitted the NDC update in 26.08.2021. The estimation of carbon from AFOUL , particularly from forestry is now more précised as the Forest Refence Level (FRL) has been determined and approved by the secretary MoEFCC. It is now estimated 0.37 Mt.COe equal to 0.09 % from forestry subsector among 14 UNFCCC subsectors of Bangladesh . The possible mitigation

actions will be under unconditional contribution by 2030, Deforestation Reduction-2,00,000Ha; Reforestation/Afforestation – 1,50,000 Ha; Forest Restoration -1,37,800 Ha; and Increase Tree Cover -22.37% (2014) to 24%.

While conditional contribution will be same as the action will be different, as follows: maintain the forest cover and tree cover through collaborative forest management, social forestry and other programs; forest conservation by scale up alternative income generation activities for forest dependent communities by 55,000 families; co management in protected areas by 72,000 Ha; additional coastal afforestation activities; maintain the restoration of degraded or deforested areas; plantation in roadsides, embankments, private land etc. (Ref: P12-17/37, NDCs 2021).

**Forest Investment Plan:** Forest investment plan is a climate change related investment program. It is initiated by the World Bank. It is expected that the funding will be from Green Climate Fund or Forest Carbon Partnership Facility (FCPF). The total budget for the plan is 25 million USD. So far, no funding has started in the forestry sector to combat deforestation and forest degradation. If the plan is implemented fully, five types of benefit will be accrued from the forestry sub-sector. These are as follows: (i) Environmental co- benefits; (ii) Socio-economic co-benefits; (iii) Institutional co-benefits; (iv) Climate resilience; and (v) Carbon sequestration benefit. In the plan the total area projected for plantation are as follows: (FIP, P-97-98)

- Reforestation of degraded and deforested hill forest lands- 16,075 hectares;
- Community identification, engagement, capacity building etc. for hill forests- 5000 households;
- Management, monitoring, logistics and maintenance- 16,075 hectares;
- Private land restoration for enhanced carbon sequestration- 18000 hectares;
- FENTC and SFPC renovation/temporary nursery establishment- 50 number;
- Capacity building of the BFD frontline staffs and farmers- 200 number; and
- Maintenance, management and monitoring including logistics-3.8 million USD.

**Table 10: Plantation under Bangladesh Climate Change Trust Fund (BCCTF)**

Financial Year	Block plantation (hectares)	Strip plantation (k.m.)	Sale, Distribution and production of Seedlings (in thousand)
2009-2010	0.00	0.00	17,400
2010-2011	4,527.50	1819	21,330
2011-2012	9,509.16	822.32	7,732
2002-2013	2,460.00	76.00	13,000
2013-2014	1,000	0	0
2014-2015	600	0	60
2015-2016	600	0	0
2016-2017	0	0	0
2017-2018	0	0	0
2018-2019	0	0	1,468
2019-2020	0	0	1,490
<b>Total</b>	<b>18,696.66</b>	<b>2,717.32</b>	<b>62,480</b>

Source: Bangladesh Forest Department (Planning Unit)

Development of Indicators of SFM: The first FAO global forest resource assessment was published in 1948. It consisted of five indicators, which were focused more to assessment of timber availability than to sustainability of forest management as a whole. The history of the idea of C&I of SFM dates back to 1992 when the United Nations Conference on Environment and Development adopted the “Forest Principles “and Chapter II of Agenda 21. Approximately at the same time, the ITTO started its work on “Criteria for the measurement of Sustainable Tropical Forest Management”. After this summit the concept of Criteria and Indicators for sustainable forest management has started to be more and more internationally accepted. The criteria and indicators are policy instruments by which sustainability of forest management in the country or region or progress towards sustainable forest management, may be evaluated and reported on. The Criteria Characterizes or define the essential elements or set of conditions or processes by which SFM may be assessed (MCPFE,1998b). There are six CRITERIA in the Pan European set:

- Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles;
- Maintenance of forest ecosystem health and vitality;
- Maintenance and encouragement of productive functions of forests (wood and non-wood);
- Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystem;
- Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water); and
- Maintenance of other socioeconomic functions and conditions.

### 3.2.7 Institutional Capacity and Coordination of Forestry Sub-sector Development

The Ministry of Environment Forest and Climate Change (MoEFCC) is the apex body of the Government and responsible for the policy, planning and administration of all forestry and environment related issues and development program. MOEFCC is mandated to ensure environmental protection and sustainable development through the development and implementation of appropriate policy and regulations. Key agencies under the MOEF are: (i) Bangladesh Forest Department; (ii) Bangladesh Forest Research Institute; (iii) Bangladesh Forest Industries Development Corporation; and (iv) Bangladesh National Herbarium and the Bangladesh Climate Change Trust.

The government of Bangladesh adopted the first National Forest Policy in 1979 with the objective of providing greater protection and placing greater emphasis on conservation of the country’s forest assets whilst concomitantly developing its rural and industrial economics. Principally, Bangladesh Forests Department (FD) is responsible for the management, planning, protection and strategy development of the country’s forest resources in accordance with the National Forest Policy (updated in 1994), Forest Act and regulations. The manpower has been increased from 5916 (Enam Commission) to 8681 (2001), which now stands at 10492 including transferred staff from completed development projects. But the enforcement of this newly amended provision is difficult to implement in the whole country, because the upazila forest officer is comparatively a lower grade officer than it is required, i.e., forester. The administrative head of each upazila is Upazila Nirbahi Officer (UNO) is a senior scale officer. The co-ordination with the other line departments is also difficult by 15<sup>th</sup> grade forest officials. The supporting staff at the upazila level is only one in number.

The main elements of the institutional strengthening program are the policy and legal reforms, Infrastructure development, transfer of technology through training and research and development and establishment of Tree Farming Fund. The Ministry of Environment Forest and Climate Change has prepared an investment plan for Environment Forest and Climate Change with a funding from USAID similar to the investment plan for food and nutrition under the Ministry of Agriculture and Ministry of Food. The project was started in 2013 and ended in 2016 after huge consultation with the Non-Government Organizations, Professionals and the Bureaucrats. However, Bangladesh Forest Department received a loan of 175 million US Dollars in 2019 from IDA.

The necessity of investment in the environment, forestry and climate change sector in Bangladesh is significant. The need is bound to economic and population growth pressure on environment and natural resources. Inadequate interagency co-ordination is repeatedly mentioned in the 7<sup>th</sup> FYP as an issue and an obstacle. In 2016-2017, ADP listed about 170 projects that could be categorized as attending to these needs. However, there is limited coordination among ministers and agencies in designing and implementing these projects, meaning missed opportunities for synergies and complementarities. Bangladesh did not have a framework linking EFCC policies with investments. Against this backdrop, the EFCC CIP will help improve the planning, implementation, coordination and –most importantly- the monitoring of investments in the EFCC sectors. It will also help mobilize new resource and direct them to where they are most needed. The recurring budget provision has to make development projects for capacity building through trainings and outreach program.

### 3.2.8 Coastal Afforestation

Coastal afforestation was started in 1965 on pilot basis . To protect the polder and embankment, at that time it was an expert view, that the scouring effect of wave coming through borrow pit can be reduced. Among the, different means biological solution would more resilient against storm and tidal surges. Over the time there were few more cyclones, particularly, cyclone hit on 12 November, 1970 was the most devastating. In that cyclone more than three lakhs people were died. Huge livestock and standing crops were damaged including the infrastructures. Learning from some of the tidal swamp species ,which have the potential of viviparous germination , planting of Keora and Baien in the newly accreted coastal islands and chars started as trial and error basis. It was found huge successful in seventies of the best countries. In 1976, Ministry of Land handed over about 12 lakhs acres of coastal land to Forest Department , of which lion share was not accreted. The important projects of coastal afforestation are as follows (Table 11):

**Table 11: Name of the projects of coastal afforestation**

Sl.No	Name of the project	Year of Implementation
1.	Coastal Afforestation Project	1967-68 -1979-80
2.	Mangrove Afforestation Project	1980-81-1985-86
3.	Second Forestry Project	1986-87-1990-91
4.	Forest Resource Management Project	1992-93-2000-01
5.	NijumDwip national park dev program	2005-06-2009-10
6.	Coastal char Afforestation Project	2005-06-2009-10
7.	Char Development and Settlement Project -3	2005-06-2009-10
8.	NijumDwip national park dev project	2014-15-2015-16
9.	Coastal afforestation project to face adverse effect of climate change	2010-11-2011-12
10.	Community based adaptation to climate change in coastal afforestation of Bangladesh	2011-12
11.	Char development and settlement project -4	2011-12-2017-18
12.	Afforestation on BWDB Embankment and adjacent Char land	2011-12
13.	CBACC-CF	2012-13-2013-14
14.	CRPARP	2013-14-2015-16
15.	ICBAR project	2017-18-2018-19
16.	Coastal Afforestation of new Chars from the Bay of Bengal	2017-18-2022-23
17.	Sustainable Forest and Livelihood Project	2019-20-2023-24

**Objectives of Coastal Afforestation:**

- Stabilization of newly accreted coastal land;
- Reduction of loss and damage by climate induced cyclone and tidal surges in the coastal belt (adaptation);
- Increased Carbon sequestration to contribute to reduce atmospheric emission (mitigation); Development of new habitat for coastal and marine biodiversity.

**Species Planted In Coastal Afforestation:** Keora (*Sonneratia apetala*); Golpata (*Nypafruticans*); Bian (*Avicenniaofficinalis* ); Knkra (*Bruguira sexangular*) Gewa (*Exocariaagallocha*), Sundori (*Heritieria fomes*); Passur (*Xylocarpusmekongensis*) etc.

**Achievement of Coastal Afforestation:** About 2,39,830 hectares plantation completed , from the beginning of coastal afforestation. About 44,800 hectares arable land in the coastal area was handed over to district land administration for crop production at the decision of National Environment Council. Bangladesh territory has been extended by 1,680 square kilometers in the bay of Bengal.

Bangladesh Forest Department has conducted a feasibility study in 2015 and identified 66,752 hectares new accretions suitable for coastal afforestation in the near future. During the 7<sup>th</sup> Five Year Plan coastal afforestation in newly accreted islands has been given more emphasis than before and planed 30,000 hectares area. However, the target of 8<sup>th</sup> five-year plan is about 50,000 hectares, thus afforestation in the accelerated coastal area should be given due importance.



### 3.2.9 Social Forestry and Community Engagement

The concept of social forestry came into being, when National Commission of Agriculture in India published a report in 1976. The objective was to decrease the pressure on the productive forest. The production of fuelwood, fodder, timber and non-wood forest product through the active participation of local community, is called social forestry. The pioneering community forestry project was started first in 1979-80 from Betagi and Pomora, Chottagram.

The community engagement in forestry has been initiated by BFD in 1981. Initially the participants were selected from poor community, those have only own house and less than 50 decimal lands. The target areas were seven northwestern districts. BFD got technical and financial support from Asian Development Bank for a project named Community Forestry Project. First community forest project came out successful. The successive development project, named Upazila Afforestation & Nursery Development Project was also financed by ADB, implemented on participatory modalities across the country except CHT. The Forestry Sector Project and Coastal Green Belt Project were also implemented in the country. All these initiatives became effective for sustainable community engagement through The Social Forestry Rules, 2004. In the process of legal reforms, Forest Act-1927 was amended in 2000, creating provision of social forestry in the reserved forest. Subsequently, the social forestry rules-2004 has been approved by the government.

Achievement of Social Forestry:

- Plantation raised from 1981-82 to 2021-22:-1,05,283 hectares (wood lot plus agroforest); and strip plantation: 78,832 Km.
- Beneficiaries :Male 7,57,606 and female 1,50,942 Nos.
- Benefit distributed among 2,34,602 participants, so far BDT 438,30,37,905
- Tree Farming Fund: Up to 2021-22-BDT 84,15,749
- Govt. Revenue BDT 580,46,21,226
- Share of Land Owning Agencies and Local Government (UP):-BDT 246,13,68,574.

The co-management has been initiated in the Protected Area Management of the country in 2003. The Protected Area Rules, 2017 have been in force since its approval. However, the collaborative forest management have been initiated under the SUFAL project in 2018 and a community operations manual.

**Table 12: Name of the Social Forestry Projects**

Sl.No	Name of the project	Year of Implementation
1.	Community Forestry Project	1981-87
2.	Thana Afforestation and Nursery Development Project	1987-95
3.	Extended Social Forestry Project	1995-97
4.	Forest Resource Management Project	1992-2000
5.	Coastal Greenbelt Project	1995-2000
6.	Forestry sector project	1997-04
7.	Social Forestry for Forest Development and Management	2006-08
8.	Poverty Alleviation Through Participatory Forestry Development	2006-08
9.	Poverty Alleviation Through Social Forestry	2010-13

Source: FD, MOEFCC

**Sundarban as a Living Shield Against Cyclone and Tidal Surges:** Total area of Sundarban is 10,000 square kilometer of which area of Bangladesh portion is 6017 Sq.Km. It extends from south eastern tips of West Bengal to south western part of Bangladesh. It has been developed on active delta of Ganges and Meghna on the shoreline of Bay of Bengal. The Sundarban is almost exclusively 63.2% covered by mangroves equivalent to 3,999 Sq.Km. The remaining area is covered by rivers and khals. The Sundarban and coastal zones are dominated by native vegetation. It has comparatively higher DBH class due to *Heriteria Fomes* and *Exocariea Agalocha*. The Sundarban contains extremely high densities of above ground and below ground biomass carbon stocks having 3-4 times and 9.6 times higher densities respectively than the national average. The total carbon densities of all five carbon pools in the Sundarban is 345 t/hectares (soil to 1 M depth. Recurring tropical cyclone hit the coast line in the pre-monsoon and post-monsoon seasons.

In 1988 there was a cyclone that hit Sundarbans caused wildlife death and in 2007 Sidr damaged 40% of the area along with salinity intrusion and water logging beyond Sundarban. Velocity becomes reduced when it traverse the Sundarban. It is due to interception by tall and dense trees of compact Sundarban of width ranges from 80-100 feet (south to north). The Bhola cyclone hit the central coast mostly Bhola and Noakhali districts causing huge loss of lives and properties, where death toll was about 5,00,000. The cyclone hit in 1991, the death toll was about 1,30,000 in the district Chattogram. But in SIDR (Khulna-Barishal Cyclone) hit in 15 November, 2007 the death toll was 3,500 and the AILA hit in 2009, loss of lives was low. In the AILA 711 KM of embankment was damaged. BULBUL and AMPHAN hit Sundarban in 2019 and 2020 respectively. BULBUL was originated in the ANDAMAN SEA with a speed of 155 KM /hour. The landfall was in Satkhira and diverted to Khulna and Bagerhat. According to the Meteorological Department, the speed was reduced to 100 KM/hour. AMPHAN lost speed from 220 KM/hour to 151 KM/hour when it reaches north to Sundarban from the Bangladesh coast line. Principally the tropical cyclone exhibits two types of attack, i.e. high speed wind and the tidal surges. Analyzing, the speed at origin and the acquired speed at the place of landfall and resultant speed after crossing the Sundarban mangrove forests, it is observed that the multistoried, resilient dense forests of vast extent can contribute to reduction of damage caused by both of the attacks substantially. Sundarban is a world heritage site, has been declared in 1997 for Outstanding Universal Values (OUV). Sundarban mangrove forest is managed differently with those of SAL and HILL Forests, i.e. there is no logging, nor any afforestation in the mangrove forest ecosystem. It is a very dynamic ecosystem, susceptible to adulteration biosafety, caused by Alien and Invasive Species (AIS). It is the last remaining habitat for Bengal Tiger. Only the traditional livelihood scope through the limited harvest of fish, mud crab, Gol pata, and honey are allowed from Sundarban under strict regulatory compliance.

### 3.2.10 Challenges for Forestry Sub-sector

The major Challenges for Forestry Sub-sector Action Plan are given below.

**Shortage of Trained and Adequate Manpower:** All the districts do not have district level office set up and lack of forest inventory, M&E and Wildlife Wing. However, a restructuring proposal is under consideration in the Ministry of Public Administration for more than five years. The manpower has been increased from 5916 (Enam Commission) to 8,681 (2001), which now stands at 10492 including transferred staff from completed development projects. Moreover, a new organogram has been developed and submitted to MOPA in 2022, having the total number of staff position will be 15,475 increased from 10,492. But the enforcement of this newly amended provision is difficult to implement in the whole country, because the upazila forest officer is comparatively a lower grade officer than it is required, i.e., forester. The administrative head of each upazilla is Upazila Nirbahi Officer (UNO) is

a senior scale officer. The co-ordination with the other line departments is also difficult by 15th grade forest officials. The supporting staff at the upazilla level is only one in number.

**Table 13: Manpower of Forest Department (Existing and Proposed) (Partial)**

Name of the posts	Grade	Scale	Existing post	Proposed post	Abolished Post	Proposed Manpower
Chief Conservator of Forests	1	78000/- (fixed)	1	0	0	1
Addl. Chief Conservator of Forests	2	66000-76490/-	0	6	0	6
Dy Chief Conservator of Forests	3	56500-74400/-	4	0	4	0
Conservator of Forests /Director	3	56500-74400/-	0	27	0	27
Conservator of Forests	4	50000-71200/-	11	0	11	0
Asst. Chief Conservator of Forests	5	43000-69850/-	5	0	5	0
Divisional forests officer	5	43000-69850/-	63	57	0	120
Chief Instructor	5	43000-69850/-	0	5	0	5
Chief Instructor	6	35500-67010/-	1	0	1	0
Professor	5	43000-69850/-	0	0	0	0
Principal Research Officer	5	43000-69850/-	0	2	0	2
Principal Veterinary Surgeon Principal Biodiversity	5	43000-69850/-	0	1	0	1
Conservation Officer	5	43000-69850/-	0	2	0	2
Executive magistrate (Deputation)	6	35500-67010/-	0	12	0	12
Estate Officer (Deputation)	6	35500-67010/-	0	4	0	4
Senior Instructor	6	35500-67010/-	0	10	0	10
Senior Instructor	7	29000-63410/-	4	0	4	0
Computer Programmer	6	35500-67010/-	1	1	0	2
Maintenance Engineer	6	35500-67010/-	0	1	0	1
Senior ACF/Adl. DFO/Dy.Dir.	6	35500-67010/-	0	166	0	166
Senior Research Officer	6	35500-67010/-	2	7	0	9
Senior VreterinarySurgeon	6	35500-67010/-	0	4	0	4
Senior Botanist	6	35500-67010/-	1	0	0	1
Sr.Biodiversity Conservation Officer	6	35500-67010/-	0	9	0	9
Law Officer	6	35500-67010/-	1	0	0	1
Subdivisional Forest Officer Assistant Estate Officer (Deputation)	7	29000-63410/-	7	0	7	0
	9	22000-53060/-	0	15	0	15

Source: Forest Department, 2022

**Homestead Forests:** BFI report, reveals that about 3/4 of the major primary products are supplied from TOF which cover 87.2% of the total country area. Despite the moratorium in force for the last 23 years in the country, there is a huge exploitation of timber and fuelwood from the hill and SAL forest zone. Though the number and the areas of PA have been increased, the logging could not be stopped. The moratorium was imposed on SAL forest 50 years back, where deforestation (18%) is the highest in the country. Hence the proposition of increased supply of timber and fuelwood from homestead forest is not logical. Rather following SDG 15, indicator 1&2 should be followed.

**Table 14: Total quantity of the five most common primary tree and forest products collected across zones, (qty /year )**

Zone	Timber (m <sup>3</sup> /year)	Bamboo (no/year)	Fuel wood (t/year)	Leaves (t/year)	Fruits (t/year)
Sundarban periphery	162,641	1,001,536	176,836.3	17,170	66,387
Coastal	546,782	2,862,231	1,092,556	739,337	152,771
Hill	387,694	23,582,926	1,051,976	159,429	159,244
Sal	370,747	17,757,559	201,067	1,388,598	535,605
Village	6,185,092	261,953,123	12,327,647	22,263,131	5,353,377
National	7,652,955	307,157,375	14,850,082	24,867,665	6,267,384

Source: BFI Report- 2016-19

**Forest in Chittagong Hill Tracts:** Total area of CHT is 13,294 square kilometers, about 9% of the country total. Two types of forests, Reserved Forests (RF) is 3,66,858.91 hectares and Unclassified State Forests (USF) 6,95,226 hectares are managed, first one by the Forest Department and second one is controlled by the Deputy Commissioner. USF is regulated by The Chittagong Hill Tracts Regulation, 1900. The USF lands were given lease to local people, at the rate of 5 acres, upto 10 acres, who is more interested in grove culture. At the same time shifting cultivation is the traditional culture of tribal population in USF. But land use is dominated by forestry and the region is one of the country's leading suppliers of wood. The USF land is divided into mouzas. Each of the mouza has a headman. There are three circles, each of the circle is headed by circle chief called RAJA, namely, Chakma Circle, Bomang Circle and Mong Circle. They are called traditional leader. In CHT mouza headman collects the land revenue from the lessees. The Chittagong Hill Tracts Regulation 1900 has some unique provision of land leasing in the country. In the article number 34 it is said that, originally entitled as permanent resident of CHT the maximum ceiling of arable plain land will be five acres including leased land. Another five acres of grove land can be leased to same individuals. Moreover, on satisfactory record of grove culture, the DC can give more grove land up to maximum five acres, i.e. total 10 acres of hill slopes. This lease was continued till 1986-87. The USF land have been recorded in the name of DC as khas in CHT. The remaining vast chunk of USF has been used by tribal community for Jhum farming. Over the century the population has been increased many fold. In the early 1900 AD the Jhum cycle was about 10-12 years. Now it has been reduced to 3-4 years. The shifting cultivation is a nomadic agriculture, which needs virgin area of high forest locally called jhum farming across the entire area of the Unclassified State Forest (USF). As a consequence, natural vegetation disappear from USF land and reserved forests as there was no regulatory control of neither DC nor the FD, due to insurgency. Though there is moratorium on harvesting in the natural forests, FD issues the free license against the owner of forest produce of the leased plots. As a result, most of the hills become degraded as the adjacent plot is harvested by rotation. The physiography of CHT land is as follows:

Consolidated shales beds. The sedentary agriculture is only suitable in 18% of the area CHT. The source of income is limited from jhum farm and grove culture. The slash and burn is a unsustainable agriculture, that accelerate the soil erosion, reduce infiltration fertility and enhance runoff and thereby poor natural regeneration. As a result natural forests, whether, RF or USF have been highly degraded. The monoculture of teak is also one of the causes of soil erosion. This is a great challenge of conservation forestry in the country.

The lessee of the land used to plant the saplings in his plot. When these tree attain 3 to 4 feet girth they are allowed to apply to the Deputy Commissioner for verification of land title. The office of DC send this report to the office of the Divisional Forest Officer for free license under the CHT Forest Transit Rule 1973. DFO verify the respective plot and verify the standing trees through his field offices, i.e. range officer. The range officers prepare a size list of the trees and calculate the volume of timber and fuelwood, that would be permitted for harvesting. This practice has been going on, since the CHT Forest Transit Rule 1942 had been revised.

The extraction of trees from CHT is a regular activities of timber businessmen. But the free license is issued in the name owner of the land parcel.

**Table 15: Timber Exploited from CHT by Free License in 5 Years**

Year	No. of Bolli	Timber (Cft )	Fuelwood (Cft)
2017-18	17,572	63,783,84.89	36,000
2018-19	10,581	54,145,37.29	22,350
2019-20	20,412	46,762,12.08	18,200
2020-21	26,232	70,105,58.49	30,750
2021-22	32,866	72,992,16.15	27,290
<b>Total</b>		<b>3,07,78,908.9</b>	<b>1,34,590</b>

Source: CF Rangamati and ACCF (MP), FD

**Massive Logging in Hill Forest:** In the three hill districts, there is a huge Unclassified State Forest (USF) from which the tribal populations have taken lease of lands for grove culture. They used to cultivate commercial tree species, like teak, gamer to get cash income. By default, the farmer gets the free license for timber extraction from BFD. Years together millions of cubic meters of timber are harvested free of costs. Eventually it will destroy our biodiversity through cultivating only few commercial species. Not only that, it could not be a strategy of sustainable forests management.

**Phasing Out of Forest Produce Extraction from CHT:** The revision of CHT Forest Produce Transit Rules 1973 would enable the office of Deputy Commissioner in digital identification of proposed land for issuing free license by the forest department either to stop logging in the critical watersheds of both USF and RF should be identified and conserved only for bio-diversity. To optimize the water yield the native vegetation across the critical watersheds should be restored instead of horticulture practice in CHT. Provide alternative livelihood to the Jhumias, so that shifting cultivation would not be only livelihood option and the Jhum cycle is broadened.

**Growing Stock Assessments:** National forest assessment is a robust program. Not only BBS, BFRI, BNH, Survey of Bangladesh, SRDI etc. should be involved. It is carried out at some interval of 5 years. Since, the Allocation of Business has fixed the mandate, MOEFCC used to carry out the forest inventory, taking support from the attached department, divisions etc. Memorandum of Understanding (MOU) may be signed as and when the inventory program is undertaken with adequate financial allocation and the activities are designed.

**Unsustainable Financing of Forest Management:** Forestry sector Master plan (1994) could be a reliable data source for investment plan in the successive five-year plans from 1995. The forestry sector master plan had estimated an investment of 80,000 million BDT for 20 years. But the actual expenditure found in 2015 is only 38% of the total outlay.

**Outdated Forest Act:** The act was promulgated in 1927. By the time, we had partition in 1927 and liberation war in 1971. The socio political context has been changed drastically. Moreover, the State Acquisition and Tenancy Act 1950 have been enforced all over the country. It is an umbrella act, has overarching role on the forestland. The nature of rights, customary rights, prescriptive rights and the servitudes needs to reconsider in the forest act. The penal provision is also very low and insufficient. This penal provision could not reduce the theft of forest produce in the country. As a result, deforestation has become the emerging threat of forest and biodiversity loss in the country.

**Moratorium and Deforestation:** Moratorium has been imposed on extraction from natural forest from 1989. But, there is a demand in the market for forest produces. As a result, huge deforestation has been taken place in the country. Particularly, the non-wood forest product is wasted and died over time. The people around the forest collect those produces indiscriminately. The withdrawal of moratorium is a demand of time. The moratorium on logging in the natural forests in force, huge logging in CHT has been going on. Apart from that, the morbidity and old age of trees of government forests are ignored in enforcing moratorium. Uncontrolled and unregulated felling from watershed areas of CHT causes forest degradation and loss of watershed potential of hill forests. This activity is contrary to the principles of sustainable forest management. Forest is a biological entity, subject to be diseased and eventually would die. It is also economic goods, capable of affecting value chain. The gap between supply and demand of forest produce is very wide in the country. Huge amount of foreign currency is lost every year to import various types of forest products. To minimize this gap conservative exploitation of forest produce can be reintroduced from government forests. Otherwise, this type of strategy cannot support the sustainable development of the country. In the name of free license, about 86,000 hectares of hill forest was lost in the last 15 years. This is the failure of management strategy. Several initiatives have been taken for revision of Forest Act 1927 to control pilferage of forest produce. But due to the absence of sustained political commitment, it could not be finalized.

To enhance the forest coverage, the sectorial allocation and policy support issue should go side by side. The people live in and around the forest, live on ecosystem services. This historical truth was ignored when the moratorium had been imposed on logging. But the deforestation could not be arrested by moratorium. The inland SAL forest is the best example of moratorium in the country. Out of 1,20,000 hectares of SAL forests, only 45,000 hectares left with forest cover. The lion share of SAL forest is lost to encroachment. Very small number of degraded forests have been converted to participatory plantations. However, tenure conflict is the principal cause of encroachment of forest land in the country. According to the latest estimate 2,50,000 acres of forest land is encroached now. A very small portion of which are encroached by poor people. They can be relocated outside the forests, to make the forest undisturbed, keeping the recovered land free of illegal possession. To evict the rich encroachers from the forests, first we have to classify the encroachment. Then, identify the tenure conflicts, which may hinder eviction drive. Then overcome legal encumbrances, through engagement of competent lawyer. This fight might be with the industrialists, empowered by cohorts of political affiliation. These need sustained political commitment of the party in power. This may need such a legal provision that cannot be challenged in any court of justice. The eviction of encroachment will need significant amount of funds that might be provisioned in the five-year plans.

### 3.2.11 Addressing the Cross-cutting Issues

**Climate Change and Vulnerability of Bangladesh:** Bangladesh is frequently assessed to be one of the most vulnerable countries in the world to climate change because of its disadvantageous geographic location; flat and low-lying topography; high population density; high levels of poverty; reliance of

many livelihoods on climate sensitive sectors, particularly agriculture and fisheries and inadequate institutional structures. Many of the adverse effects of climate change, such as salinity intrusion, sea level rise, higher temperatures, enhanced monsoon precipitation, and an increase in cyclone intensity, will exacerbate the existing stresses adversely impacting the development of Bangladesh, especially by reducing water and food security and damaging the infrastructure.

Climate change in Bangladesh could adversely affect forest ecosystem, biodiversity and even mitigation potential of forests. If forests coverage decline continues, then the potential for forests to sequester carbon will be reduced over time. Thus, Bangladesh must address the challenge of climate change, vulnerability of extreme climate risks and depleting forest resources and carbon sink. FIP aims to reduce deforestation and forest degradation and enhance tree cover to conserve biodiversity and enhance ecosystem services, including carbon stocks and livelihoods.

Nationally Determined Contribution, Bangladesh report to UNFCCC in 2021 is an inclusive document of climate change on AFOLU sector is mentioned in the chapter 3.24. Apart from these, Climate Change Related REDD+, Forest Investment Plan, BCCSAP-2009, preparedness of the Country have been mentioned, elsewhere in the action plan.

**Tenure Conflict:** Outstanding delay of reservation processes, encroachment of forest land, leasing of forest land for non-forestry purpose, transfer of forest land to industry, infrastructure development, lack of demarcation of forest with private land. About two third of CHT land is under dual administration of deputy commissioner and headmen of Mouza. The exercise of customary rights i.e. shifting cultivation made the terrain degraded. However, the individual land right of the tribal population is a popular demand now.

**Poor Institutional Coordination:** The institutions, entrusted with forestry, management and research are very old and have been running with shortage of skill manpower. The fifteenth amendment of the constitution of Bangladesh has made an insertion as article 18A. It says, “The State shall endeavor to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests and wild life for the present and future citizens.”

The constitutional provision has been reflected in the vision of the forestry sector. And the mission has been sharpened to achieve the new strategic objective. As such the institutions capacity should be reviewed and realigned with the mission.

### **3.2.12 Alignment with Sustainable Development Goals**

United Nations have fixed these goals for global prosperity, based on three key pillars, i.e. social, economic and environmental dimensions. The tenure has been fixed from 2016-2030. There are 17 goals and 169 targets would stimulate the actions over the 15 years in areas of critical importance for humanity and the planet.

The goal no. 15 is relevant to forest subsector that says, “Protect, restore and promote sustainable use of terrestrial ecosystem, sustainably managed forests, combat desertification and halt and reverse land degradation and halt biodiversity loss”. Goal no. 15.1, 15.2, 15.5, 15.8 and 15.9 achieving time line fixed as 2020, which include, conservation, restoration and sustainable use of terrestrial and fresh water ecosystem and their services in particular, forest, wetlands, mountains and dry land in line with obligation under international agreements; sustainable management of all types of forests with substantial increase of global forests, including afforestation/reforestation and restoration of degraded

forests of all types. It has also fixed same timeline to halt the biodiversity loss, preventing extinction of threatened species. It also gave commitment to take measures to prevent the introduction of Alien Invasive Species (AIS) on land and aquatic ecosystem. (SDG, P- 27)

By 2020, we had to integrate ecosystem and biodiversity values into national and local level planning, including the development of poverty reduction strategies and accounts. Urgent actions have been suggested to stop poaching and trafficking of protected species of flora and fauna including demand and supply of illegal wildlife products; significant actions to reduce degradation of natural habitat. By 2030, desertification, degradation of land and soil, caused by draught should be eradicated.

Through 15.A, SDG have asked to mobilize fund from all sources to conserve and sustainable use of biodiversity and ecosystem. SDG also pin-pointed (15.B) the obligation of mobilizing significant number of resources from all sources to continue sustainable forest management with adequate amount of incentives for developing countries. It underscored the need of enhancement (15.C) of global support for efforts to combat poaching and trafficking of protected species including by increasing capacity of local communities to pursue sustainable livelihood opportunities. It is also observed that, target 3 and 5 of goal number 1; target 6 of goal number 6; target 2 of goal number 12; target 1,2,3 of goal number 13; target 2 and 5 of goal number 14 have also relevance with forest sector. SDG has a wide range of emerging issues of development, developed through a series of in-depth consultation across the global community, likely to affect the sustainable development.

### 3.2.13 Development Funding for Forestry Subsector

The development work in the forest sub-sector has been accomplished under projects, funded by bilateral and multilateral Development Partners (DPs) and the trend is likely to be continued in the future. The average development funding available to BFD in the last five years (2011-12 and 2015-16) has been to the tune of 2,470 million BDT per annum. This allocation contains nearly 62% Official Development Assistance (ODA). However, some projections for future can be made on the basis of trends observed in the recent past.

### 3.2.14 Estimating Resource Allocation and Gap Analysis

**Seventh Five Year Plan:** ADP allocation in the 7<sup>th</sup> FYP was Tk.26.321 Billion (Table 16). But the indicative budget allocation for 7<sup>th</sup> FYP was 42.7 Billion taka. The indicative budget is found against tentative program. But the ADP amount found for project implementation was only 61.64% on an average.

**Table 16: Indicative Allocation and actual ADP under 7<sup>th</sup> FYP**

(BDT in billion)

7 <sup>th</sup> FYP Financial year	Indicative ADP	Actual ADP
2015-16	4.8	7.75 62
2016-17	7.3	4.1450
2017-18	8.6	5.8459
2018-19	10.1	4.1837
2019-20	11.9	6.7602
<b>Total</b>	<b>42.7</b>	<b>26.321</b>

**Eighth Five Year Plan:** For first three years, forestry subsector got 18.7911 as against 34.2 indicative allocation, which is only 54.94%. As a result, the target fixed through five-year plans, adopted from



National Forest Policy, 1994, could not be achieved. The sixth five year plan fixed the target of forest cover 15%, whose baseline was 13.10%. But the fifth and sixth five year plan together achieved additional 2.2% forest coverage (13.3%-11.1%). The evaluation of 7<sup>th</sup> five year plan is not yet completed. The achievement should be more rational and practical if, 2,50,869 hectares of plantation could be raised to achieve approximately 15% forest cover. However, the target fixed for the five year plan ought to be constructive. Despite the forecasting made by exacerbation, the capacity of the institution, availability of suitable land, the plans could be more effective.

The identification of program is not always very consistent with the strategic objective of the forestry subsector. BFD, BFRI and Bangladesh National Herbarium did not follow the provisions of five year plan in the past in the cases of project development. Moreover, the MOEFCC and the Finance Division gave less priority to the sub-sector as the allocation of ADP is less than 60%. The subsector is largely dependent on Official Development Assistance (ODA) (62% of ADP) against 38% from domestic source. The development partners have their own Country Assistance Strategy (CAS). However, the Development Partners should be asked to follow the Paris Declaration for aid effectiveness.

It is also seen, from the ADP figure of 7<sup>th</sup> and 8<sup>th</sup> Five Year plan that the uniformity is maintained in funding in different financial years . It might be due to foreign aid , as in the 7<sup>th</sup> five year plan FD had two IDA funded development projects, SRCWP and CRPARP . But in 2018-19 the actual ADP was dropped. The attached department, like FD, DOE, BFRI and BNH could not prepare the development project in aligning the strategic goals of 8<sup>th</sup> five year plan. However, the fixing of ADP, could be visionary in the forest, environment and climate change sector, as the ministry can contribute to the natural resource governance which can aid to sustainable development in the country.

#### **Eighth Five Year Plan:**

ADP allocation in the 8th FYP for first 3 years Tk.18. 7911 Billion Taka (Table 13) But the indicative budget allocation for 8th FYP was for the first 3 years is 34.2 Billion taka, which is only 54.94.

**Table 17: Indicative Allocation under 7<sup>th</sup> FYP and Actual ADP (Current Price)**

(Billion in Taka)

<b>7<sup>th</sup> FYP</b>	<b>ADP (BDT)</b>	<b>Actual ADP (BDT)</b>
<b>Financial year</b>		
2020-21	9.4	5.9874
2021-22	11.5	5.4168
2022-23	13.3	7.3869
2023-24	15.5	-
2024-25	18.6	-
<b>Total</b>	<b>34.2</b>	<b>18.2</b>

**Table 18: Achievement of 8<sup>th</sup> Five Year Plan Afforestation and Reforestation**

<b>Financial Year</b>	<b>Block Plantation (Ha.)</b>	<b>Strip Plantation (Km)</b>	<b>Mangrove Plantation (Ha)</b>	<b>Seedlings Raising for sale and distribution</b>
2020-21	15701	1820.4	10470	19.33
2021-22	17785.2	2065	12290	26.445
<b>Total</b>	<b>33486.2</b>	<b>3885.4</b>	<b>22760</b>	<b>45.775</b>

Source: ACCF, Dev. Planning unit, FD

**Table 19: Achievement of 8<sup>th</sup> Five Year Plan Forest Department ADP and Expenditure**

(BDT in million)

8 <sup>th</sup> FYP (on-going)	ADP (BDT)	Actual Expenditure (BDT)
2020-21	3830.80	3361.624
2021-22	4225.70	3757.42
2022-23	5234.8	-
2023-24	3,502.3	-
2024-25	3,026.6	-
Total	14,289.40	-

Source: Forest Department

### 3.2.15 The Indicators, Targets of Sustainable Development Goals

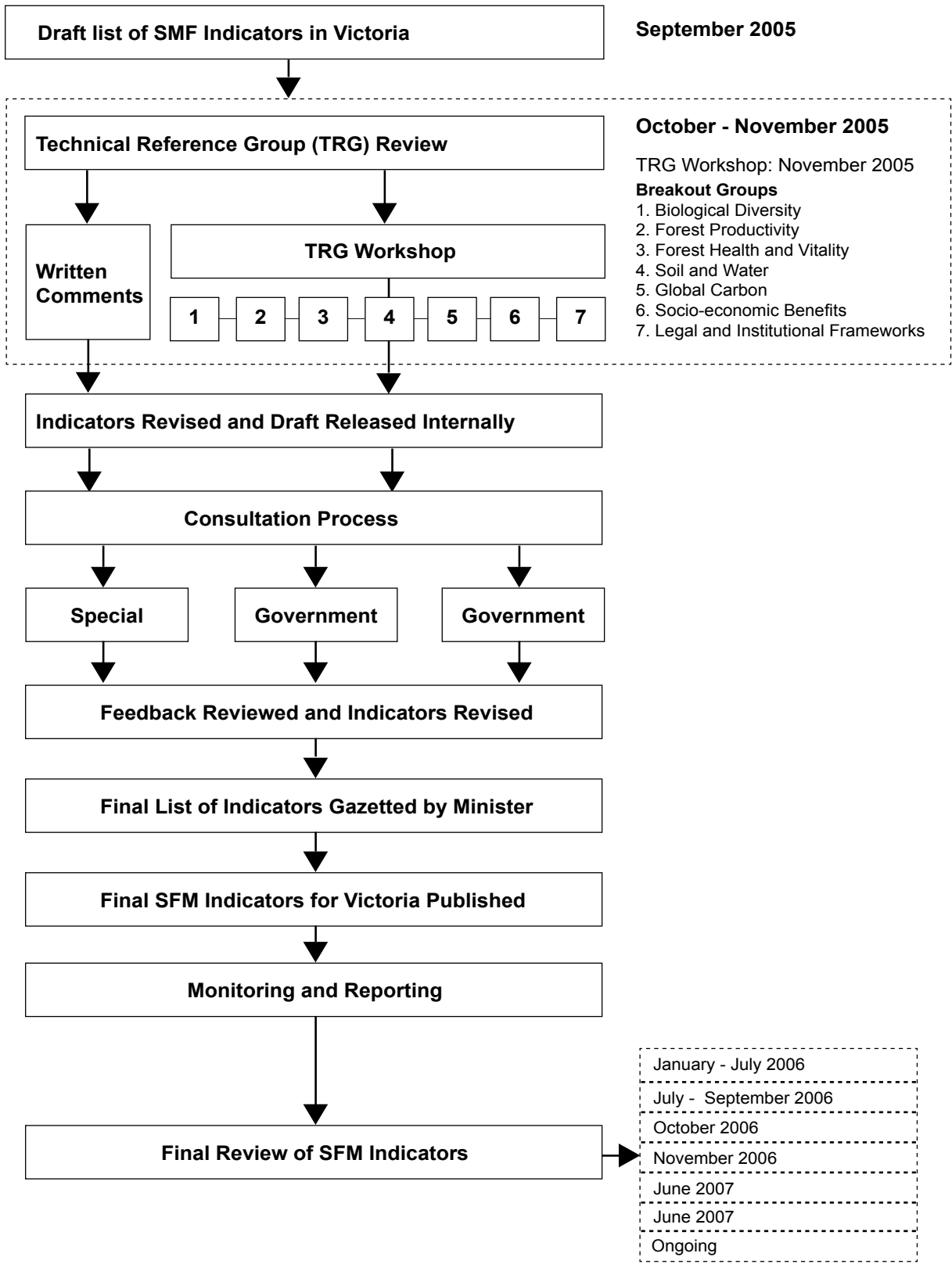
Quantitative indicators are expressed in measurement units and the necessary via regular forest inventories, other field surveys, remote sensing, etc. Periodically measured indicators show the direction of change regarding the criterion. The list of qualitative indicators includes for example, the forest area and the growing stock for the criteria 1, forest damage for the criteria 2, increment and felling for the criteria 3, deadwood volume or naturalness classes for the criteria 4, the area of protective forests for the criteria 5, and contribution of forests to GDP or the area of recreation forests for the criteria 6.

Qualitative Indicators: The qualitative indicators are those that have to be described and assessed, and the data are collected using questionnaires. They are used to describe legal and institutional frameworks of forestry, as well as the policies and instruments for the implementation of SFM.

Montreal Process: The Montreal Process Working group on C&I for the conservation and sustainable management of temperate and boreal forests was launched in 1994 as a response to the Rio Forest Principles. Original set of C&I was adopted by Santiago declaration in 1995. Originally it consisted of seven criteria and 67 indicators. The current set represents the 5th version of MP C&I and it has seven criteria and 54 indicators.

- i. Conservation of biological diversity
- ii. Maintenance of productive capacity of forest ecosystem
- iii. Maintenance of forest ecosystem health and vitality
- iv. Conservation and maintenance of soil and water resources
- v. Maintenance of forest contribution to global carbon cycles
- vi. Maintenance and enhancement of long term multiple socio-economic benefits to meet the needs of societies
- vii. Legal, institutional, and economic framework for forest conservation and sustainable management.

Forest was managed on sustained yield basis till 1989 in the country. Moratorium on logging has been imposed on natural forests and has been continuing. There are sustainable forest management practices in several countries. The criteria of SFM has been developed by Forest Europe and Montreal processes. The indicators are developed by country itself at sub-national (regional) and national level on the basis of forest management objectives.



**Fig. 3: Process for developing the Criteria and Indicators for Sustainable Forest Management (Derived from Victoria, Australia)**

### 3.2.16 Theory of Change

The expected outcome of the sub-sector action plan is mentioned in the column 10 Theory of Change is appropriately projected in different columns of the framework, including responsibility, finance, target, assumption, locations, alignment with SDG and BDP 2100, since SDG and BDP has overarching role. However an inclusive theory of change is prepared which contained vision, mission, objectives/ outcome, outputs, strategies and interventions are stated below:

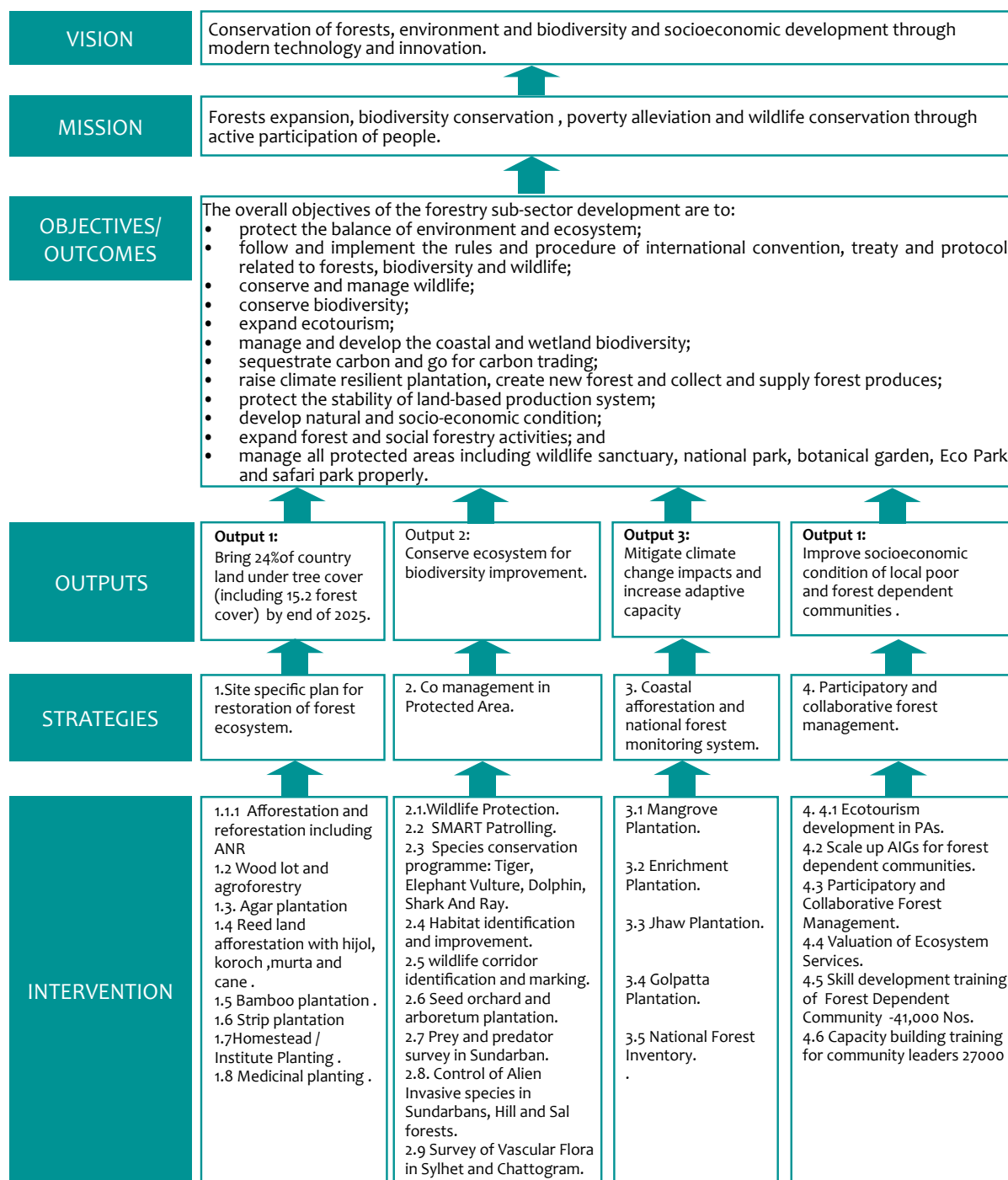


Fig. 4: Theory of Change

### 3.2.17 Action Plan Framework for for Forestry Sub-sector Development

For an effective action plan, the past failure should be identified first. Then check out the program for future implementation. And the programmes should be narrative in clear terms with physical and financial quantity.

For preparation of forestry sub-sector action plan, the following elements (conservation, halting forestation and forest degradation in natural forest as well as expansion of agro-forestry) were considered. These are;

- Information generation on forest land encroachment
- Enact a new forest conservation act to restrict non-forest use of forest land
- Reorganize the forest department to build capacity of the department
- Redefine unclassified State Forest, Protected, Acquired and Vested forest
- Revision of Social Forestry Rules 2004, taking into account the principles of sustainable forest management
- Priority to be given on protection of sensitive and biologically potential areas in the natural forests and plantations
- Review of transfers of forest land, which are not absolutely necessary
- Review of clear feeling system of forests and plantation, in order to reduce the damage of biodiversity and integrity of ecosystem
- Incorporate the international collaboration themes of ICTPs in existing and new policy.
- Collaborative Forest Management: The collaborative forest management committee have been formed, as guided by community operation manual ,prepared by FD and approved by MOEFCC. A dedicated senior consultant is engaged to draft a collaborative forest management rule to institutionalize the collaborative management in the country. However the collaborative forest management rules have been prepared.

Forest is a long-term nature-based production system dependent on the anthropogenic interference. Natural forest once established may persist for long time, generate huge ecosystem services on which people depend for their wellbeing, unless there is a catastrophe. But afforestation on a fresh site, needs huge effort and social and environmental support along with quality planting and maintenance. However, following forestry subsector action plan framework for five years period for the country may be very useful (Table 19).

### 3.2.18 Towards a result based M&E Framework

The eighth five year plan strategy is based on the progress made with results-based monitoring in the 6FYP and the 7FYP. The strategic content and relevance of the DRF in the planning process has gained significance. In the specific context of Vision 2041 and the 8FYP, a results-based M&E is recognized as critical to helping the Government track and monitor progress and take corrective measures when major gaps or divergences emerge. The importance of generating the relevant database to do proper results-based monitoring and evaluation has also gained recognition. This has enabled the development of a detailed DRF, which includes the following:

- Identifies core macroeconomic and sectoral development objectives linked to PP2041 and the SDGs;
- Indicates the different monitorable indicators;
- Identifies the data source;
- Indicates the responsible line ministry/ agency that should prepare the data;
- Defines a baseline and sets targets for the end-year as well as the intermediate years of the 8FYP.

A total of 15 top priority areas have been defined, of which 4 are macroeconomic in nature and the other 11 are sectoral. Each of these development goals is linked to the SDG and fully consistent with the development vision and target set by the government in PP 2041. Table 6.1 contains national priority areas and the number of indicators used for measuring performance. Performance of the 8FYP will be assessed against progress towards these developments using 104 measurable indicators.

The following M&E Framework (Table-20) has been derived from of 8<sup>th</sup> five year plan, slightly modified on the basis of fundamentals outlined in the 8<sup>th</sup> five year plan. The action plan framework, theory of change and the M&E framework have few common parameters. The text described in the plan document is overall guideline and a vision for forward looking inclusive M&E framework. The output of forest subsector is very time consuming, the outcome and impact assessment can not be exhaustive, unless sufficient time length is allowed for significant data.

**Table 20: Action Plan for addressing the challenges of Forestry sub-sector**

Strategic Goal of 8FYP	Thematic Category/Thematic Area	Action	Base line	Target	Implementation period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions	
							SDG's Target	BDP 2100 Measures				
1	TA1. Bring 24% of the country's land under tree cover by the end of 2025	1.1 Hill Forest restoration: ANR, Enrichment plantation, Mixed plantation and Reforestation Chattogram, CHT, Sylhet, Cox's Bazar, Habiganj and Moulvibazar	Forest-14.1% Total-22.37% BFI 2016-19 (Satellite imagery)	1,30,580 ha	5 years July 2023 - June 2027)	13058	Goal 15, Target-2	-	Restoration of degraded forest with integrated watershed management	BFD	Appropriate Locations are identified and collaborative forest management is followed	
		1.2 Plain land Sal Forest restoration: -Wood lot and Agroforestry Location: Tangail, Gazipur, Dinajpur & Mymensingh	Do	7220 Ha	5 years July 2023 - June 2027)	600	Goal15, Target-2	-	Production of timber and fuelwood.	BFD	Highly degraded forest land is identified.	
		1.3 Reed Land:-Murta, Cane ,Hijol, Karoch plantation Sunamganj, Sylhet	Do	600 Ha	5 years July 2023 - June 2027)	111	Goal 15, Target-2	-	Fresh water swap forest restored	BFD	Land tenure Problem resolved	
		1.4 Agor plantation	Do	500 Ha	5 years July 2023 - June 2027)	40	Goal 15, Target-2	-	-	BFD	-	
		1.5 Bamboo and Cane Location: Ctg, Cox's Bazar, Moulvibazar ,Habiganj, CHT and Sal Forest region	Do	2,000 Ha	5 years July 2023 - June 2027)	140	Goal 15, Target-2	-	Raw materials of cottage industry are produced.	BFD	Site specific plan is followed	
		1.6 Tree Outside Forests: Strip plantation Location: Roads, Railway line and Embankment all over the country	Do	15,000 km+ Seedling-100 million	5 years July 2023 - June 2027)	1200	-	Cross cutting issues: Agriculture food	-	-	BFD	RHD, LGED, Bangladesh Railway , BWDB and the District Council are in coordination with the Forest Dept..
		1.7 Homestead /Institute Planting and seedling sale	Do	100 million nos.	5 years July 2023 - June 2027)	1200	Goal-13, Target -1	Nutrition and livelihood	More biomass, more carbon and accelerated ecosystem services beyond the forests.	BFD	Owner of marginal lands, private lands are allowed to convert other wooded lands.	

Strategic Goal of 8FYP	Thematic Category/ Thematic Area	Action	Base line	Target	Implementation period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
1	T1. Bring 24% of the country's land under tree cover by the end of 2025	1.8 Medicinal (aromatic) planting- Location: Moulovibazar, Hobigonj, Sylhet, Tangail Mymensingh and Sherpur.	Nill	1,000 Ha.	5 years July 2023 - June 2027)	96	Goal 15, Target-2	-	Traditional medicine and herbal cosmetics can be produced from the raw materials	BFD	Unani and Ayurvedically medicine manufacturer are in coordination with the Forest Department.
		1.9 Rare and endangered Spp. (Seed Orchard and Arboretum Plantation	Nill	600 hectares	5 years July 2023 - June 2027)	96	Goal15, Target-2	-	Ex-Situ Conservation measures is ideal home for rare and endangered species	BFD	Ex-Situ Conservation measures is ideal home for rare and endangered species
		1.10 Management of Bamboo Regeneration Area	Nill	10,000 ha (fire line and anti-trespass measure)	5 years July 2023 - June 2027)	120	Goal 12, Target-2	-	Bamboo Production is optimized and sustainable supply of the marked.	BFD	Bamboo mixed hill and sal forest and properly identification pointless need Protection
2	T2. Conserve eco-systems for biodiversity improvement (contd...)	2.1. Co-management in PA	19.78%	72,000 Ha	5 years July 2023 - June 2027)	50	Goal 14, Target-5	-	Integrity of PAs Manual	BFD	PA rules in entered of the dependent Population
		2.2 Wildlife Protection (SMART patrolling in major PAs and Combat Transboundary Wildlife Crime) Location: Sundarban and Hill forests of Sylhet Chattogram, Cox's Bazar & Sal forests	Nill	1 million Ha	5 years July 2023 - June 2027)	1050	Goal 15, Target-7	Preservation of ecosystem for plant wild animals, fishes, birds etc.	Biodiversity conserved at ecosystem level	BFD	Human capital and financial capital are critically utilized.



Strategic Goal of 8FYP	Thematic Category/ Thematic Area	Action	Base line	Target	Implementation period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2:100 Measures			
2	TA2. Conserve eco-systems for biodiversity improvement (contd...)	2.3 Species conservation program (Tiger, Elephant, Vulture, Dolphin shark and ray) Location: Sundarban, Cox'sBazar, Chattogram, Habiganj, Tangail, Moulvibazar, CHT and Serpur	Nil	(Tiger, Elephant, Vulture, Monkey and Deer. 10,000 Ha	5 years July 2023 - June 2027)	200	Goal 15, Target-7	-	Food chain is restored for ecological balance.	BFD	Tiger action plan, Elephant and Bangladesh wild- life conservation master plan are followed
		2.4 Habitat identification and improvement	Nil	10,000 Ha	5 years July 2023 - June 2027)	100	Goal 15, Target-7	-	Specificity of habitat is categorized and improved through management intervention.	BFD	Relative abundance of wild animals and food habit is known along with roosting behavior.
		2.5. Wildlife Corridor Identification and Marking- Hill Forests	19.78% of for- est area Protected Area (Achievement after 7 <sup>th</sup> five year plan )	-	5 years July 2023 - June 2027)	150	Goal 15, Target-7	-	Intensive used routes of particular animals are recorded to avoid human wildlife conflict	BFD	Resident and migratory Asian elephant movement is technologically traceable.
		2.6 Establishment of Tissues Culture Lab. Location: Chattogram, Rajshahi. and Dhaka.	Nil	3	5 years July 2023 - June 2027)	40	Goal 12, Target-2	-	Quality planting materials of rare and endangered plants are available	BFRI & BFD	Technical staffs are trained and equipment are ready at hand.
		2.7. Seed Orchard and Arboretum Plantation Location: Sal forests and Hill forests	Nil	1,000 Ha	5 years July 2023 - June 2027)	1050	Goal 15, Target-5	-	Rare and critically endangered spp are reproduced in ex situ	BFRI/BFD	Standard protocol is followed with the active support of taxonomist and plant breeding specialist.

Strategic Goal of 8FYP	Thematic Category/ Thematic Area	Action	Base line	Target	Implementation period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
2	TA2. Conserve eco-systems for biodiversity improvement (contd...)	2.8 Capacity Development of FD, BNH and BFR I Personnel 4078 persons. (Masters, Diploma, Certificate)	Nil	4078 Nos.	5 years July 2023 - June 2027)	1250	Goal 13, Target-3	-	Capacity building of the professional for- esters, Subordinate forest service, allied forestry profession- al, scientists are con- versant with state of art knowledge for public service	BNH BFD	Transfer the innovative technology by BFR I and BFD are in harmony supported by policy directives.
		2.9 Infrastructure Development at District and Field Offices	Nil	1000 nos.	5 years (from - to)	1200	Goal 1 Target-5	-	Satisfaction of frontline staff is harnessed for better public service.	BFD	Smart green infrastructure are planned for climate resilient housing .
		2.10 Prey and Predator Survey in Sundarbans.	Nil	-	5 years July 2023 - June 2027)	70	Goal 15 Target-7	-	Food chain is better understood than ever before, be useful for habitat management	BNH + BFD	Biosafety Rule is fully enforced
3	TA3. Mitigate climate change impacts and increase adaptive capability	2.11 Invasive Alien Species Control. (Hill forests & Sal Forest). Location: Sundarban, west WS Teknaf WS, ChunotiWS, Lawachora NP	Nil	-	2 years July 2023 - June 2025)	30	Goal 15 Target-8	-	Terrestrial and aquatic ecosystem is conserved.	BNH + BFD	Biosafety Rule is fully enforced
		3.1. Mangrove plantation: Location: Borguna, Patuakhali, Bhola, Noakhali, Chattogram and Cox's bazar	0.37 Mt CO2 equivalent = 0.09% NDCs (2021)	50,000 Ha	5 years July 2023 - June 2027)	1500	Goal 13, Target 2	Cross cutting issues :sustainable land use	Green belt against cyclone and tidal surge (Adaptation). Carbon sequestration (mitigation).	BFD	Deposit work through PWD

Strategic Goal of 8FYP	Thematic Category/ Thematic Area	Action	Base line	Target	Implementation period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
3	TA3. Mitigate climate change impacts and increase adaptive capability	3-2 Enrichment Planting (Mangrove) – Borguna, Patuakhali, Bhola, Noakhali, Chattogram and Cox's bazar	Nil	2,700 Ha.	5 years July 2023 - June 2027)	90	Goal 13, Target-2	And spatial planning :enhance afforestation and plantation	Green belt against cyclone and tidal surge (Adaptation). Carbon sequestration (mitigation).	BFD	Degraded coastal forest land are identified and recovered
		3-3 Jhaw Plantation Borguna, Patuakhali, Bhola, Noakhali, Chattogram and Cox's bazar	Nil	900 Ha	5 years July 2023 - June 2027)	45	Goal 13, Target 2	In the coastal zone for stabilizing land	Green belt against cyclone and tidal surge (Adaptation). Carbon sequestration (mitigation).	BFD, BNH & BFRI	The site selection and planting of two valuable spp is based on science and technology
		3-4 Golpata Plantation	Nil	1,400 Km	5 years July 2023 - June 2027)	70	Goal 13, Target 2	-	Green belt against cyclone and tidal surge (Adaptation). Carbon sequestration (mitigation).	BFD	The site selection and planting of two valuable spp is based on science and technology
		3-5. National Forest inventory and GHG assessment (Forest & Tree Outside Forests)	Nil	1000 km	5 years July 2023 - June 2027)	25	Goal 13, Target 2	xxx	NFMS is a reliable source of biophysical and socioeconomic data of forest ecosystem, likely to be acceptable by UNFCCC	BFD, BFRI & BNH	Periodical effort with technical staff, skill in forest inventory and appropriate soft and hardware
		2-12 Survey of Vascular Flora- greater Sylhet & CTG. Location: Gazipur, Tangali, Mymensingh, Serpur, Netrokona, Jamalpur, Kisorgongji	Nil	-	2 years July 2023 - June 2025)	40	Goal 13 Target-2	-	Status of floral biodiversity is known down to the genetic, species and the ecosystem level	BNH	The professional manpower, logistics and state of art knowledge is deployed and used.

Strategic Goal of 8YP	Thematic Category/ Thematic Area	Action	Base line	Target	Implementation period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
4	T4. Improve socio-economic condition of local poor and forest dependent communities	4.1. Ecotourism Development in PAs Location: Sundarban, Cox'sBazar, Chattogram, Gazipur, Tangail, Serpur, Moulvibazar, Habiganj, Sylhet	Nil	40	5 years July 2023 - June 2027)	100	Goal 15, Target 8	-	Enhance ecosystem services. i.e food, water, timber, air purification, pollution and soil formation	BFD	PA Rules 2017 is fully implemented to uphold Co-management principle
		4.2 Scale-up Alternative Income Generating activity for forest dependent communities – Participatory / collaborative forest management	Nil	55000 nos. families 55000 House Hold.	5 years July 2023 - June 2027)	1680	Goal 1, Target 3	-	Forest dependency of local community is reduced, thereby forest is protected	BFD	Coordination between the grass root forest officers and the community leaders are in place
		4.3 Participatory collaborative forest management	Nil	55000 nos	5 years July 2023 - June 2027)	48	Goal 15.2	-	Additional carbon sink is created	BFD	Lands are Hassel free and funds are released on time.
		4.4 Valuation of Ecosystem Services-Major Protected Areas	Nil	50000 Ha	5 years July 2023 - June 2027)	36	Goal 15.6	-	Sharing of benefit with the dependent population on the PA	BFD/BFRI	Proper identification of PA and experts are engaged

**Table 21: Monitoring & Evaluation Framework for Forestry Sub-sector**

Thematic Category/ Thematic Area	Action	Indicator	Base Year	Baseline	Status	Target		Responsible agency	Assumptions	
						2005	2030			
01. Bring 24% of the country's land under tree cover by the end of 2025	1. ANR, Enrichment plantation, Mixed plantation - 1,30,580 ha	Restoration of degraded forest ecosystem	2015	Forest 14.1% Total-22.37% BFI 2016-19 (Satellite imagery)	Degraded forests.	15.2% Total-24%	Estimated projection for 9th five year plan. Total-25.82%	BFD	Appropriate Locations are identified and collaborative forest management Plan is followed.	
	2. Wood lot and Agro-forestry - 7220 Ha	Production of timber and fuel wood.	2015	-	Encroached Forests	-	-	BFD	Highly degraded forest land is identified.	
	3. Reed Land: -Murta, Cane, Hijol, Karoch plantation -600 ha	Fresh Water swap forest restored	2015	-	Encroached Land	Goal 12, Target-2	-	BFD	Land tenure Problem resolved .	
	4. Agor plantation: -500 ha	-	-	-	-	-	-	BFD	-	
	5. Tree Outside Forests: Strip plantation: -15000 km	Sustained supply of fuelwood and timber to rural areas at the cheap price .	-	8.27%	Marginal land	8.80%	-	BFD	RHD, LGED, Bangladesh Railway, BWDB and the District Council are in coordination with the Forest Department.	
	6. Homestead and institutional plantation -100 million	More biomass , more carbon and accelerated ecosystem services beyond the forests.	-	-	-	-	-	BFD	Owner of marginal lands , private lands are allowed to convert other wooded lands.	
	7. Medicinal (aromatic) planting: -1200Ha.	Traditional medicine and herbal cosmetics can be produced from the raw materials	-	-	-	-	-	BFD	Unani and Ayurvedically medicine manufacturer are in coordination with the Forest Department.	
	8. Rare and endangered Spp. (Seed Orchard and Arboretum Plantation: -600 ha	Ex-Situ Conservation measures is ideal home for rare and endangered species	-	-	-	-	-	-	-	Ideal site is selected for ecological requirements of the species.
	9. Management of Bamboo Regeneration Area: - 10,000 ha (fire line and anti-trespass measure)	Bamboo Production is optimized and sustainable supply of the marked.	-	-	-	-	-	BFD	Bamboo mixed hill and sal forest and property identification pointless reed Protection	

Thematic Category/ Thematic Area	Action	Indicator	Base Year	Baseline	Status	Target		Responsible agency	Assumptions
						2005	2030		
02. Conserve eco-systems for biodiversity improvement	1. Co - management in PA -72000 Ha	Integrity of Protected Areas	-	19.78% of forest area Protected Area (Achievement after 7 <sup>th</sup> five year plan)	-	-	-	BFD	PA Rules in entered of the dependent Population
	2. Wildlife Protection (SMART patrolling in major PAs and Combat Transboundary Wildlife Crime)	Biodiversity conserved at ecosystem level	-	-	-	-	-	BFD	Human capital and financial capital are critically utilized.
	3. Species conservation program (Tiger, Elephant, Vulture, Dolphin shark and ray) 10,000 Ha.	Food chain is restored for ecological balance.	-	-	-	-	-	BFD	Tiger action plan, Elephant and Bangladesh wildlife conservation master plan are followed.
	4. Habitat identification and improvement -	Specificity of habitat is categorized and improved through management intervention.	-	-	-	-	-	BFD	Relative abundance of wild animals and food habit is known along with roosting behavior.
	5. Wildlife Corridor Identification and Marking- Hill Forests 3 (Three).	Intensive used routes of particular animals are recorded to avoid human wildlife conflict.	-	-	-	-	-	BFD	Resident and migratory Asian elephant movement is technologically traceable
	6. Establishment of Tissues-Culture Lab. 1,000 Ha.	Quality planting materials of rare and endangered plants are available.	-	-	-	-	-	BFRI & FD	Technical staffs are trained and equipment are ready at hand.
	7. Seed Orchard and Arboretum Plantation-4078 Nos.	Rare and critically endangered spp are reproduced in ex situ.	-	-	-	-	-	BFRI & FD	Standard protocol is followed with the active support of taxonomist and plant breeding specialist.
	8. Capacity Development of FD, BNH and BFRI Personnel 4078 persons.	Capacity building of the professional foresters, Subordinate forest service.	-	-	-	-	-	FD, BNH, BFRI	Transfer the innovative technology by BFRI and BFD supported by policy directives.
	9. Infrastructure Development at Dist., & Field Offices -1000 nos	Satisfaction of frontline staff is harnessed for better public service.	-	-	-	-	-	FD	Smart green infrastructure are planned for climate resilient housing.
	10. Prey and Predator Survey in Sundarbans in 2 years.	Food chain is better understood than ever before , be useful for habitat management.	-	-	-	-	-	BFD	Wildlife biologist with state of art knowledge are engaged in the survey.
	11. Status of floral biodiversity is known down to the genetic, species and the ecosystem level.	Biodiversity conserved at ecosystem level	-	-	-	-	-	BNH	The professional manpower, logistics and state of art knowledge is deployed and used.

Thematic Category/ Thematic Area	Action	Indicator	Base Year	Baseline	Status	Target		Responsible agency	Assumptions
						2005	2030		
3. Mitigate climate change impacts and increase adaptive capacity	1. Mangrove plantation: 50,000 Ha	Green belt against cyclone and tidal surge (Adaptation). Carbon sequestration (mitigation).	2019	0.37Mt CO <sub>2</sub> equivalent = 0.09% NDCs (2021)	-	640200 ha.	960300 ha.	BFD	Newly accreted lands are available for plantation.
	2. Enrichment Planting (Mangrove) – 2,700 ha	Terrestrial and aquatic ecosystem is con- served.	-	-	-	-	-	BNH + FD	Bio-safety Rule is fully enforced
	3. Jhaw plantation 900 ha	Green belt against cyclone and tidal surge (Adaptation). Carbon sequestration (mitigation).	-	-	-	-	-	BFD	Degraded coastal forest land are identified and recovered.
	4. Golpata Plantation: 1400 KM	Green belt against cyclone and tidal surge (Adaptation). Carbon sequestration (mitigation).	-	-	-	-	-	BFD	The site selection and planting of two valuable spp is based on science and technology.

Thematic Category/ Thematic Area	Action	Indicator	Base Year	Baseline	Status	Target		Responsible agency	Assumptions
						2005	2030		
4. Improve socioeconomic condition of local poor and forest dependent communities.	1. National Forest inventory and GHG Assessment (Forest & Tree Outside Forests)-	NFMS is a reliable source of biophysical and socioeconomic data of forest ecosystem, likely to be acceptable by UNFCCC.	-	-	-	-	-	FD , BFRI & BNH	Periodical effort with technical staff , skill in forest inventory and appropriate soft and hardware.
	2. Ecotourism Development in PAS	Enhance ecosystem services. i.e food, water, timber,air purification,pollination and soil formation.	-	-	-	-	-	FFD	PA Rules 2017 is fully implemented to uphold Co -management principle.
	3. Scale-up Alternative Income Generating activity for forest dependent communities – 40 Nos.	Forest dependency of local community is reduced, thereby forest is protected.	-	-	-	-	-	BFD	Coordination between the grass root forest officers and the community leaders are in place.
	4. Participatory / collaborative forest management -55000 nos	Additional carbon sink is created.	-	-	-	-	-	BFD	Lands are hassel free and funds are released on time.
	5. Valuation of Ecosystem Services-Major Protected Areas. 50,000 Ha	Sharing of benefit with the dependent population on the PA.	-	-	-	-	-	BFD/BFRI	Proper identification of PA and experts are engaged.



### 3.2.19 The Way Forward

**Sustainable Forest management (SFM):** In recent years, forest policy of Bangladesh is shifted from exploitation of resources to conservation and sustainable management of ecosystems. So, the approach towards increases of forest resource per unit area, wood in particular, has to be maintained for coming decades. The sustainable use of forest needs extraction to meet the demand for forest produce. Extraction quantum is determined on the basis of increment of biomass in the trees. Mean annual increment is estimated through forest inventory. Then it is compared with yield and volume table, to determine the allowable cut. The silvicultural system is fixed on the basis of regeneration potential of the forest or plantation and prescribed in the management plan to follow the sustainable forest management principle.

**Fuel Wood Saving Technology:** The bio-mass (wood) dependent population in our country is 80%, who burns fuel wood either from public forest land and marginal lands through illegal logging, as it is cheap and readily available. Therefore, economics of alternative energy should be advocated. The subsidy on renewable energy like Improved Cook Stove (ICS), bio-gas plant, solar cooker etc. should be given from the national budget.

**National Forest Monitoring Systems (NFMS):** A robust and transparent national monitoring system should be fully measured, reported and verified. Use a combination of remote sensing and ground-based forest carbon inventory approach when estimating anthropogenic forest related green gas emissions by sources and removals by sink, carbon stocks and forest area changes based on the most recent IPCC guidance. Provide the estimates those are transparent, consistent and accurate. The results should be available and suitable for review as agreed by COP (Verification) (Ref; decision 1/CP16 Cancun.)

**Training and Outreach Program:** Sheikh Kamal wildlife Centre (SKWC), FDTTC and Forest Academy should conduct regular training program for staff and officers of the Forest Department. BFR, BNH, BCSIR and BFIDC on forestry and wildlife conservation .

**Protection of Wild life from Poaching and Trafficking:** For protection of wildlife dedicated Judicial Magistrate Court may be deputed for the Prosecution Offence Report (POR) under forest act 1927. The legal provision for dedicated court and scope of summary trial is embodied both in the Wild life (conservation and security) Act 2012 and Forest Act 1927. The forest and wildlife officers should be imparted adequate training for prosecution and trial.

**Restoration of Habitat:** Critical habitat of Asian Elephant and other wildlife should be restored and conserved. The government has formulated the plans: The Wildlife Conservation Master Plan (2015-35), Bangladesh Tiger Action Plan(2018-27), Bangladesh Elephant Conservation Action Plan(2018-27), and Bangladesh Vulture Conservation Action Plan and these action plans should be properly implemented. Conflict between forest Dept. and Bangladesh Railway, R & H, and LGED on the use of wildlife habitat, should be resolved permanently by the competent authority.

**Tree Outside Forest (TOF):** With the advent of forestry extension service, the afforestation outside forest started. The marginal land has been identified as the potential site. The community forestry programme started planting on marginal land in 1981 ,along with planting in designated forest land. In this process several participatory forestry projects were implemented along the roadsides, railway lines, embankment, and premises of the Institutes . But the marginal lands administered by the R&H, LGED, Bangladesh Railway, BWDB recently undertake afforestation program. These programs should

be discouraged by the government. According to allocation of business, MoEFCC will strengthen the TOF program for climate change mitigation and poverty alleviation.

**Social Forestry as a Means of Alternative Livelihood:** Social forestry in the north western part of the country is functioning since 1981. The profit-sharing agreement was executed between forest department and participants. The participatory forestry become very successful with the support from community the investment would be sustainable if a revolving fund is generated. As per the criteria, the landless people are selected as participants for social forestry. After a definite interval, standing trees are sold for extraction. The sale proceeds are divided among the different categories of shareholder, e.g. 55% for strip plantations, 45% for wood land and agro-forestry plantations and rest 10% is kept for Tree Farming Fund (TFF) for next rotation replanting. This process should be continued to achieve sustainable social forestry in the country. Under the projected increasing population, it will not be possible to extend the forest area horizontally. However, participatory forestry will help protect the trees from illicit felling and encourage the people to increase income and improve vegetation cover.

**Assisted Natural Regeneration of Forests:** Since the tree density of our forests is less than 70%, target to attain density, assisted natural regeneration (AVR) is very promising option to forester. The budget requirement for enrichment plantation as per the number of seedlings should be estimated. ANR associated with enrichment plantation is the key tool for biodiversity conservation, which should strengthen for enrichment of plantation.

**Sundarban Mangrove Forests Conservation:** Normally afforestation program is not carried out in Sundarban. Since the succession is very dynamic in active delta the mangroves regenerate naturally. But due to both anthropogenic and natural causes the density of plants has been decreasing day by day. To sustain the proactively of mangrove forest, the conservation effort is crucially needed. The poaching of tiger and spotted deer is the highest challenge of Sundarban mangrove forests. So the real time patrolling must be operational instead of Spatial Monitoring and Reporting Tool (SMART) patrolling. The logistics and man power supported by sustainable financing should be included in the BFD budget line to make the Sundarban a zero poaching area.

**Boundary Demarcation and Mapping:** The boundary of public forest is very flexible and vulnerable to encroachment. The main cause of vulnerabilities is agri-cropping, private infrastructure, public road, industry, human settlement and allotted official use. To address the crises, adequate number of surveyors may be deployed to survey the forests land and fix the boundary pillars in the conspicuous places. Encroachment of forests land is also caused by wrong recording in the settlement operation. The matching of forest maps with those of mouza maps are very much needed to fight against forest land and encroachment. Geographical Information System (GIS) and Remote Sensing (RS) technology may be practiced to prepare the forest maps. However, to address the encroachment and outstanding problem and wrong recording needs a policy decision to establish a set up in the BFD organogram.

**Zonation of Productive and Conservation Forestry:** Aggressive research will be necessary to increase the productivity of forest with indigenous plants to discourage the exotic species. Thus, a compatible management of forest ecosystems needs to be developed where production and protection can be ensured. Besides, long-term program has to be initiated for developing trained man power required for the conservation of forests ecosystem including integrity of protected areas. The policy of greater thrust for deriving the indirect benefits of forests ecosystem, including ecotourism has to be effectively continued.

**Urban Forestry:** Area of townships is expanding all over Bangladesh. But urban forestry is virtually lacking. In order to maintain a pollution free, climate proof environment, in the major cities urban forestry needs to be introduced under the auspices of the forest department.

**People's Awareness:** People's awareness is still lacking towards the importance of forests and biodiversity. Even too many educated people, the role of wildlife in an ecosystem is little known. Mass education is required to motivate the people for the protection of wildlife and conservation of its habitat. A strong motivation of the people living in the vicinity of the forests and Protected Areas will be required to implement the government policy of conserving the natural habitats, wildlife and biodiversity.

**Accelerated Coastal Afforestation:** The on-going coastal afforestation activities need to be continued for land reclamation, carbon sequestration and to establish first line of defense against the frequently occurring storm surges and likely occurrence of tsunami.

**Non -Wood Forest Product Improvement:** Medicinal and aromatic plants in the forest reserve and outside the forest can be an alternative income generation activity. Apiculture, Cane, Murtaand Bamboo cultivation, are also very popular AIGs activity.

**New Forest Act and Revised Wild life Act:** Though, Wildlife Act has been promulgated in 2012, the provisions of the act being ambiguous, could not be enforced fully. The revision of The Wildlife (Protection and Security) Act 2012 and Protected Areas rules are emerging issues of biodiversity conservation. A dedicated regulatory framework for result based payment in REDD+ program has to be formulated. With the transformation of forest

## Annex-1: List of proposed Projects with Indicative Budget for Forestry sub-sector

Area (TA)	Thematic Name of Proposed Project	Indicative Budget (Million Taka)		
		2024	2025	2030
TA1.1	Reforestation in the district of Chattogram & Cox's Bazar	2500	2500	2500
TA1.2	Reforestation in Hobigonj , Sylhet & Moulovibazar	1000	1000	1000
TA1.3	ANR and Enrichment plantation in CHT, Chattogram & Cox's Bazar	1000	1000	1000
TA1.4	Woodlot plantation in Dinajpur, Rangpur, Tangail, Mymensing, Sherpur & Gajipur	250	250	250
TA1.5	Agroforestry In suitable degraded Sal forests	50	50	50
TA1.6	Agar, bamboo, cane and Murta plantation	50	50	50
TA1.7	Tree Outside Forest (TOF ) Plantation	600	600	600
TA1.1	Medicinal plantation	32	32	32
TA2.2	Rare and endangered species plantation	32	32	32
TA2.3	Management of bamboo regeneration areas	40	40	40
TA2.4	SMARTPatrolling in Sundarbans and major PAs	350	350	350
TA2.5	Species Conservation program	75	50	75
TA2.6	Habitat identification &improvement	50	50	50
TA2.7	Wildlife corridor identification &marking	50	50	50
TA2.8	Establishment of tissue culture lab	20	20	-
TA2.9	Seed orchard and arboretum plantation	350	350	350
TA2.10	Improvement of forest management capacity	850	800	800
TA2.11	Prey and predator survey in Sundarbans	40	30	-
TA2.11	Prey and predator survey in Sundarbans	40	30	-
TA2.12	Control of Alien Invasive species	20	10	-
TA2.13	Survey of Vascular flora	20	20	-
TA2.1	Preparation of integrated management plan of ten forest divisions	40	40	40
TA3.2	Mangrove plantation in the coastal areas	530	530	530
TA3.3	Golpata and jaw plantation	40	40	45
TA3.4	National forest inventory	15	10	-
TA4.1	Development of ecotourism facilities in PAs	40	20	40
TA4.2	Institutionalization of Collaborative forest management in Bangladesh	700	700	300
TA4.3	Valuation of ecosystem services	20	36	-
TA4.4	Co management activities in PAs	15	20	15



**Fisheries**





### 3.3 Fisheries Sub-sector Action Plan

#### 3.3.1 Introduction

Bangladesh is blessed with potentials and well diversified vast inland and marine water fisheries resources, where Fisheries sector playing important role in securing food and nutrition security, employment generation, poverty alleviation and livelihood improvement of rural peoples, environmental conservation and overall economic development of the country. Bangladesh now becomes one of the world's leading fish producing countries with a total production of 4.759 million MT fishes in FY 2021-22 (against target of 4.664 MT) in conformity with the targets of Vision-2021 of the government. Through this remarkable achievement Bangladesh became a self-sufficient country in fish production since 2016 providing now 63g (instead of target 60g) of fish per person in daily dietary consumption. Bangladesh ranks 3rd position in inland open water capture production, 5th in aquaculture production as stated in the FAO report. The State of World Fisheries and Aquaculture 2022. Bangladesh also ranks 1st in global catch of Hilsa shad, ilish (GI Product). The Fisheries sector has been expanding at an average annual rate of 6.23% during 7<sup>th</sup> FYP (DoF FRSS 2022). In spite of global financial crisis situation due to Covid19 and ongoing war, the growth performance of this sector seems still quite consistent and encouraging. Department of Fisheries is trying to sustain this growth performance, aligned with government development plans and policies. The GDP growth in the fisheries sector is 2.08 percent and the contribution of the fisheries sector in the overall agriculture sector is 21.83 percent in FY 2021-22 (BER 2022). More than 12% of population is directly or indirectly engaged in various activities under fisheries sector for their livelihood. In 2021-22, the country earns BDT 5191.75 crore by exporting almost 74.04 thousand MT of fish and fishery products contribute 1.05% of the total national export earnings (EPB 2022). During the recent past years, the steady and sturdy growth performance in fisheries sector has helped to achieve this milestone. Despite the impression of growth the sub-sector is facing challenges that can limit the growth in the near future along with renewed opportunities through the development of local and global research findings combining with free international trade and marketing of agricultural products. The main goal of agriculture is to achieve self-sufficiency in food and nutrition. To attain this goal, the government of Bangladesh has placed highest importance on the overall development of fisheries sub-sector.

#### 3.3.2 Situation Analysis

##### Overall Fisheries Sector

The fisheries sub-sector is one of the largest growing sub-sectors of agriculture in Bangladesh. According to FAO (2022), Bangladesh ranks 3rd in producing fish from inland open water bodies, 5th in aquaculture production and 11th in marine fish production. Currently Bangladesh ranked 4th in tilapia production in the world and 3rd in Asia. Over the last four decades, the total fish production of Bangladesh has been increased more than six times (7.54 lakh MT in 1983-84 to 47.59 lakh MT in 2021-22) (Fig-5). The 8<sup>th</sup> FYP plan objectives for fisheries were to enhance productivity, food security, improvement of livelihood adopting climate change challenges and equitable distribution of benefits along with conserving the potential fisheries resources and aquatic biodiversity. During the 7<sup>th</sup> FYP period, the fisheries sub-sector grew annually at 6.23%. The total fish production has increased from 3.878 million MT in 2015-16 to 4.503 million MT in 2019-20, at the end of 7<sup>th</sup> FYP and the yearly volume growth rate was 5.94%.

The two major contributing factors behind the performance of fisheries sector are: firstly, significant increase in inland closed water aquaculture (in ponds, lakes, beels, baors, some seasonal floodplain areas, semiclosed water body) through adopting technological interventions along with using quality fish feed and improved hatchery produced fish seed/fingerlings. Beside, competitive high profit margin of aquaculture than other traditional agriculture production systems encouraged farmers towards conversion of lowlying land in to fish ponds by raising embankments since the last three decades. Paying sincere efforts in research to develop breeding and culture technology of important indigenous species resulted to revival of endangered natural fishes as well as added diversification in aquaculture with popular small fish culture. Secondly, conservations and management of Inland open water fisheries resources introducing

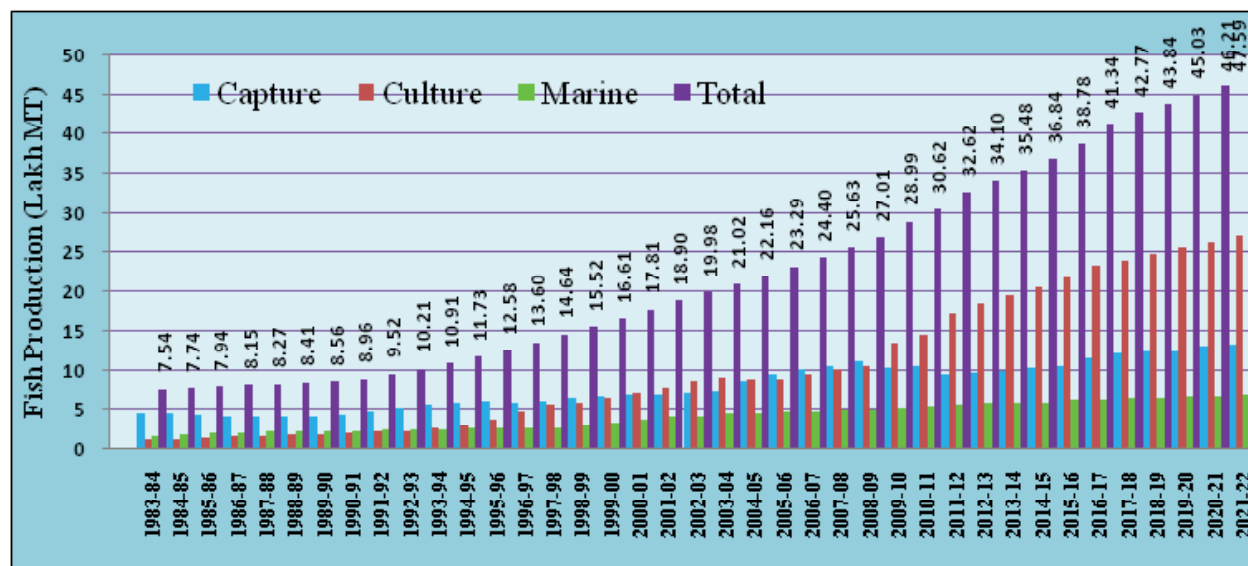
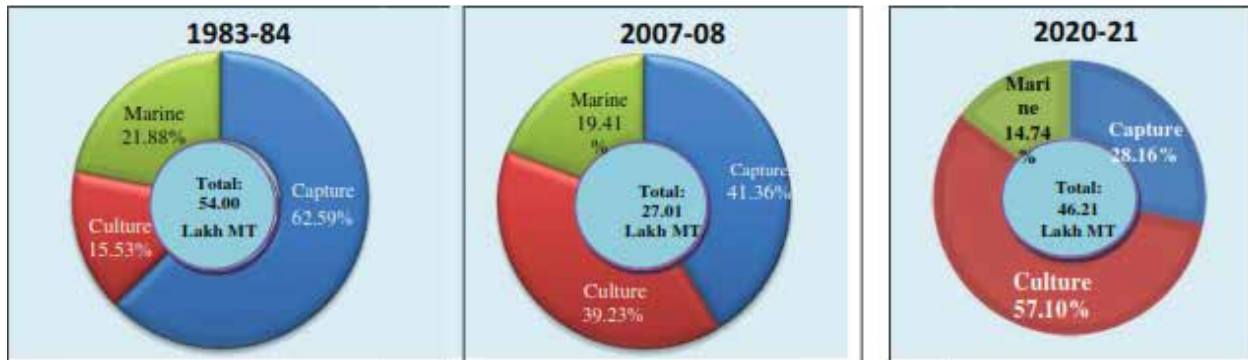


Fig. 5: Last 39 years sector-wise fish production trend (lakh MT) (DoF, FRSS, 2022)

Community-based fisheries management (CBFM) has largely contributed to enhanced biodiversity and availability of indigenous species by habitat restoration, establishment of fish sanctuary, fish fingerling stocking in natural fish habitat, fishing ban/restrictions during breeding season resulted increased production. The total inland water fisheries production with closed water aquaculture and open water catch are historically the major supply source of fisheries productions in Bangladesh. The trends of fish production and growth performances Fig-5 at different water resources based analysis shows important findings which may taken into highest consideration for future Fisheries Sector Action Plan.

The overall growth rate of total fish production in 2021-22 is 2.98% which becoming a slower growth rate than the past decades. In 1983-84, the total fish production was 7.54 lakh MT, where major contributions were from inland capture fisheries 4.71 lakh MT (62.59%) followed by marine catch fisheries (1.65 lakh MT (21.88%) and aquaculture (mostly pond/shrimp farms) only 1.17 lakh MT (15.53%) respectively. After 39 years, total fish production increased to 47.59 lakh MT in 2021-22, where significant changes were observed in inland closed water (aquaculture) contributes 57.39% (27.31 lakh MT) followed by inland open water (capture) fisheries 27.78% (13.22 lakh MT) and marine fisheries catch was only 7.06 lakh MT contributing 14.83% of the country's total fish production. This production scenario indicates that inland fishery contributes a major share of the country's total productions which is about 40.52 lakh MT (85.17%). The growth rates of inland culture and inland capture fisheries are 3.50% and 1.57% respectively.





**Fig. 6: Contribution of inland capture, culture and marine fisheries to total fish production (since 1983-84 towards 2010-21)**

### Inland Open Water Fisheries

The growth performance of inland capture fisheries shows a slightly moderate increased trend where inland aquaculture shows a moderate increased trend. Fish production has been increased compared to previous years during 7<sup>th</sup> FYP and last two years of 8<sup>th</sup> FYP . Over the last near four decades, the capture fish production has increased 2.8 times more (4.72 lakh MT in 1983-84 to 13.22 lakh MT in 2021-22). The fish production diversity of different fisheries resources of inland open water fisheries of river, beel, floodplain and Kaptai lake in 2021-22 are respectively and corresponding growth rates are 1.63, 0.67, 0.71 and 45.30 percent, respectively shows in Fig. 6. The productivity, growth rate and contribution share (percentages) to National annual fisheries production of the potential inland open water resources (38.61 lakh ha) couldn't perform satisfactory level in comparison to progress achieved in inland closed water fisheries paying more efforts in aquaculture. Floodplain resources (26.46 lakh ha), the major single contributor of the open water catch (17.47% of total fish production), fish production has increased 4.13 times more (from 2.01 lakh MT in 1983-84 to 8.31 lakh MT in 2021-22) through different technological and management interventions. However, the overall productivity of open water capture fisheries is still now (in 2021-22) quite low (only 314 kg/ha). In particularly, catch from Sundarban ecosystem and Kaptai lake is very poor in respect to their resource potentiality in terms of natural productivity and environmental suitability. During this period, the fish productions from different inland open water fisheries resources like river/estuaries was (401 kg/ha), Sundarban (137 kg/ha), beel (925 kg/ha), floodplain (314kg/ha) and Kaptai lake (261 kg/ha) couldn't perform well in respect to their areas (ha) and aquatic resources potentiality due to different social, environmental and management factors (Fig. 7). (DoF FRSS, 2022. Page- 18-24).

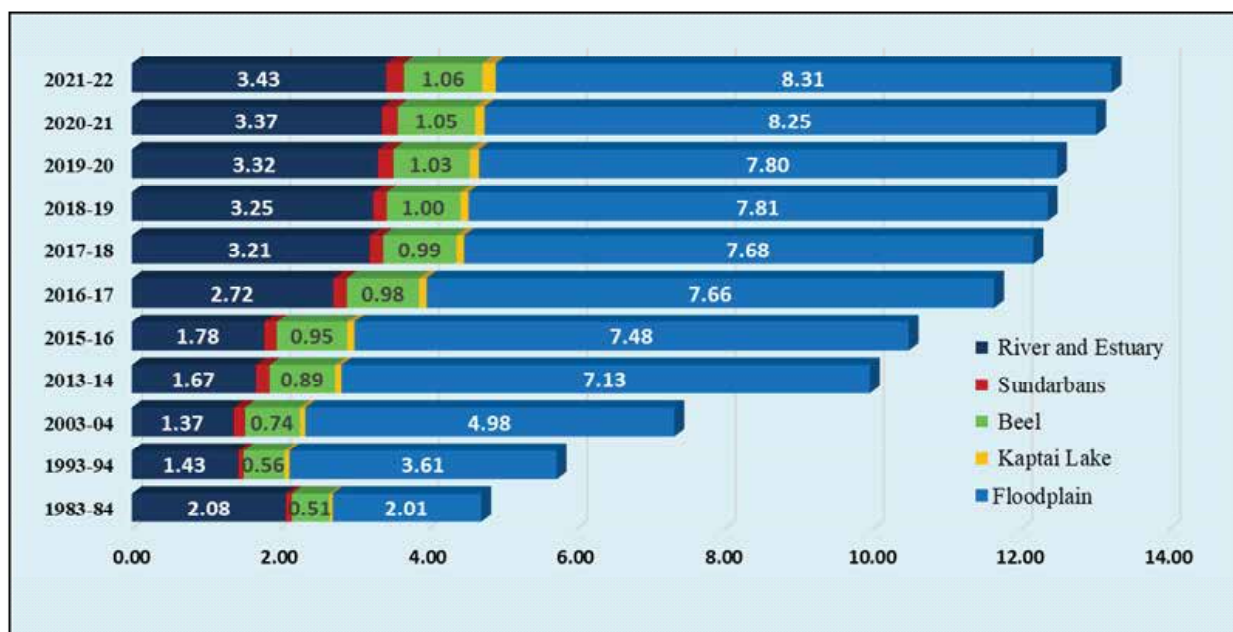
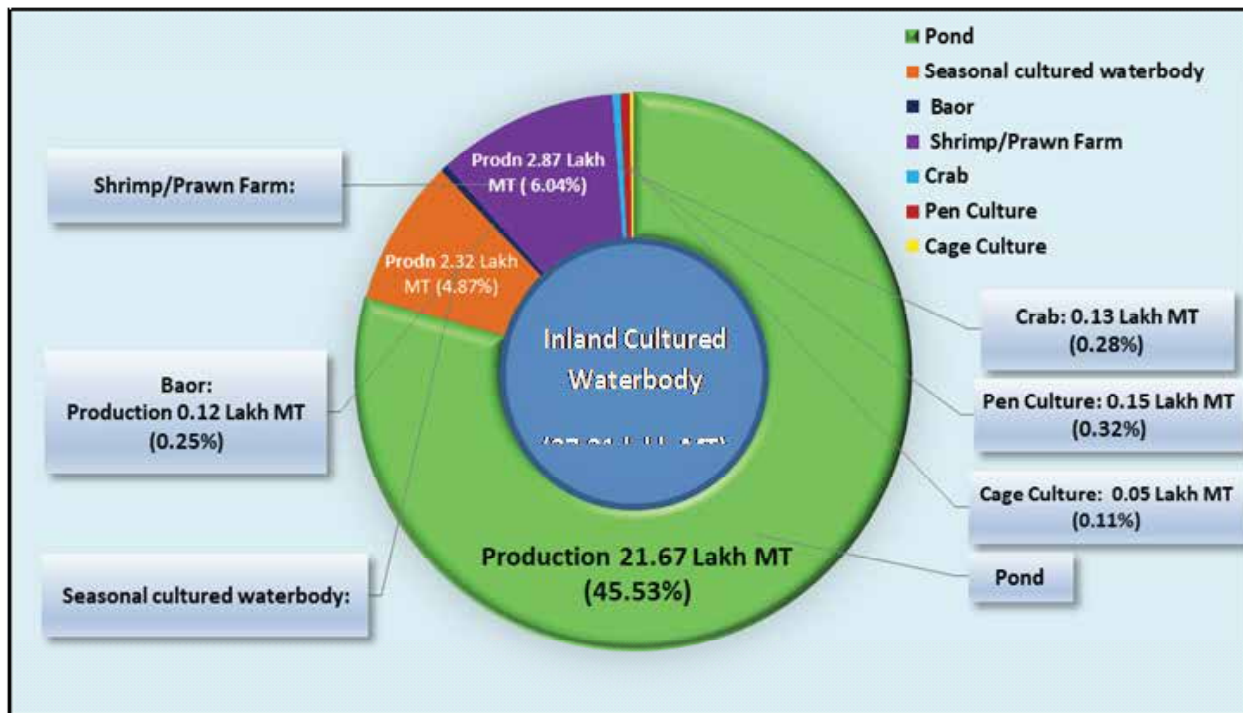


Fig. 7: Last 39 years, source-wise fish production of capture fisheries (Lakh MT)

### Inland Closed Water Fisheries (Aquaculture)

Aquaculture has been the most rapidly growing agro-food sector in Bangladesh over the last three decades. The overall growth performance from inland aquaculture shows a moderate, reasonable, and admirable increasing trend. Aquaculture has been progressing with reasonable success due to the expansion of various developed technologies. The aquaculture production became more than doubled (10.06 lakh MT in 2007-08 to 27.31 lakh MT in 2021-22) during the last thirteen years. Over last 39 years, aquaculture contribution to total fish production has been increased remarkably from 15.53% in 1983-84 to 57.39% in 2021-22 which are shown in Fig. 8 & Fig. 9.

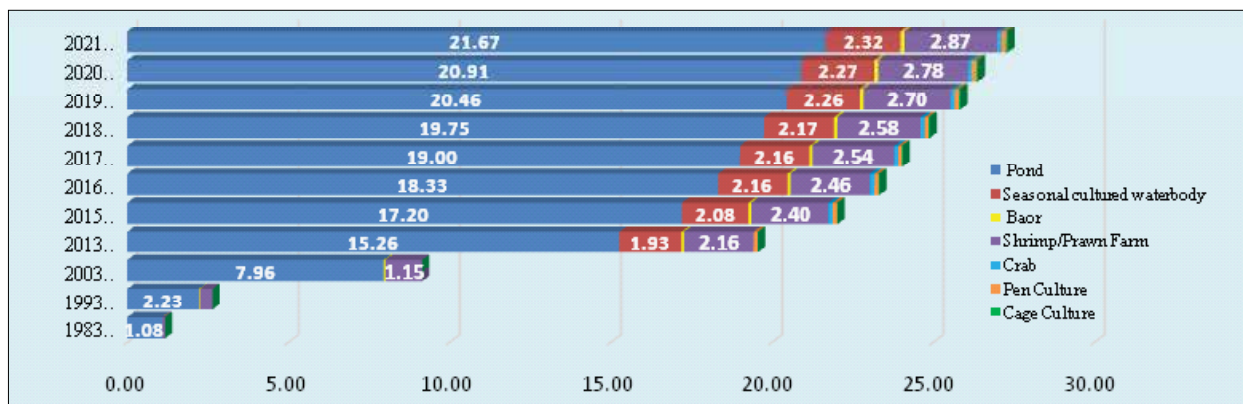
During the last three decades, both the area, fish productions from inland culture fisheries and productivity (kg/ha) of pond, seasonal cultured water body, baor and shrimp farms has increased. Now-a-days pen and cage culture are also getting popularity and increasingly practiced as culture system in Bangladesh (shown in Fig. 8). Over the years, fish produced in closed water fisheries in 8.45 lakh ha areas like pond, baor, paddy field/floodplain and shrimp/prawn farms has increased substantially while the same productivity for other water bodies stagnated. The production performances is highest in pond (5276 kg/ha) followed by baor (2060 kg/ha), seasonal water bodies mostly semi-closed floodplain under CBFM approach (1555 kg/ha) and coastal shrimp/ prawn farms (1093 kg/ha). The major contributions by the closed water fish production (aquaculture) in 2021-22 from pond, seasonal cultured water body and shrimp/prawn farm are 21.67 lakh MT, 2.32 lakh MT and 2.87 lakh MT, the corresponding contributions to total national production are 45.53%, 4.87%, and 6.04% respectively. In Bangladesh, aquaculture production systems are mainly extensive and improved extensive in floodplain/ irrigated rice fields, semi closed water bodies, beels, baors with semiintensive and in few cases intensive systems in the ponds in particularly commercial farming practices.



**Fig. 8: Fish production diversity of inland cultured waterbody in 2021-22**

Two types of aquaculture practices are being observed on in Bangladesh - freshwater and coastal aquaculture. Freshwater aquaculture comprises mainly pond farming of carps (indigenous and exotic), pangas, tilapia, climbing perch and a number of other domesticated fish. Coastal aquaculture is comprised mainly of shrimp and prawn farming in gher (coastal pond or enclosures). Species-wise fish production of pond aquaculture in FY 2021-22 are shown in the following graph (Fig. 9). Crab production is 0.13 lakh MT (Fig. 10) which getting popularity on behalf of their environmental suitability, fast growing climate resilient species and increasing market demand with good price and better export market accessibility which replacing the slow growth shrimp farming sector. But due to unavailability of artificial propagation of crablets (Crab Seed) from hatchery sources, still depending on natural sources, (mainly wild catch from Sundarban and territorial estuaries), limiting the scope of crab aquaculture and export.

(Parenthesis indicates contribution percentage)



**Fig. 9: Last 39 years source-wise inland aquaculture fish production (Lakh MT)**

## Coastal Fisheries

In Bangladesh, coastal aquaculture considered under closed water aquaculture sector comprised of both shrimp/prawn and finfish and shrimp farming in ghers (ponds/rice field's enclosures) has been expanding in coastal belt mostly in Khulna, Bagerhat, Satkhira, Jessore, Cox's Bazar and Chittagong District. During last four decades, shrimp/prawn and fin fish coastal aquaculture practices has been considerably expanded in 2.63 lakh ha farming areas produced 2.87 lakh MT in 2021-22 where 1.37 lakh MT shrimp/prawn and 1.50 lakh MT fin fishes. A significant increase in coastal farm productions has been observed from 8219 MT in 1983-84 to next three decades as 39447 MT (in 1993-94), 1,14660 MT (in 2003-04), 2,16447 MT (in 2013-14) and 2,46406 MT (in 2016-17). Next subsequent period of last one decade coastal aquaculture cum shrimp sector couldn't retain this sharp growth rate due to facing different socio-economic, environmental factors and policy issues. The productivity and annual growth rate of shrimp/prawn dominated coastal aquaculture sector couldn't achieve expected success during last two decades in comparison to the freshwater ponds and other closed water aquaculture sub components.

Fish production in closed water aquaculture, particularly in ponds (4.10 lakh ha) has increased substantially while the same productivity for coastal shrimp/prawn farms more or less stagnated during last 8 years. According to DoF FRSS (2021-22), the production performances was highest in pond (5276 kg/ha) followed by baor (2060 kg/ha), seasonal closed water bodies floodplain (1555 kg/ha), while coastal shrimp/prawn farms productivity is only 1093 kg/ha (521 kg shrimp/prawn + 552 kg fin fishes). The contribution of closed water aquaculture production from pond is 21.67 lakh MT (45.53%) of the total fish production where coastal shrimp/prawn farms contributing only 2.87 lakh MT (6.04%).

Recently Mud Crab production getting popularity on behalf of their environmental suitability, fast growing, climate resilient species and increasing domestic and export market demand with better prices which replacing the slow growth shrimp farming sector. The Crab production/catch and export data reported from Bangladesh Forest Department (BFD), Export Promotion Bureau (EPB) and DoF are mainly wild catch of adult hard shell live crabs from the Sundarban and surrounding areas. The crab production/catch was 14421 MT in 2016-17 showing gradual decline in volume to 13397 MT in 2021-22. This declining production volume due to enforcing regulatory restriction of catching wild crabs from Sundarban since 2015 for biodiversity conservation. The aquaculture practices of mud crabs in coastal farms started commercially from 2015-16 having suitable salinity and other ecological conditions in some coastal areas of Satkhira, Bagerhat, Khulna and Cox's Bazar. A small quantity of farmed soft shell crabs processing and export started 2017. Due to unavailability of artificial propagation of crablets (Crab Seed) from hatchery sources, still depending on natural sources, (mainly wild catch from Sundarban and territorial estuaries), limiting the scope of crab aquaculture and export. The low productivity of potential coastal aquaculture areas resulted mostly due to lack of diversifications in aquaculture farming system with suitable technological interventions; traditional knowledge of farmers about aquaculture, GAP and disaster management; inadequate water supply for farming and infrastructure facilities; unavailability of good quality disease free shrimp/prawn seeds; quality and safe fish feed/aqua medicinal products, inadequate extension, monitoring and support services.

Financial access for farm investment and finally limited market accessibility due to lack of capacity to comply the regulatory requirement of food safety and quality through the value chain for domestic or export market. Along with increasing climate change affects causing salinity intrusion, frequent natural disasters like unpredicted tornado, cyclone and high tidal water surges suddenly damage entirely the coastal shrimp farms becoming common phenomena in the coastal areas are now big challenges. Before, social conflicts about the ownership, rights and accessibility of land-water resources, environmental facilities supporting or against agriculture transformation (rice farming vs.

shrimp farming) were the key issues in coastal areas which had threatened and down streaming the progress in coastal aquaculture to explore economic potentiality.

As shrimp is one of the major export items, government of Bangladesh has taken up different programs to increase shrimp production through dissemination of appropriate technology and to promote businessfriendly supply chain with special care for hygiene and safety of fish and fishery product to be marketed both in domestic and export market. Presently farmers are encouraged to complying Good Aquaculture Practices (GAP), becoming more interested to adopt eco-friendly shrimp farming system and also cluster shrimp farming approach. Emphasis was also given to maintain quality standards in all stages of fish and shrimp production, processing and export with strong monitoring by the Competent Authority (CA). However, Government initiatives and intervention are not adequate to support large numbers of coastal farmers to address the above challenges and increase the productivity until private sector involvement and capacity building could be enhanced through Public-Private Partnerships.

### Marine Fisheries

The growth performance of inland fisheries has shown a moderate increased trend where marine fisheries production is slow, steady and stagnant trends since last 20 years not achieved at expected level. In 200304, marine fish catch was 4.55 lakh MT when total fish production was 21.02 lakh MT, contributed about 23% of the National total fish production. During this period although total production becomes more than double as 47.58 lakh MT in 2021-22 where marine catch contribute 7.06 lakh MT But the marine catch increased with a very little annual incremental growth rate and declining trends of the proportionate contribution lowered to 14.83% with a moderate increase in volume (only 24791 MT) from previous year (2020-21). The annual growth rate of marine catch was 3.64% which mostly due to increase in Hilsha fish catch in the marine. Historically the artisanal fisheries contributing more or less 80-85% of the total marine catch whereas industrial trawlers catch only 15-20%. Among the total marine catch of 7.06 lakh MT in 202122, Industrial fishing trawlers catch was 1.37 lakh MT (19.43%) and artisanal fishing boats were 5.69 lakh MT (80.57%). The marine catch becomes almost stagnant since last 20 years with reducing Catch Per Unit Efforts (CPUE) and slow growth rate for depletion in major stocks of important marine species due to over exploitation with increasing fishing pressure by increasing number of artisanal fishing boats and industrial fishing fleets. Besides, implication of inadequate monitoring, control and surveillance (MCS) measures and regulatory enforcement, IUU fishing, climate change impacts, pollution and different socio-economic and political issues limiting the scope of potential marine resources.

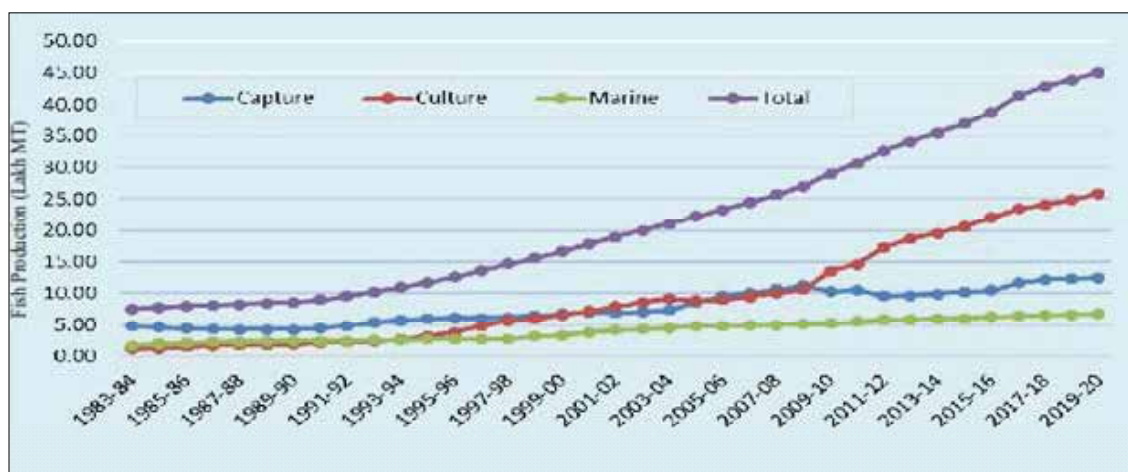


Fig-10: Trends of fish production (in lakh MT) over last 37 years

## Hilsha/Ilish Fishery

Hilsha (Ilish) is the national fish of Bangladesh. Hilsha (*Tenualosa ilisha*) is the largest single-species fishery in Bangladesh with landings by volume 5.67 lakh MT in 2021-22, which makes the highest contribution to the 11.91% of country's total fish production and 1% to the GDP. Hilsha got recognition of geographical indication (GI) product of Bangladesh in 2017. Among this total catch of Hilsha, the marine catch includes 3.22 lakh MT and inland water riverine catch during migration is about 2.45 lakh MT. Hilsha production once abundant in 1970's gradually declined in many rivers system in 1990's. This declined river catch has been attributed to a combination of factors such as the closure of migratory routes, river siltation, overfishing, indiscriminate catching of brood stocks and juveniles use of monofilament small meshed nets (current jal), mechanization of fishing, and increasing numbers of fishers, industrial pollution, and climate variability.

Total annual Hilsha production showed a sharp decline in 2002-03, but after 2005, due to the implementation of Hilsha Fisheries Management Action Plan (HFMAP), Hilsha production increased at the rate of 3.5% per year till 2014-15. Government has undertaken several protection and conservation measures to protect jatka and Hilsha brood. HFMAP is being implemented through mass awareness campaign, rallies, meetings, enforcing conservation acts, establishing Hilsha sanctuaries, seasonal fishing ban, distribution of rice among the poor fishers, offering alternative livelihoods of fishermen as cash incentives. As a synergistic impact of the general management activities of the government and PES - the environmental management approach, the average annual incremental total Hilsha production in Bangladesh increased from 3.5% to 9% after 2015 and production has almost doubled over the 13 years but slows down from last year to current year with very little increase of only 1410 MT with growth rate only 0.25%. The Hilsha production trends are increased gradually since 2004, which are shown in the following graph (Fig. 11).

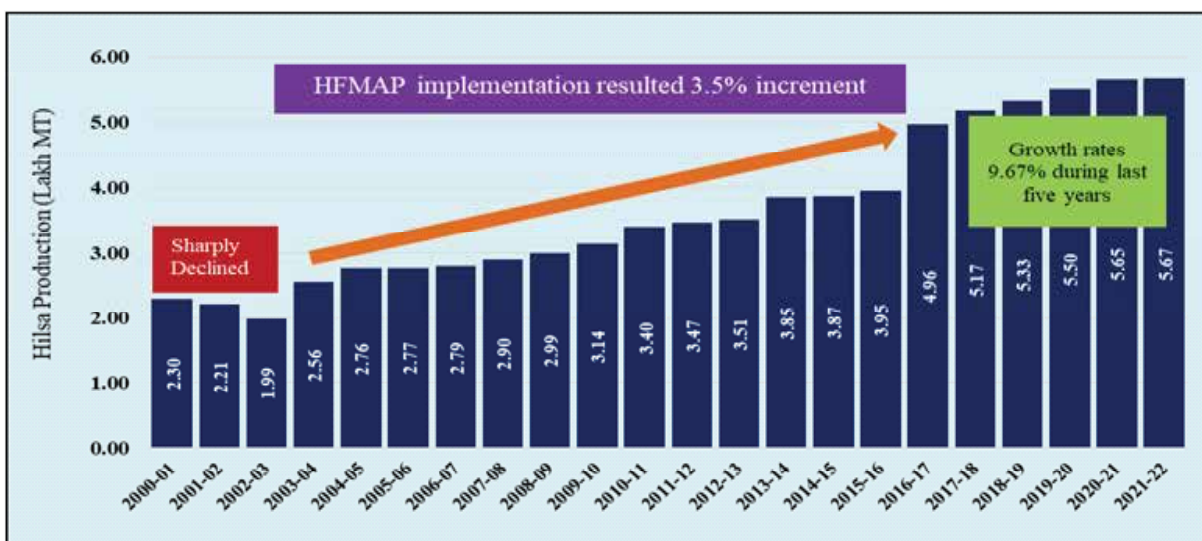


Fig-11: Hilsha (shad) production trends over last two decades

## Significance of the Coastal and Marine fisheries Resources

Apart from this remarkable success achieved in fisheries since last 3 decades, still there have some gaps and inequity about availability and accessibility of the resources, in particularly to the coastal poor community. Due to the limitations of accessible resources in coastal belt along with facing frequent

natural disasters, environmental degradations and climate change affects, scope of employment and socio-economic development of around 20 millions coastal population beside the Bay of Bengal is still a big challenge. The Marine and brackish water fisheries are the most valuable aquatic resources for them playing vital role in employment and livelihoods of millions of people. In parallel to the population increases, the marine catch didn't increased that much, even declining trends of important commercial species due to increasing fishing pressure, pollution, navigation, constructions and other man made factors limiting their opportunities to get sustainable catch along with their lack of knowledge for proper utilizations of the harvested resources.

Other than catching fish and subsequent value chain actors, their alternative income generation and employment opportunities not yet addressed in respect to the national development efforts progressed in land based economy, GDP, industrialization of the country since last 30 years. Coastal aquaculture sector (0.3 million ha) potentiality couldn't explored which might be the easy, nature based solution by enhanced productivity. In 2021-22, average inland pond aquaculture production exceeds 5276 kg/ha whereas coastal aquaculture production is only 1093 kg/ha (521 kg shrimps/prawns and 572 kg other fishes). Coastal and Marine aquaculture production can be increased 3-5 times giving policy support for marine resources mapping (MSP), management and conservation, involving skilled human resources, diversification of the coastal aquaculture with other commercially important species beside shrimps, introducing GAP, Traceability, Certification, Processing and value addition & branding of fish/shrimps products to increase the national and international market accessibility.

#### **Hatchery and nursery: Challenges in good quality fish/shrimp seed supply appropriate word should be used**

Hatchery and nursery development helped commercializing the aquaculture activities. development of artificial breeding techniques and availability of hatchery and nursery sources fish/shrimp seeds enhances the Inland aquaculture production of indigenous and exotic carp species, tilapia, pangas and Thai/Vietnamese koi expanded massively. Besides, new interest grew in farming of indigenous species like koi, singh, magur, pabda, gulsha, mola, etc. because they are getting scarce on open water areas while they have high market demand and contribute household level nutrition supply. Presently 110 Government and 874 Private sector hatcheries are contributing for the adequate supply of required fish seed for inland aquaculture production and also nursery and fingerling stocking program in inland open water fisheries management to increase the productivity and catch. To increase galda and bagda shrimp culture, 50 Bagda shrimp hatchery (all are private) and 39 Galda/prawn (28 Govt. + 11 Private) hatcheries have been established under both public and private ownership.

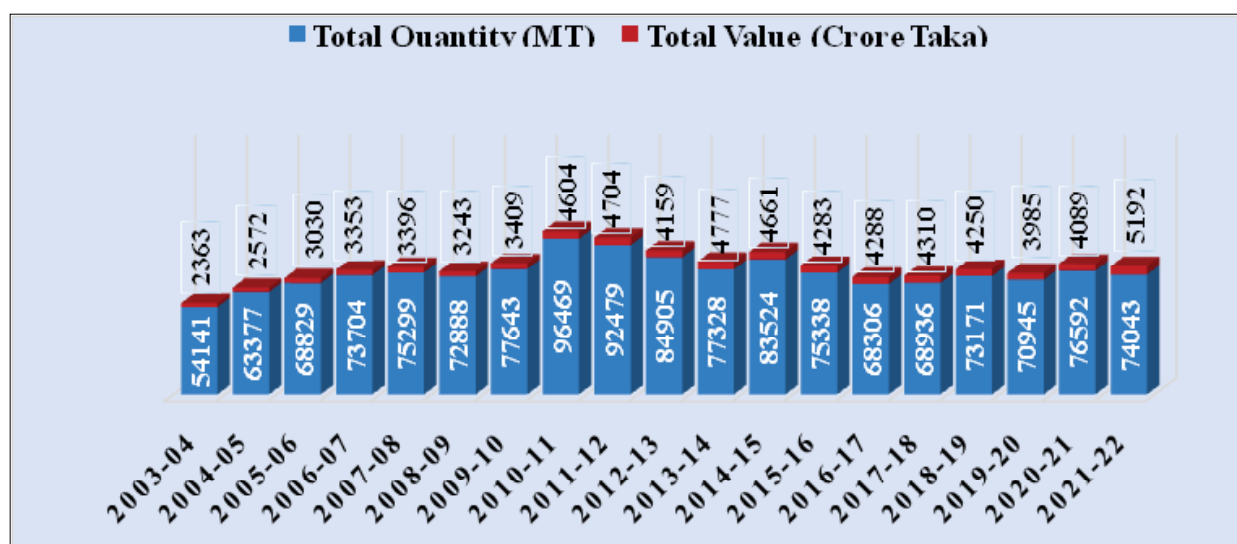
However, the seed quality of both finfish and shrimp/prawn is a major threat for aquaculture expansion. Fish seed deteriorated mainly of inbreeding and scarcity of quality brood stock, while shrimp seed quality deteriorated due to scarcity of virus-free mother shrimp. Open water capture fishery has been shrinking and availability of indigenous fish's species natural brood stock and parent genetic resources in rivers, canals, haor, beel, etc. declining rapidly.

#### **Export of Fish and Fisheries Products**

Fish and fishery products are one of the major export commodities of Bangladesh. Mainly galda, bagda, harina and other species of shrimp and different marine fishes like sea bass, datina, pomfret, cuttle fish, crab, cuchia etc. are exported from Bangladesh. Besides these, dry fish, shark, finfish scale and shrimp shell are also exported. Bangladeshi fish and fishery products are exported to more than 50 countries including European Union (EU), USA, Japan, Russia, China etc. EU countries are the major importers of

Bangladeshi fish and fishery products. In the fiscal year 2021-22, Bangladesh earned 5191.75 crore taka by exporting 74042.67 MT of fish and fishery products. During last two decades, the export trends and corresponding foreign earnings (in crore) are shown in the following graph (Fig. 12).

Shrimp is one of the major export items in Bangladesh. Total shrimp and prawn production including capture has been increased from 1.40 lakh MT in 2000-01 to 2.61 lakh MT in 2021-22 and its current growth rate is 3.65%. Coastal aquaculture both shrimp and prawn and finfish farming are expanding, and total shrimp and prawn production have been increased over the last 20 years, which are shown in the following graph (Fig. 12). Several government initiatives including zoning of shrimp areas, official ban of wild shrimp fry from nature, shrimp farming infrastructure development, quality certification system and farmer training programmes contributed to this growth. Several initiatives, including training of farmers on Good Aquaculture Practice (GAP), implementation of National Residue Control Plan (NRCP), modernization of fish quality control laboratories, etc. attributed to the export success.



**Fig-12: Last two decades export trends of fish and fishery products and corresponding foreign earnings**

### 3.3.3 Vision, Mission, Objectives and Targets

**Constitutional Obligation:** According to the article 15 of the constitution of Bangladesh- it shall be a fundamental responsibility of the state to securing citizens with i) provision of the basic necessities of life, including food; and ii) right to work or right to guaranteed employment at a reasonable wage. It is a fundamental responsibility of the state to ensure availability of required quantity and quality of fish for the citizen and creation of employment opportunities in fisheries sub-sector.

#### Vision and Mission

**Vision:** The main vision of Fisheries sector is to achieve self sufficiency in animal protein supply to ensure food and nutrition security, environmental conservation and socio-economic development of the country.

**Mission:** To support sustainable growth in fish and shrimp production with other aquatic resources for domestic consumption and exports, and management of open-water fisheries resources through community participation leading to equitable distribution of the benefits for optimal economic and social growth in Bangladesh.



## **Mission Statement of DoF (2008)**

The mission of Fisheries Sector is to support sustainable growth in fish and shrimp production with other aquatic resources as well, for domestic consumption and exports, and management of open water fisheries resources through community participation leading to equitable distribution of the benefits generated, for optimal economic and social growth in Bangladesh

### **Overall Objectives:**

The overall objective of fisheries sector were to enhance productivity, food security, improvement of livelihood adopting climate change challenges and equitable distribution of benefits along with conserving the potential fisheries resources and aquatic biodiversity.

The overall objective of the fisheries sub-sector in the 8<sup>th</sup> FYP is to support sustainable growth in fish and shrimp production with other aquatic resources for domestic consumption and exports by managing openwater fisheries resources, exploring blue economy through community participation leading to equitable distribution of the benefits for optimal economic and social growth, and reducing post-harvest loss.

### **The strategic objectives for the sub-sector are to:**

- Enhance fisheries resources and production;
- Alleviate poverty through creating self-employment and improvement of socio-economic conditions of the fisheries;
- Achieve economic growth and earn foreign currency by exporting fish and fisheries products;
- Manage resources including manpower development for ensuring optimum productivity, sustainability of production and conservation of fisheries resources;
- Establish and maintain fish and wetland sanctuaries which include ban on fishing in certain eco-sensitive areas; including sundarban and peripheral estuaries
- Harness the potential of blue economy, stock assessment and management of marine fisheries and promote sustainable exploitation of marine fishes, especially tuna like other pelagic fishing;
- Develop value chain in fish and fisheries products, and
- Ensure safe and quality fish supplies in the domestic and international market.

### **Targets:**

The major targets of government are to:

- Increase 21% aquaculture and 17% fish production by 2025 from baseline;
- Increase 20% hilsa and 9% marine fisheries production by 2025;
- Raise per capita protein intake to 64 g/day from domestically produced fish and fisheries product by 2025;
- Raise export to 0.85 lakh MT by 2025 from frozen shrimp, fish and value added fish products;
- Ensure quality and safe seed and feed at growers level;
- Reappear at least 85% of endangered fish species in sanctuary area by 2025 from baseline;

- Creation of more (20%) employment opportunity for unemployed youths;
- Raise fish farmers/ fishers income to 30% by 2025;
- Participation of women in aquaculture production, fisheries CBOs/Co-management and fish/shrimp processing industries increase to 30%;
- Identify potential areas for proclamation of marine protected areas by 2030;
- Good Aquaculture Practice (GAP) and Good Manufacturing Practice (GMP) at all stages of fish/shrimp supply chain to comply international market; and
- Maintain food safety measures for domestic markets.

### 3.3.4 Policies and Strategies for Supporting Fisheries Sub-Sector

The most relevant government policy of fisheries sub-sector was the National Fisheries Policy (NFP)-1998, which aims to:

- Enhance fisheries production;
- Alleviate poverty through creating self-employment and improved socio-economic conditions of the fishers and farmers;
- Fulfill the demand of animal protein;
- Achieve economic growth through earning foreign currency by exporting fish/shrimp; and
- Maintain ecological balance and conserve biodiversity.

On the basis of NFP-1998, National Fisheries Strategy (NFS)-2006 was formulated with a number of buildingblock strategies and action plans, which constitutes specific 8 different sub-strategies:

- Aquaculture;
- Aquaculture extension;
- Inland capture fisheries;
- Marine fisheries;
- Shrimp;
- Monitoring and evaluation;
- Human resource development; and
- Quality control.

The Department of Fisheries (DoF) has taken different policies and action plan to achieve the targets of Sustainable Development Goals (SDGs), Vision 2021 as well as perspective plan to achieve four strategic objectives:

- Social development: to enhance the health and well-being of the people through production of nutritious food and development of productive and secure livelihoods;
- Economic development: to stimulate more economic activities in rural communities, create more rural employment opportunities, increase incomes of rural households, and save or earn foreign exchange through import substitution or and/or more export earnings;

- Ecological health: to promote the conservation of aquatic biodiversity, enhancement of genetic resources, conservation of natural resources, and ecological resilience; and
- Strong institutions: to establish an enabling environment and develop capability to manage the sector effectively, provide support services needed for sustainable and responsible development and help to facilitate an equitable and fair allocation of resources and distribution of benefits.

### **Strategic objectives in the 8<sup>th</sup> FYP plan**

The strategic objectives in the 8<sup>th</sup> FYP plan for the fisheries sub-sector will be achieved by increasing fish production targets as set out in Table 16. The plan targets to increase the participation of women in aquaculture production, fisheries, CBOs/Co-management and fish/shrimp processing industries by 30%. Good Aquaculture Practice (GAP) and Good Manufacturing Practice (GMP) will be promoted at all stages of fish/shrimp supply chain to comply international standard.

**Inland Aquaculture:** Culture fisheries being the major sources of fisheries growth in the country, further environment friendly and cost-effective intensification in pond aquaculture and brackish water shrimp farming areas, coastal aquaculture diversification and productivity enhancement will be required to meet the growing demand in the country. On this ground, the 8FYP will focus on sustainability (environmentally, socially and economically compatible) and quality (improved food safety and traceability for compliance) of the fish production and management system. A proper safeguarding mechanism for the landless and marginal farmers will be developed against any type of natural and non-natural shocks. Supply of genetically improved quality fish seed/fingerlings and fish feeds through private sector will remain an important strategy for culture fisheries. Promoting small indigenous species in conjunction with pond carp culture will be given importance to enhance diversification in fish protein consumption for better dietary/nutritional uptake.

The Bangladesh Fisheries Research Institute (BFRI) will work on new varieties and technological development and provide technical support to the Department of fisheries (DoF), which will be responsible for dissemination at the field level. The DoF will also work extensively on developing capacity of the farmers through skill development programs.

### **Strategies for Inland Freshwater Aquaculture Development**

The following priority strategies have been identified for aquaculture development:

- Aquaculture intensification (up to certain environmental and socio-economical sustainability level) and species diversification will be promoted;
- Farm mechanization and vertical expansion of aquaculture will be the major priority along with reducing cost for sustaining and diversifying of aquaculture production;
- Climate resilient, environment-friendly Green Aquaculture technologies (eg. IAA - Integrated AgricultureAquaculture system) will be encouraged in small scale and medium scale aquaculture with maximum utilization of available local inputs and renewable resources
- For commercial aquaculture & Poultry sector, to reduce dependence on competitive imported based animal feed/inputs, policy & technological support will be provided for local resources based feed ingredients and animal feed production;
- Fish health management strategy and aquaculture policy will be adopted and implemented for sustaining development of the fisheries sector;

- Introduction of adaptive climate resilient aquaculture technologies and fisheries management system for the poor fish farmers/fishers of coastal region through training and farm demonstration;
- Operation of hatcheries, nurseries and supply of spawn and fry, in which the private sector is the key player, will be constantly monitored by GO-NGO collaboration and public- private partnerships;
- Production, import and marketing of fish and shrimp feed, feed ingredients, minerals and vitamin premix, and other inputs will be monitored constantly (under well defined M& E and Regulatory framework) ;
- Pen culture and cage culture in the flood plains, with individual/multiple cooperative ownership will be encouraged which can certainly contribute to productivity;
- Aquaculture and conservation will be restructured to reinforce the strengths of each other, sustainable
- Community-based flood plain aquaculture will be combined with maintaining sanctuaries and restocking of indigenous species;
- Natural breeding, spawning, nursery and grow-out areas will be conserved to complete the whole lifecycle and natural reproduction process to ensure genetically pure brood stock and quality fingerlings;
- Transportation and rearing in the hatcheries will be facilitated to ensure supply of virus-free shrimp PL, all hatcheries will ensure PCR testing of both mother shrimps and shrimp PL (under regulatory control);
- Community organizations of shrimp/crabs/finfish farmers and other primary stakeholders will be supported with technology, input, financing and market linkage by contract growing system run by the processing plants and/or monitored by the DoF and partner NGOs;
- Strengthening capacity of the producers/stakeholders/VC actors through the fisheries value chain along with regular systematic monitoring, documentation of activities generating IT data base for auditing and certification to ensure implication of prescribed GAP/GHP/GMP.
- Development and maintaining of tractability system to identify the sources/routes of contaminants/ banned antibiotics and other hazardous chemicals used for fish farming and fish processing times so as to take lawful and corrective measures to improve/ratify them;
- Increasing fish production by introducing different fish culture methods /natural conservation management promoting habitat restoration, fish sanctuaries under the community enterprise approach in suitable/threatened habitats by conserving natural environment in inland open water areas including rice-cum-/alternate fish culture;
- Extension support and research extension linkages will be strengthened; and
- Climate resilient, eco-friendly and cost-effective sustainable aquaculture and fisheries technology promoting under SME support for youth enterprises and create employment opportunities for both rural and urban areas. RAS of fish production for landless and marginal farmers and also in the urban areas.

## Coastal Aquaculture

The main constraints to the expansion of sustainable shrimp farming and coastal aquaculture are inadequacy of proper water management infrastructure, scarcity of good quality/ virus-free shrimp and prawn post larvae, inadequate technology support, social conflicts on competing water and land uses and the benefits and cost sharing, and failure to maintain quality between harvest to processing and tracing the sources of contamination. Therefore, the following strategies will be implemented:

### Strategies for Coastal Aquaculture

- Government will define shrimp farming zones (resources mapping) in the coastal region based on natural advantages of shrimp and prawn farming considering environmental facilities, impacts of climate change and agriculture transformation trends along with rehabilitate water management infrastructure in each zone to optimize production and environmental sustainability;
- Different technologies of aquaculture practices diversified with available species and cluster farming system will be promoted in different zones depending on agro-ecological suitability;
- Special emphasis will be given for management and conservation of Sundarban and peripheral estuaries ecosystem to restore biodiversity, retain genetic resources and facilitate breeding, nursery and grazing ground for coastal and marine species enhancing marine catch and coastal aquaculture productivity;
- Introduction of SPF shrimp by private sector, which is duly facilitated, monitored and regulatory controlled by the government;
- Brood Management Center (BMC) will be established for availability of virus free captive mother shrimp for production of virus-free shrimp PL which is becoming scarce from sea;
- Conservation of genetic resources of shrimp and prawn parent stock and their harvest by stress-free trawling, transportation and rearing in the hatcheries will be facilitated;
- To ensure supply of virus-free shrimp PL, all hatcheries will ensure PCR test of both mother shrimp and shrimp PL and DoF will provide monitoring, quality control and certification of PL quality for both galda and bagda hatcheries;
- Import of both galda and bagda PL will be controlled, including illegal border trading;
- Beside shrimp/Prawn, breeding technology and hatchery facilities will be develop for other important coastal/marine fin fishes, mollusks and crustaceans species like sea bass, mullet, cat fishes, crabs etc for enhancing coastal aquaculture diversification and productivity
- Extension support and research extension linkage will be strengthened regarding seaweed, shrimp/ prawn, crab/shell & fin fishes and cuchia (eel) farming in coastal area;
- Community organizations/Clusters of shrimp/fish farmers and other primary stakeholders will be supported with technology, input, financing and market linkage by contract growing system run by the GO/NGOs, private sector entrepreneurs, processing industry under strictly monitoring by the GoB/DoF and assigned partner NGOs;
- Traceability of supply source will be ensured by contract growing and marketing system which will also ensure supply of virus-free PL, good quality and contamination-free feed and other inputs at reasonable price; and
- Ensure define trail of e-Traceability and subsequently screening throughout the supply chain.

## Open Water Capture Fisheries

Inland open water fisheries playing important role as accessible animal protein sources supporting food and nutrition security, employment and livelihoods for poor rural people. Open water fisheries is the natural habitat, spawning and nursery ground of our all indigenous species and sources of genetic resources for hatchery to ensure supply of quality fish seed for aquaculture. The open water capture fishery is an important source of livelihood and protein for rural households. But this habitat has been adversely affected by environmental degradation due to different factors like pollution, river erosion, siltation, embankment which ultimately affecting breeding and spawning grounds of many indigenous fish species. Inland open water resources will be conserved in a sustainable way and prior emphasis has given to improve productivity during the 8<sup>th</sup> FYP.

### Strategies for Inland open water Fisheries

The following strategies will be implemented:

- Inland unused water resources will be conserved and developed for fish production;
- Pollution control of river and lakes will be a major focus for government agencies;
- prevent further deterioration of water logging, blockade of water-flows and shrinkage of water bodies because of unplanned infrastructures like embankments, roads, urban housing projects and industrialization;
- Any development projects must follow the environmental rules and regulations, SEAP, (Land and water reclamation policy/acts) and incorporate adequate mitigation measures in consultation with the relevant Ministries/Agencies like Ministry of Fisheries and Livestock, MoLGRDC, MoAg, MoWR, MoEFCC and other concerned;
- Projects and program will be implemented to construct and maintain fish-passes and fish-friendly regulators;
- Fish and wetland sanctuaries which will be established with complete ban on fishing in certain eco-sensitive areas like the Sundarbans, parts of Kaptai Lake, and several sections of the river Halda, selected beels and haor areas and certain sections of the Bay of Bengal, etc.;
- Permanent fish sanctuary for habitat restoration in selected beels, haors, baors, lakes will be encouraged by engaging CBFM approach. Support will be provided to conserving 20-25% areas re-excavating in each water bodies retaining 2-2.5 meter water depth in dry season and strictly maintained with never-fishing restricted zone for safe habitat and let them allow to freely breed during rainy season over the flooded areas under regulatory measures
- For sustainable hilsa fish production, Maximum Sustainable Yield (MSY) will be determined and strongly monitoring. Community based Fisheries Management (CBFM) and Ecosystem Management approach (EAFM) and other precautionary measures will be applied to avoid overfishing. Management of Hilsa sanctuary will be strengthened. Measures will also be taken to improve hilsa marketing system and its value chain;
- The Fish Act 1950 will be strictly implanted, and if needed, the act will be revised;
- Fishermen will have access to social safety sets like VGD and VGF and alternative livelihoods AIGA support during the ban/restriction periods of fish catching;

- Proper insurance schemes for the fishers/fish farmers will be made available; and
- The fishermen will be organized in sustainable community based organizations and such organizations will be given biological production based management and conservation responsibility of khas jalmohal on long term basis so that they conserve rather than just exploit resources.

### **Marine Fisheries Resources**

- Marine fisheries resource is an important component of the blue economy. The strategies for marine fisheries in the 8<sup>th</sup>FYP plan are aligned with the perspective plan 2041 and the Bangladesh delta plan 2100. The present status, trends, opportunities and significance of the coastal and marine fisheries resources has been elaborately discussed in the previous chapter (page: 6-9). The major challenges to achieving the expected outcomes from marine fisheries resources and explore the scope of Blue economy are as follows:
- Survey on marine fisheries stocks assessment
- IUU (illegal, unreported and unregulated) fishing
- Destructive fishing, catching of juveniles
- Shift in climate change paradigm and livelihood transformation
- Marine and coastal water pollution
- Degradation of highly productive coastal and near-shore marine habitats
- Adoption of mariculture (sea bass, mullet, native species etc.)
- Diversification and intensification CR coastal aquaculture
- Monitoring, Control and Surveillance (MCS)
- Shortage of skilled manpower

### **Strategies for Marine Fisheries Resources**

To facing and overcome the above challenges, the following strategies will be undertaken:

- Institutional capacity building of DoF and concerned agencies in terms of HRD and infrastructure for strengthening of monitoring control and surveillance system (MCS) in EEZ and ABNJ areas of Bangladesh in Bay of Bengal
- Formulation of National Marine Fisheries Policy & updating regulations (Marine Fisheries Act, 2019)
- More study and research efforts to identify the trends of abundance or decline in catch, breeding, nursery and migration of commercially important species, their ecological status, habitat and relevant science based information for deciding policy/acts regarding conservation and exploration
- Resources mapping of the coastal and marine resources for spatial Planning, Zoning and identification of the Ecological and Climate zone specific marine aquaculture, conservation, sanctuaries areas, potential fishing grounds for marine catch and Marine Protected Areas
- Regular, periodic & rapid assessment of fisheries stocks by species and provide science based data, information for policy decision making regarding TCA and marine resources harvest

- Determine maximum sustainable yield (MSY) along with strictly regulate total allowable catch (TCA) (quota) thorough assessment on a regular basis;
- Identify conservation needs and methods that can be effectively administered and regularly continuing with necessary capacity building enhancing regulated and responsible fishing
- Restrict and control poaching of marine resources combating IUU fishing along with control over illegal entry of foreign fishing vessels;
- Collaborative efforts for strengthening MCS involving Coast Guard/Navy/ Riverine Police/ Local Administration and other agencies clearly defining their roles and responsibilities
- Modernize existing MCS with IT based system, introduction of Vessel Tracking and Monitoring System (VTMS) along with land and onboard vessel inspection and monitoring of the catch
- Establishment of Marine Surveillances Check Post (17) and Joint Monitoring Centers (JMC) at different strategic locations around the 710 km Coastal areas under satellite monitoring coverage
- Promote mariculture with potential species, including seaweed culture
- Explore the potentials of deep sea fishing by assessing, managing and conserving maximum sustainable yields (MSY) for each stocks
- Livelihood transformation of fishers with AIGA, resources conservation, EAFM, CCRF and Climate resilient programs
- Digital marine fisheries resource mapping (DMFRM) for the marine waters using digital cartography of the marine fisheries resources is an essential tool for efficient and sustainable harvesting of the marine resources.
- A common DMFRM can be developed for SAARC countries that will be very useful to all the countries and at the same time will save the required investment in this respect;
- Collaborative effort for distant water fishing (beyond 200 meter of EEZ and ABNJ) to explore and exploit tuna and large pelagic fishes;
- Establish MPAs (marine protected areas) as breeding and grazing grounds, conserving biodiversity
- Registration of all mechanized/non-mechanized fishing boats and providing fishing license, providing GPRS Connected AIS devices with connectivity, vessel insurance and financial accessibility with soft loan
- Providing Marine Fisher's Smart ID Card with GPS & Mobile phone set connectivity, Life insurance, their hands on training on marine resources conservation, fishing rules/regulations, fish harvesting, Post-harvest handling, storage and transportation and communications and regular data recording of catch
- Training will also provided on sea safety, navigation, machinery maintenance, disaster risk management, early warning & signaling system and protection from natural disasters, sea pirates, illegal fishing trawlers and several other factors
- Establishment of a central data base for assessment, management and exploration of marine resources, MCS and research purposes.



## Other Strategies:

The other important strategies specific to fisheries sub sector are:

- Private sector investment will be encouraged for fisheries productions through entire value chain;
- Public-Private Partnerships (PPP) for both in-country and joint-venture foreign investment will be encouraged for large scale safe and quality fisheries production, processing and value addition to promote agro-based industries targeting international market enhancing employment and export earnings;
- Motivational activities for farmers/ entrepreneurs will be taken to adopt eco-friendly farming practices through farm mechanization, optimizing feed/inputs uses preserving soil-water health
- Application of Information and Communication Technology (ICT) will be promoted to disseminate fisheries information and modern technology in the remote areas of the country for facilitating fisheries activities particularly the aquaculture and fisheries management regimes;
- Promulgation of new acts, laws, rules, regulations, aligned with SDG targets;
- New development projects and programs will be undertaken aiming the specific SDG targets,
- Develop skilled/trained manpower to operate modern laboratory as well as processing plants;
- Being fishers community beside coastal and marine environment are highly vulnerable to the climate change, draught, salinity intrusion, cyclone and numbers of natural diasters, special consideration will be given to their livelihood transformation;
- Regular and long-term study/research on change of biodiversity, impact of sanctuary, habitat restoration; physical, chemical and biological changes of inland and marine open water bodies, fish production, fish migration and socioeconomic condition of fisher folk will be implemented; and
- Collaboration and coordination among ministries, department and agencies will be strengthened along with their clearly defining roles & responsibility framework and coordination mechanism
- Besides, considering the huge demand for hygienic dry fish in the country and abroad, DoF and the Bangladesh Fisheries Development Corporation (BFDC) will take initiative to establish modern shutki mohal in different strategic locations of the country to produce hygienic dry fish.
- The shipbuilding industry in Bangladesh is getting a boost with the developments in the fisheries sector. To explore the blue Economy opportunity, our ship building industry will be engaged for manufacturing safe and efficient artisanal fishing trawlers and Deep Sea Fishing vessels for our fishing and export to other fishing nations
- Our skilled and very energetic, brave fisherman has good demands in neighboring fishing nations like Maldives, Sri Lanka, Oman, Bahrain, Thailand, Malaysia, Indonesia and other countries. Providing necessary training as required by the importing countries, strong initiative will be undertaken to export skilled manpower (fisherman) for export earning as well as reducing fishing pressure in Bay of Bengal under Bangladesh.

- A lot of fishing trawlers, barges, tugs and vessels fishing/shipping in Bangladesh requires repair, maintenance and servicing support in docking/undocking/building facilities. The existing BFDC established dockyard at the Chattogram Fish Harbors and Pathorghata Fish Landing Centre is inadequate against demands. To enhance the existing facilities, another two-channel slipway has recently been constructed at the Chattogram Fish Harbour. In order to expend the docking facilities for fishing boats, more dockyards will be established at different strategic locations in coastal areas.

**Table 22: Projected production and demand of fishes in the 8FYP**

Sl No	Source of water bodies	Baseline (2020-21)			Projection (2024-25)		
		Water area ('000 ha)	Total production ('000 MT)	Production (kg/ha)	Water area ('000 ha)	Total production ('000 MT)	Production (kg/ha)
<b>Open water</b>							
1	River and estuaries	854.00	331.00	0.388	854.00	395.70	0.46
2	Sundarbans	177.00	19.20	0.108	177.70	20.00	0.11
3	Beel	114.16	105.40	0.923	114.16	110.4	0.97
4	Kaptai Lake	69.00	10.60	0.154	69.00	11.00	0.16
5	Floodplain/Haor	2617.00	818.40	0.313	2617.00	825.06	0.32
<b>Total open water</b>		<b>3831.86</b>	<b>1284.60</b>		<b>3831.86</b>	<b>1362.16</b>	
<b>Aquaculture</b>							
6	Pond/Dighi	371.00	2032.20	5.478	371.00	2333.30	6.29
7	Baor	5.00	8.50	1.700	5.00	8.84	1.77
8	Seasonal cultured water-body	131.00	230.90	1.763	131.00	252.26	1.93
9	Shrimp/prawn Farm	275.00	271.40	0.987	275.00	295.60	1.07
10	Crab	98.54	12.80	0.130	98.54	14.00	0.14
11	Pen culture	5.29	10.60	2.004	5.29	11.08	2.09
12	Cage culture	0.013	4.30	330.769	0.013	4.60	353.85
<b>Total aquaculture</b>		<b>885.84</b>	<b>2570.70</b>		<b>885.84</b>	<b>2919.68</b>	
<b>Marine water</b>							
13	Marine Artisanal		569.40			583.00	
14	Marine Industrial (Trawler)		127.70			130.16	
<b>Total marine water</b>			<b>697.10</b>			<b>713.16</b>	
<b>Grand total</b>			<b>4552.40</b>			<b>4995.00</b>	
<b>Total demand</b>			<b>4552.40*</b>			<b>4552.00*</b>	

(DoF, 2019)

\*Including other uses fish (export + fish meal + wastage),

\*\* Considering 60 gram per capita consumption and BBS projected population growth (Source: DoF, 2019).

Table 23. Resources based fish production until 7<sup>th</sup> FYP, Projected in 8<sup>th</sup> FYP and achieved (until 2021-22)

Sector of Fisheries	Production (MT)												Growth Rate % (2021-22)		
	1983-84	1993-94	2003-04	2013-14	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22					
<b>A. Inland Fisheries</b>															
1. River and Estuary	207766	143425	137337	167373	271639	320598	325478	331793	337051	342545					1.63
2. Sundarbans	7783	7127	15242	18366	18086	18225	18282	21007	21544	24259					12.60
3. Beel	51373	55592	74328	88911	98117	99197	99890	103104	104871	105573					0.67
4. Kaptai Lake	4057	6635	7238	8179	9982	10152	10578	12696	12345	17937					45.30
5. Floodplain	200616	360597	497922	712976	765782	768367	781481	779801	825433	831317					0.71
<b>Capture Total</b>	<b>471595</b>	<b>573376</b>	<b>732067</b>	<b>995805</b>	<b>1163606</b>	<b>1216539</b>	<b>1235709</b>	<b>1248401</b>	<b>1301244</b>	<b>1321631</b>					<b>1.57</b>
6. Pond	107944	222542	795810	1526160	1833118	1900298	1974632	2046258	2090787	2166715					3.63
7. Seasonal Cultured Waterbody	0	0	0	193303	215547	216353	217340	225948	226608	231692					2.24
8. Baor	862	2201	4282	6514	8002	8072	10343	10969	11319	11685					3.23
9. Shrimp/Prawn Farm	8219	39447	114660	216447	246406	254367	258039	270114	278417	287497					3.26
10. Crab	0	0	0	0	14421	11787	12084	12562	12337	13397					8.59
11. Pen Culture	0	0	0	13054	13368	11015	12361	13425	14282	15063					5.47
12. Cage Culture	0	0	0	1447	2490	3523	3802	4590	4995	5021					0.52
<b>Culture Total</b>	<b>117025</b>	<b>264190</b>	<b>914752</b>	<b>1956925</b>	<b>2333352</b>	<b>2405415</b>	<b>2488601</b>	<b>2583866</b>	<b>2638745</b>	<b>2731070</b>					<b>3.50</b>
<b>Inland Fisheries Total (A)</b>	<b>588620</b>	<b>837566</b>	<b>1646819</b>	<b>2952730</b>	<b>3496958</b>	<b>3621954</b>	<b>3724310</b>	<b>3832267</b>	<b>3939989</b>	<b>4052701</b>					<b>2.86</b>
<b>10. B. Marine Fisheries</b>															
13. Industrial (Trawler Fishing)	14500	12454	32606	76885	108479	120087	107236	115354	119121	137170					15.15
14. Artisanal	150382	240590	422601	518500	528997	534600	552675	555750	562118	568860					1.20
<b>Marine Fisheries Total (B)</b>	<b>164882</b>	<b>253044</b>	<b>455207</b>	<b>595385</b>	<b>637476</b>	<b>654687</b>	<b>659911</b>	<b>671104</b>	<b>681239</b>	<b>706030</b>					<b>3.64</b>
<b>Total Fish Production (A+B)</b>	<b>753502</b>	<b>1090610</b>	<b>2102026</b>	<b>3548115</b>	<b>4134434</b>	<b>4276641</b>	<b>4384221</b>	<b>4503371</b>	<b>4621228</b>	<b>4758731</b>					<b>2.98</b>

### 3.5.5 Institutional Capacity and Coordination of the Fisheries sub-Sector

Implementation of Institutional Mechanism to attain the target of 8<sup>th</sup> FYP, covering input indicators (resources, policy changes, etc.), covering output indicators, and covering impact indicators. The Institutional Mechanism for 8<sup>th</sup> FYP Progress Monitoring Indicators are shown in the following Table 23.

**Table 24: Implementation of Institutional Mechanism for 8<sup>th</sup> FYP Progress Monitoring Indicators**

SI No	8 <sup>th</sup> FYP Target to Attain	Input Indicators ( Resource/Policy Changes etc. )	Output Indicators	Impact Indicators
01	Attain self-sufficiency in aquaculture and fisheries production and generate surplus for export	<ul style="list-style-type: none"> <li>Number and areas (ha) of farms and area under aquaculture, such as- pond, shrimp gher, floodplain, baor, pen culture, cage culture etc</li> <li>Number of farmers trained;</li> <li>CBOs assisted, number of benefited members; and</li> <li>Marketing of quality fish fry, shrimp PL, feed and other inputs.</li> </ul>	<ul style="list-style-type: none"> <li>Production and yield (kg/ha) by production system, species, location and trend;</li> <li>Export quantity by major species and export value, trend over the years;</li> <li>Per capita fish consumption.</li> </ul>	<ul style="list-style-type: none"> <li>Increased income of fish farmers/ fishers;</li> <li>Poverty reduced among fish farmers/fishers;</li> <li>Increased employment in aquaculture &amp; fisheries.</li> <li>Increased availability and accessibility to fish enhanced overall food &amp; nutrition security</li> </ul>
02	Improve conservation of aquatic biodiversity in inland open waterbodies	<ul style="list-style-type: none"> <li>Number and area of Jalmohal under long term lease and sustainable co-management approach;</li> <li>Number of CBOs and fisher households assisted and direct assistance per fisher; Species wise quantity of fingerling stock;</li> <li>Number and area under sanctuary and habitat restoration; and</li> <li>Number of fish passes and fish friendly regulators established and functional.</li> </ul>	<ul style="list-style-type: none"> <li>Species wise fish caught by season, area and trend over the years;</li> <li>Catch per unit effort by season, area and trend;</li> <li>Income of fisher households improved.</li> </ul>	<ul style="list-style-type: none"> <li>Species diversity improved;</li> <li>Endangered species reappear;</li> <li>Poverty reduced among in the fishing communities; and</li> <li>Fisheries CBOs attain sustainability.</li> </ul>
03	Enhance coastal and marine fisheries production	<ul style="list-style-type: none"> <li>Area under sustainable management approach;</li> <li>Number of CBOs/fisher-folk households assisted and direct assistance per fisher;</li> <li>Stock assessment of resources; and</li> <li>Area coverage under mariculture.</li> </ul>	<ul style="list-style-type: none"> <li>Species wise fish caught by season, area and trend over the years;</li> <li>Catch per unit effort by season, area and trend; and</li> <li>Income of fisher households improved.</li> </ul>	<ul style="list-style-type: none"> <li>Species diversity improved;</li> <li>Poverty reduced among in the fishing communities;</li> <li>Fisheries CBOs attain sustainability.</li> </ul>
04	More income and equitable distribution of benefits	<ul style="list-style-type: none"> <li>Number of fisher and fish farmer households assisted particularly female-headed and other distressed households;</li> <li>Number of CBOs assisted, number of women members in CBOs; and</li> <li>Number of CBO members trained, provided inputs and benefits.</li> </ul>	<ul style="list-style-type: none"> <li>Increased income- % increase; and</li> <li>Number of self and employment created by sex and IGA category.</li> </ul>	<ul style="list-style-type: none"> <li>Poverty reduced in the target communities; and</li> <li>Target water bodies have increased biodiversity.</li> </ul>

SI No	8 <sup>th</sup> FYP Target to Attain	Input Indicators ( Resource/Policy Changes etc. )	Output Indicators	Impact Indicators
05	Improve food safety	<ul style="list-style-type: none"> <li>Restrict the use of hazardous chemicals in fish and shrimp feed, hatcheries, nurseries, farms, processing and preservation;</li> <li>Number of drives to enforce such restriction, offences identified, punished, penalty amounts realized and number imprisoned; and</li> <li>Number of CBOs, farms, fisher groups, depots, ice plants, processing plants, hatcheries, nurseries, feed mills, traders, etc. in the supply chain linked to Quality Control and Traceability System.</li> </ul>	<ul style="list-style-type: none"> <li>Number of rejection in the foreign ports reduced</li> <li>Number of exporter and processors complying international standards increased and their share in export increased.</li> <li>Percentage of sample tested for quality in the local markets increase over the years</li> </ul>	<ul style="list-style-type: none"> <li>Country Image improved for exporting quality product</li> <li>Local consumers' have better access to safe fish and fish products</li> </ul>
06	Strengthen implementation capacity of the concerned GoB agencies, NGOs, LGBs and CBOs	<ul style="list-style-type: none"> <li>Number of vacancies in the professional level and in the districts, upazila, research stations, training institutes etc. below 10%;</li> <li>Laboratory, offices, projects etc. have required equipment, logistics, operating fund and authority to execute project/ programme without fear;</li> <li>Number of officers and support staff are trained, have needed skills, understanding of rules and procedures, delegation of authority etc. so that are comfortable to work without hesitation and fear; and</li> <li>Number of GoB agency officer/ staff reoriented to added role in facilitation, GO-NGO collaboration, public-private partnership, CBO and NGO capacity building and networking; rather than direct implementation or control of anything and everything.</li> </ul>	<ul style="list-style-type: none"> <li>Average time (month) needed to prepare/ revise TPP/DPP, briefing reports, proposal for creating new posts, revenue programme; monthly and quarterly progress report etc;</li> <li>Average time (days) needed to process and approve proposals in the ministry and agency level;</li> <li>Average time needed to prepare procurement plan and procure goods, works, services (months); and</li> <li>Physical and financial progress of projects and programmes improved 90-100% by year end.</li> </ul>	<ul style="list-style-type: none"> <li>Decision making smoother, faster and transparent;</li> <li>Services delivered more efficiently; and</li> <li>Extension service delivery (number of fish farmers and fishers served) increase at least 10 % annually.</li> </ul>

**Human resources development (HRD):** The HRD is an important component of any development planning and takes at least a generation to develop skilled manpower. Therefore, it is important to have proper manpower and career planning for fisheries sub-sector and have matching program for HRD. The HRD is required at all levels starting from grassroots farmers, land less labor, women, unemployed rural youths at the primary level to technicians, managers, entrepreneurs, at the secondary level and scientists, lecturers and teachers at the tertiary level. While primary level training should be organized nationally, the secondary level may be in the region and tertiary on the global basis. In order to utilize the human resources properly, those trained in secondary and tertiary levels in specific field should be provide ample opportunities for their career advancement, otherwise they leave for better opportunities elsewhere and the sector loses a trained hand which become counterproductive for the actual development of the sector.

**Institutional capacity development:** The fisheries sub-sector pays much importance in strengthening the capabilities of its officials, researchers and administrative personnel through in-country and overseas long term (MS and PhD) and short term training programs, study tours and sabbatical with

the support from national and international agencies including BARC, IDA, BTA, MONBUSHU, USAID, FAO/UNDP, EU, JICA, Dutch, DFID, NACA, IDRC, WorldFish, etc. The short term training programs on research and/or project planning/ designing and management, fisheries extension program, office management, computer programming, etc. will be organized periodically to develop the skill of researcher, administrative personnel and staffs in the subsector.

### 3.3.6 Challenges of Fisheries Sub-sector

The fisheries sub- sector performed quite well during the 7<sup>th</sup> FYP period but the sector is confronting with the following challenges which are hindering the overall development of the sub-sector:

**Degradation of natural habitat:** Production from the four million hectares of seasonal flood land which is the most important component of inland fishery, includes floodplains, beels and rivers are the main hub of fish production in Bangladesh. However, encroachment and degradation of natural resources, rapid urbanization and infrastructure investments etc., which negatively impacted fisheries and increased pollution.

**Inland capture fisheries:** The inland capture fisheries is now shrinking mainly because of over-fishing, use of destructive gears, silting up of water bodies, closure of natural fish passes, non-fishers' control of the jalmohal by malpractices in lease and by encroachment, and pollution of water bodies by agro-chemicals, industrial wastes and urban sewers etc. The result is sharp decline of inland capture fisheries, which were the main sources of livelihoods of the poor fishers and a source of free protein supply for many rural households.

**Inland aquaculture:** The inland aquaculture is undergoing multiple challenges including poor brood stock management, inadequacy of the supply of fish and shrimp spawn and fries of desired quality and from reliable source at reasonable price, low availability of reliable and quality fish feed at reasonable cost, spread of infectious diseases of both fish and shrimp, lack of institutional capacity to assist with the needed extension service, ensure supply of quality inputs, quality of the produce, and supply chain development etc.

**Brackish water aquaculture:** Shrimp and brackish water aquaculture have been growing over the last four decades but the productivity remains low. The processors and hatcheries have created excess capacity; shrimp production could not reach the desired and potential level. One reason is that the shrimp farms, particularly the brackish water bagda farms, use very traditional and extensive method, hence yield remains very low (about 200 kg/ha). Golda farming is facing scarcity of feed while bagda farming is facing scarcity of good quality and virus- free fry called post larvae (PL).

**Marine fisheries resources:** Marine fisheries are experiencing a decline in its share in total fish production shrinking from almost 18% in 2009-10. Key challenges include, overcapacity of fishing effort, infringement of rules and regulations, entry of illegal fishing vessels and poaching in the Bangladesh EEZ, long gap exploratory survey on stocks assessment, intense and over fishing deploying destructive and illegal gears, shift in the climate change paradigm, illegal, unreported and regulated (IUU) fishing, destructive fishing, pollution, catching of juveniles, degradation of highly productive coastal and near-shore marine habitats like coral reefs, mangroves, estuaries, spawning and nursing grounds seriously impacts our marine fisheries productivity disrupting ecosystem function etc.

**Export and marketing:** The role of BFDC in fish and fish product processing, transportation and marketing is decreasing and the private sector role expanding fast. The product quality control

measures were limited to export, particularly of shrimp. Even then, it was not possible to adequately comply with the maintenance of HACCP standard and experienced return of containers for detection of hazardous chemicals. For such problems, shrimp export, particularly in the EU countries was hampered and temporarily stopped.

**Climate change:** The major long-term environmental concerns and global climate change is the most serious issue and addressing coastal and freshwater fisheries by changing temperature, siltation, inundation, river bank erosion and salinity regimes.

**Supply chain disruptions due to Covid-19:** The outbreak of Covid-19 pandemic have implications for the fisheries sub-sector in the short to medium term likely, the impact of restricted economic activities on the fisheries and aquaculture sector is difficult to assess at the time preparing this document. For wild-capture fisheries, the inability of fishing vessels to operate (due to limited demand as well as social distancing measures being difficult to abide by on board a vessel) can generate a domino effect throughout the value chains in terms of supply of products. The consequence of Covid-19 pandemic induced disruption of fisheries pandemic and supply chain.

**Other challenges:** Other challenges include scarcity of quality fish fry and fingerlings; inadequacy of quality fish feeds and farm inputs, inadequate infrastructure for processing, transportation and marketing of fish and fish products; inadequate post-harvest management system; adverse impacts of climate change; threatened aquatic biodiversity, inadequate human resources, traceability and HACCP with respect to shrimp export and logistic support and knowledge gap of the producers; and limited facilities for research and development for production up-gradation.

### **3.3.7 Linkage and Cross-cutting Issues between Institutions and Agencies**

The overall research, training, extension and management activities of the fisheries sub-sector are carried out in close cooperation, and the linkages with various national and international organizations/agencies were also developed. The sub-sector also keeps close contact with public extension organizations, different NGOs for disseminating the technologies and obtaining feedback from them. The BFRI collaborates with national universities and maintains close liaison for fisheries research and development. Among the various international linkages of BFRI and DoF: FAO-UN, the World Bank (WB), International Development Agency (IDA), JICA, EU, DANIDA, Dutch, IFAD, WorldFish, ACIAR/CSIRO, NACA, DFID and GIZ are the important partner in the sub-sector. Among the national collaborators, the main focus implies to the Department of Fisheries (DoF) followed by Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Department of Agricultural Extension (DAE), Department of Environment, Department of Forest; and close cooperation, linkages and joint research and development programmes with different NGOs are performed. The national universities including Bangladesh Agricultural University (BAU), Chittagong University and Chittagong Veterinary and Animal Science University, Rajshahi University, etc. are linked with BFRI through contract research programmes and exchange of expertise and training.

### **3.3.8 The Indicators for Sustainable Development Goals**

The indicators of SDGs for the development of fisheries sub-sector as: fish farmers/ fishers income raise by 20% by 2020; creation of more up to 25% employment opportunity for unemployed youths; participation of women in aquaculture production, fisheries CBOs and fish/ shrimp processing increase to 25%; raise per capita protein intake to 60 g from domestically produced fish and fisheries product by 2020; Good aquaculture practices (GAP) and Good manufacturing practices (GMP) at all stages

of fish/ shrimp supply chain to comply international market, and food safety measures for domestic markets; diversified coastal aquaculture management; reappear at least 75% of endangered fish species in sanctuary area by 2020 from baseline production; increased 20% hilsa fish production from baseline (2012-13) production of 3.51 lakh MT by 2020; facilities development of entrepreneurship for commercial fisheries production; introduction of mariculture by 2020; increased 18% marine fisheries production from baseline (2012-13) production of 589 lakh MT by 2020; enhance coastal and marine fisheries production in line with blue economy initiatives; and establishment of hygienic fish landing, preservation and distribution facilities and provides facilities for berthing of fishing boats, repairing of fishing crafts and gears which will reduce the post-harvest loss.

The following Table-23 describes the project/program for intervention with indicative budget to achieve the SDGs target and BDP 2100:

**Table 25: Projects/Action to achieve the Targets of 8<sup>th</sup> FYP (indicative cost in lac BDT at FY 2019-20 prices)**

SI No	Name of Project/Action) Attain	Indicative Cost	Linked to		Assigned Agency
			SDGs Target	BDP 2100 Measures	
01	National Agricultural Technology Programme Phase II (NATP-2)	38,828.00 (Completed)	1.1, 1.2, 1.3, 2.1, 2.3	Comply with goals 1 and 6, cover six geographical hotspots.	DoF
02	Greater Jessore District Fisheries Development Project	3,916.44 (Completed)	1.1, 1.2, 1.3, 2.1, 2.3	Comply with goals 1 and 6.	DoF
03	Brood Bank Establishment (Phase III)	6,225.58 (Completed)	1.1, 1.2, 1.3, 2.1	Comply with goals 4 and 6.	DoF
04	Enhancement of Fish Production Through Restoration of Waterbodies	9,215.09	1.1, 1.2, 1.3, 1.5, 2.1, 2.3	Comply with goals 4 and 6	DoF
05	Greater Cumilla Fisheries Development Project	21,131.00 (Completed)	1.1, 1.2, 1.3, 1.5, 2.1, 2.3	Comply with goals 1 and 6, geographically the project also comply with haor and flash flood areas hotspot.	DoF
06	Expansion of Aquaculture Technology Services up to Union Level Project (Phase II)	27,058.00 (Completed)	1.1, 1.2, 1.3, 1.5, 2.1, 2.3	Comply with goals 1 and 6, cover six geographical hotspot.	BFRI, DoF
07	Enhanced Coastal Fisheries (ECOFISH)	3,022.00 (Completed)	-	Comply with goals 1, 5 and 6, geographically the project also comply with coastal zone hotspot.	DoF
08	Fisheries Development Project in Rangpur Division	6,997.00 (Completed)	1.1, 1.2, 1.3, 1.5, 2.1, 2.3	Comply with goals 1 and 6, geographically the project also comply with the hotspot-Barind and drought prone areas.	DoF
09	Fisheries Resources Development Project in Rajshahi Division	4,747.00 (Completed)	1.1, 1.2, 1.3, 1.5, 2.1, 2.3	Comply with goal 1 and 6, geographically the project also comply with the hotspot-Barind and drought prone areas.	DoF



SI No	Name of Project/Action) Attain	Indicative Cost	Linked to		Assigned Agency
			SDGs Target	BDP 2100 Measures	
10	Sustainable Coastal and Marine Fisheries Project in Bangladesh	18,6887.00 (on-going)	1.1, 1.2, 1.3, 1.5, 2.1, 2.3, 2.5, 14.2, 14.4, 14.5, 14.7, 14.c	Comply with goals 1, 5 and 6; geographically the project also complies with coastal zone hotspot.	DoF
11	Hilsa Fisheries Development and Management Project	21,483.00 (on-going)	1.1, 1.2, 1.3, 1.5, 2.1, 2.3, 2.5	Comply with goals 1, 5 Comply with goals 3, 4 and 5; geographically the project also complies with the hotspot-coastal zone; river system and estuaries.	DoF
12	Development and Management of the Natural Breeding Ground of Halda River	7,787.00 (Pipeline)	1.1, 1.2, 1.3, 1.5, 2.1, 2.3, 2.5	Comply with goals 3, 4 and 6; geographically the project also complies with the hotspot-river system and estuaries.	DoF
13	Chattogram Hill Tracts Fisheries Resources Development Project	15,056.00 (on-going)	1.1, 1.2, 1.3, 2.1, 2.3	Comply with goals 1, 3, 4 and 6; geographically the project also complies with the hotspot-Chattogram hill tract.	DoF
14	Conservation and Development of Indigenous Fish and Snail Project	31,260.94 (on-going)	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	Comply with goals 1, 3 and 6; geographically the project also complies with the hotspot-River system and estuaries.	DoF
15	Promoting Safety Compliance of Fish and Fishery Products in Bangladesh	21,735.00 (Pipeline)	1.1, 1.2, 1.3, 2.1, 2.3, 8.2, 12.3	-	DoF, BFDC, BFRI
16	Development of Fisheries Resources in Inland Open Water bodies Project	1,48,571.50 (Proposed)	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	Comply with goals 1, 3 and 6; geographically cover six geographical hotspots.	DoF
17	Aquaculture and Fisheries Management Project in Haor Area (Phase II)	34,090.00 (Pipeline)	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	Comply with goal 1, 2, 4, 5 and 6; geographically the project also complies with the hotspot-haor and flash flood areas.	DoF
18	Infrastructure Development for Increasing Safe Fish Production	1,58,095.00 (Proposed)	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	Comply with goals 1 and 6; covering six geographical hotspots.	BFDC
19	Pilot Project on Tuna and Similar Pelagic Fishing in Deep Sea Project	14,007.00 (on-going)	1.1, 1.2, 1.3, 2.1, 2.2, 2.5, 14.2, 14.4, 14.5, 14.7, 14.c	Comply with goals 5 and 6; geographically the project also complies with coastal zone hotspot.	DoF
20	Management of Shrimp and Finfish Aquaculture in the Coastal Area	57,893.00 (Proposed)	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	Comply with goals 5 and 6; geographically the project also comply with coastal zone; river system and estuaries hotspot.	DoF

SI No	Name of Project/Action) Attain	Indicative Cost	Linked to		Assigned Agency
			SDGs Target	BDP 2100 Measures	
21	Community-based Climate Resilient Fisheries and Aquaculture Development in Bangladesh	12,500.00 (on-going)	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	Comply with goals 1, 3, 4 and 6; geographically the project also comply with coastal zone, river system and estuaries hotspot.	DoF
22	Climate Smart Agricultural Water Management Project (DoF Part)	10,125.00 (on-going)	1.1, 1.2, 1.3, 2.1, 2.2, 2.5, 14.2, 14.7	Comply with goals 2, 5 and 6; cover six geographical hotspots.	DoF
23	Fisheries Development Project in Mymensingh Division	17,000.00	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	Comply with goals 2, 5 and 6; geographically the project also complies with haor and flash flood areas.	DoF

## Gap Identification

Bangladesh achieved self-sufficiency in fish production with a per capita fish consumption of 62.58 g/day against set target of 60 g/day. In the recent year, fish production was satisfactory. If this growth of fish production continues, the fish production in the country is expected to be 45.52 lakh MT by 2020-21. The following Table-25 shows the present situation with gaps of the fisheries sub-sector.

**Table 26: Addressing the Programme, Provision, Present Situation and Gaps of the Fisheries Sub-sector**

SI No	Programme	Provision	Present Situation	Gaps
01	Training of fish farmers/ fishers	Fish farmers/fishers should continue to be provided with technical support and training to develop their skill and efficiencies.	There are not enough technical support and training available to compensate the fish farmers/ fishers in the field.	The training and new technologies needs to be expanded in field with technical manpower.
02	Food security/social safety net for the fishers	Seasonal unemployment is faced by fishers due to hilsa banning period, marine banning period, natural calamities, etc. During this period, they need special food security programmes/VGF.	The MoFL has been creating a database of all bona fide fishermen. The MoDMR implements the VGF programme for fishers out of work. The registration process would facilitate identification of bonafide fishers.	Proper coordination is required between MoFL and MoDMR for social safety net programmes for the fishers. Moreover, besides Hilsa fishers, the VGF program should be extended coastal fishers including Sundarbans, marine waters and Kaptai lake.
03	Quality assurance of fish and fish products	Challenges for the public sector to provide regulatory oversight and quality assurance, and play facilitative role with appropriate quality control mechanism, so the private sector continues to innovate and invest in the supply chain development.	The finfish product quality control measures are limited to export, particularly of shrimp. It is not possible to adequately comply with the maintenance of HACCP standard and experienced return of containers for detection of hazardous chemicals. For such problems, shrimp/fish/crab export are hampered and occasionally stopped.	To overcome the situation, laboratory facilities of DoF and other GoB agencies would be enhanced with trained manpower and equipment. The processing plants should be compelled and an international accreditation system should be established.
04	Linkage/ collaboration development	Collaboration between the Ministry of Fisheries and Livestock and other relevant ministries like MoEF, MoWR, MoA, MoDM is essential.	DoF, Bangladesh Fisheries Development Corporation, Bangladesh Fisheries Research Institute, universities and the private sector should also participate in the proposed interventions.	An enabling policy environment will be needed for promotion of public-private partnerships and enhanced participation of private sector entrepreneurs.

SI No	Programme	Provision	Present Situation	Gaps
05	Capacity building	Strengthening the capabilities of officials, researchers and administrative personnel through in-country and overseas long and short term training programs.	There is not enough program for capacity building in DoF, BFRI, BFDC and as well as in MoFL available to compensate the personnel in field situation.	Proper policy would be introduced to organize training programs to develop the skill of researcher, extension and administrative personnel and staffs.
06	Policy support	In order to accelerate the development activities of the fisheries sector, the government has already developed a number of policies, laws and regulations.	The final draft of National Marine Fisheries Policy 2018, Quality Control Regulation has been prepared by the Ministry of Fisheries and Livestock.	To disseminate the policies, awareness programs among stakeholder will be developed.
07	Strengthening research	Among the national collaborators, definitely the main focus implies to the BFRI and DoF followed by DoEF, BARI and development partners.	The overall research, training and management activities are carried out in close cooperation and linkages with various national and international organizations/agencies by the BFRI.	To establish linkage among BFRI, DoF and others relevant agencies.
08	Implementing SDGs	The fisheries sub-sector develop under the targets of SDGs.	MoFL has taken different policies and action plan to achieve the targets of Sustainable Development Goals (SDGs). The ministry declared 3188 km <sup>2</sup> Marine Protected Area in the Nijhumdweep which cover 4.73% of the marine territorial waters under the SDG goal 14.5.	To follow the SDGs in the sector, a relation will develop among DoF, BFDC, BFRI and private sector.
09	Blue economy concept	The Blue economy concept incorporated in the fisheries subsector.	Area under sustainable management approach, stock assessment of resources and area coverage under mariculture has been developed.	Skilled manpower will develop through policy development.
10	BDP 2100	BDP 2100 is important to develop the sub-sector	-	-

### 3.3.9 Identification of Programmes for Intervention

**Fingerling stocking and beel nursery activities:** The Ministry of Fisheries and Livestock initiated regular programme to release fingerlings of major carp in open water bodies, floodplains and closed water bodies throughout the country. The DoF continued the program for establishing beel nurseries in suitable water bodies to increase natural production in beel areas and the surrounding linked water bodies i.e. low laying rice field, floodplain, other beels, canals, rivers etc. In the last five years, a total of 3,560 MT of fish fries were released in the open water and 3967 beel nurseries were established. Moreover, 2,050 MT of additional fish is being produced annually from the open water of the country and the supply of animal protein have increased at the local level along with increasing the income of the fishermen and beneficiaries dependent on the open water bodies.

**Establishment of fish sanctuaries:** Establishment of aquatic sanctuary is one of the effective tools for conserving the fish stock, protecting biodiversity and increasing fish production. A total of 432 fish sanctuaries are operating by the local beneficiaries in different selective water bodies. Among those, 426 sanctuary were established in inland water containing 848.73 ha (including 547.61 ha Halda river sanctuary) and six hilsa sanctuaries containing total length of 432 km. There is abundance of endangered species like chital, foli, kalibaosh, air, tengra, meni, rani, swarputi, pabda, kajoli, gojar, tarabaim, fish productions etc. for the establishment of fish sanctuary, which increased up to 45% in all the areas of the sanctuary.

**Protection and conservation program for hilsa:** The government is implementing a unique coordinated management programme to protect Jatka and brood hilsa. A coordinated effort are executing by the DoF officials, local administration, Coast Guard, Bangladesh Navy, fishers and mass people residing the hilsa rich river system. Government has adopted policies for the protection, conservation and production of hilsa are: i) during the ban period (Nov. to Jun.), the Jatka fishers receive an annual allowance so that their livelihood do not hampered; ii) provides incentives and distributes trade materials to the enlisted Jatka fishers as Alternative Income Generation (AIG) activities; iii) increase public awareness to stop Jatka fishing (the Jatka Protection Act has been incremented from November to June); iv) protection mother hilsa in peak spawning season (total 22 days), through different public awareness programme and enforcement of law; v) celebrating the Jatka conservation week for creating social awareness; and vi) special combing operation lead to destroy illegal fishing net. The social safety net programme is also strengthening to protect the fishers during the Jatka ban period and during the conservation of brood hilsa in peak spawning period for 22 days. Thus, the hilsa production increased to 5,17,000 MT in 2017-18 against 2,99,000 MT in 2008-09.

**Marine fisheries resources management:** Bangladesh established her legitimate right in 1,18,813 km<sup>2</sup> area of the Bay of Bengal resolving dispute over maritime boundary with Myanmar and India during 2012 and 2014, respectively, settled by the International Tribunal on the Law of the Sea (ITLOS) and International Court of Arbitrations. This verdict ensures the sovereign right to explore exploit and manage living and non-living resources in the Exclusive Economic Zone (EEZ). This verdict also open the opportunity for Bangladesh to harness the potential from the sea to promote and strength her blue economy for wellbeing of the nation. Ministry of Fisheries and Livestock has already taken different pragmatic initiatives like short-term, mid-term and long-term action plan to ensure conservation, sustainable development and harness the potentials of the marine resources, the following initiatives are developing: i) identified fish and crustacean in the Bay of Bengal by the research and survey vessel RV Mean Sandhani; ii) developed stock assessment of marine fisheries resources by FAO in the Bay of Bengal; iii) installed vessel tracking monitoring system (VTMS) in industrial trawlers; iv) developed marine surveillance check post in Chattogram; v) developed the Area Beyond National Jurisdiction (ABNJ) to exploit the tuna fishes due to blue economy potential; vi) conserved the breeding ground and protect fishes in the EEZ; vii) achieved the membership of the Indian Ocean Tuna Commission (IOTC); viii) Tuna with other pelagic fishing at deep sea under process to explore the blue economy potentials; ix) FAO is implementing a regional Technical Cooperation Project on “Support to countries to address Illegal Unreported and Unregulated Fishing (IUU)” with joint collaboration among Bangladesh, Cambodia, Myanmar, Thailand and Vietnam; x) protected the breeding and nursery ground through converting the bottom trawler into mid water trawler; xi) developed skill manpower for marine fisheries exploitation, management and survey; and xii) The ministry declared 3,188 km<sup>2</sup> Marine Protected Area in the Nijhumdweep which covers 4.73% of the marine territorial waters under the SDG goal 14.5.

**Shrimp production activities:** Shrimp is one of the most important exportable merchandise in Bangladesh. With the increasing demand in the international market, the number of shrimp farm in coastal area is expanding. The shrimp farming area increased from 6,400 ha (2001-02) to 2,58,000 ha (2017-18); as a result, the shrimp production increased approximately 0.98 lac MT (2001-02) to 2.54 lac MT (2017-18). Motivational and training programme were conducted to increase the awareness about product's quality and safety to comply with Hazard Analysis and Critical Control Point (HACCAP) and international obligations. Besides, traceability in aquaculture and processed products are being implemented and taskforce activities related to develop HACCAP system in every stage from hatchery

to consumers. In the shrimp sector to implement traceability about 2.07 lac shrimp farms were registered. The shrimp and prawn culture/production activities are increasing through advanced culture management and contact farming system. Bangladesh Aquaculture Association (BAA) is formed to develop eco-friendly shrimp culture in the country. The Good Aquaculture Practice (GAP) is going to involve private sectors for quality assurance. Shrimp zoning activity is running to increase galda and bagda shrimp culture, about 46 galda and 49 bagdahatcheries were established both in government and private sector. In 2017-18, 1,417.25 crore shrimp PL were produced both in government and private hatcheries. Bangladesh earned foreign currencies equivalent to about Tk. 3,088.85 crore (365.54 Million USD) during 2018-19 exporting by 33,362.52 MT frozen shrimp.

**Export of fisheries products and supply of healthy and safe fish:** Fish and fisheries product are the major export products of Bangladesh. In order to ensure the healthy and safe food in the international market, fish quality control programs are implemented in three international standard laboratories located in Dhaka, Chattogram and Khulna operated by DoF. Those laboratories were accredited by the Bangladesh Accreditation Board (BAB) and achieved international standard. The Hazard Analysis and Critical Control Point (HACCP) system has been ensured at every level of production of fish and fishery products. As the part of implementing the traceability system in the shrimp processing sector, the registration process of about 27,000 shrimp farms and 90,651 commercial fish farms already completed. Bangladesh achieves noteworthy advancement in exporting fish and fishery products through training of farmers on Good Aquaculture Practice (GAP), implementation of National Residue Control Plan (NRCP), and rules/ regulations, modernization of fish quality control laboratories, etc. In 2018-19, Bangladesh earned Tk 4,250.31 crore by exporting 73,171.32 MT fish and fish products (Table-26).

**Table 27: Export earnings of fish and fisheries products**

Financial year	Amount (MT)	Earnings (Crore Taka)
2009-2010	77,643.29	3,408.51
2010-2011	96,469.23	4,603.67
2011-2012	92,479.18	4,703.95
2012-2013	84,904.50	3,412.61
2013-2014	77,328.86	4,898.22
2014-2015	83,524.37	4,662.60
2015-2016	75,337.93	4,282.82
2016-2017	68,305.68	4,287.64
2017-2018	68,935.70	4,309.94
2018-2019	73,171.32	4,250.31

Source: Department of Fisheries (2019), MoFL.

**Research activities for fisheries management:** Fisheries research needs to be upgraded to continue the flow of technology generation in line with socio-economical and environmental transformations. Various policies of other ministries impinge upon fisheries sub-sector development because these policies regulate the availability of, access to and use pattern of the open water bodies. These need to be coordinated and a necessary legal framework needs to be formulated. Quality assurance in fish harvesting, processing, marketing and export need to be especially emphasized and appropriate actions undertaken.

**Fisheries policy/acts/rules:** In order to accelerate the development activities of the fisheries sector, the government has already developed a number of policies, laws and regulations, which are as

Fish Hatchery Act-2010, Fish Hatchery Rules-2010, Fish and Animal Feed Act-2010, Government Water Management Policy-2009, National Shrimp Policy-2014, and Fisheries Quarantine Act-2017. A final draft of National Marine Fisheries Policy-2018 has been submitted to the Ministry of Fisheries and Livestock in October 2019 by DoF. Apart from these, the legislative updating of the Fisheries Inspection and Quality Control Act-2019 and Bangladesh Marine Fisheries Act, 2019 has been enacted by the parliament. In addition, the policy of providing financial assistance to the families of the dead fishermen or permanently disabled fishermen-2019 has been approved by the Government.

**ICT in fisheries:** The Ministry of Fisheries and Livestock developed a dynamic website ([www.fisheries.gov.bd](http://www.fisheries.gov.bd)) to build the fisheries sector digitally by 2021. In addition, DoF has launched four mobile apps for culture activities and disease management in fish and shrimp throughout the country. IOT device can be included for fisheries productivity for disseminating to the stakeholders.

**Inland capture fisheries:** Considering the enormous potentials of the inland capture fisheries, GoB has taken up programmes to supplement fish stock in natural water bodies by releasing fish fingerlings of various indigenous species and selected exotic species. The GoB has also taken up programs to enhance natural stock by establishing beel nurseries, maintaining sanctuaries, habitat restoration by re-excavation of canals, constructing fish passes reopening the important migratory routes, etc. Maintaining sanctuaries combining banned seasons, gear restrictions and protected areas is hindered by inability of the government to provide alternative livelihood support to fishermen. During the last decades, visible positive impacts due to Social Safety Net programme is evident in hilsa fishery management. In spite of its potential, this segment is not flourishing mainly because of overfishing, use of destructive gears, silting up of water bodies, closure of natural fish passes, non-fishers' control of the jalmohal by mal-practices in lease and by encroachment; and pollution of water bodies by agro-chemicals, industrial wastes and urban sewers etc. Thus, fish availability in the rivers, estuaries, beel, haor, baor, Kaptai Lake and Sundarbans remained static or a very discouraging growth trend.

**Inland aquaculture:** The inland aquaculture experienced fastest growth mainly due to new technologies, species and intensification and improvement of farming particularly in pond aquaculture. This has been accompanied by some new challenges: (i) poor brood stock management; (ii) inadequacy of supplying fish, shrimp/prawn, crab/ chuchia spawn and fries of desired quality and from reliable source at reasonable price; (iii) low availability of reliable and quality fish feed/aqua-medicine at reasonable cost, (iv) spread of infectious diseases of both fish and shrimp; (v) lack of institutional capacity to assist the extension service; (vi) water quality management; (vii) scale up the fish production by farm mechanization; (viii) supply chain development; (ix) introduction of insurance in aquaculture; (x) incentive to promote aquaculture; and (xi) impacts of climate change on aquaculture. The support provided for sustainable development of inland aquaculture in nationwide extension by DoF. Inadequacy of field level manpower is the main constraint in this regard. Another constraint is scarcity of quality fish fry and fingerling. Private hatcheries have developed all over the country and they produce more than enough fish fry. But, due to lack of proper supervision and monitoring from the GoB, the quality cannot be ensured. Besides, pond aquaculture and converting crop land to fish ponds, seasonal flood plain aquaculture expanded. This has contributed to rapid increase of fish production up to 1.322 million MT in 2021-22 annually. However, some risk of reducing aquatic biodiversity already under threat. To mitigate this, floodplain aquaculture should combine maintaining sanctuaries in the important beel and haor areas and natural flow of water should also further enhanced. This must include maintaining sanctuaries in parts of the beel covered by flood plain aquaculture, rearing fries of various indigenous species in nurseries and supplementing natural stock.

**Coastal aquaculture/shrimp farming:** Coastal aquaculture (brackish water shrimp and finfish aquaculture) expanded but it experienced several threats including food safety issues along with value chain and the inadequacy in social compliance, both affecting export. Another important constraint is the scarcity of virus-free shrimp fry (PL). Private entrepreneurs operating most of the shrimp hatcheries and all processing plants are highly organized and influence both market mechanism and policy support, while the farmers are least organized and scattered. Thus, community level organizations of farmers deserve support in order to ensure better extension service delivery, traceability, enhanced productivity and quality. While the processors and hatcheries have created excess capacity, shrimp production could not reach the desired and potential level. One reason is that the shrimp farms, particularly the brackish water bagda farms, use very traditional and extensive method, hence yield remains very low. In this context, GoB has taken necessary initiatives through introducing good aquaculture practices (GAP). Indiscriminate killing of fish fries of various species while shrimp fry collection contributed to resource depletion and therefore the government imposed ban on shrimp fry collection from the natural water bodies. The eco-sensitive areas should be protected first followed by sanctuaries in the relatively accessible areas where enforcement can be better administered. Also be taken necessary initiatives to flourish the enormous fisheries resource potentials of the Sundarbans, one of the world richest breeding and nursery grounds of potential aquatic animal.

**Marine fisheries management:** The marine fisheries resources imparts crucial role in the economy of Bangladesh contributing about 18% of the total fisheries production. The Bay of Bengal is one of the world's 64 Large Marine Ecosystems that generates wealth for the wellbeing of the surrounded eight maritime nations. A number of confronting issues like overcapacity of fishing effort, infringement of rules and regulations, entry of illegal fishing vessels and poaching in the Exclusive Economic Zone (EEZ), long gap exploratory survey on stocks assessment, intense and overfishing deploying destructive and illegal gears, shift in climate change paradigm, IUU-fishing, destructive fishing, pollution, catching of juveniles, degradation of highly productive coastal and near-shore marine habitats like coral reefs, mangroves, estuaries, spawning and nursing grounds seriously impact the marine fisheries productivity disrupting ecosystem function. The recent verdict given by the International Tribunal for the Law of the Sea (ITLOS) and International Arbitration Tribunal over dispute of maritime boundary with Myanmar and India legitimately settles the EEZ of Bangladesh up to 200 nautical miles from the baseline comprising 118,813 km<sup>2</sup> of maritime waters. In order to establish a comprehensive plan for sustainable conservation, management and exploitation of resources from the sovereign marine waters, the present status of fisheries resources and its future potential for the national economy needs to be framed out. The strategies and actions shall include: (i) stock assessment in conjunction to explore new fishing grounds; (ii) stock assessment by Research Vessel; and (iii) formulation of National Marine Fisheries Policy.

**Fish marketing:** Bangladesh Fisheries Development Corporation (BFDC) is involved in the processing, transportation and marketing of fish and fisheries product. Their role is now decreasing, with the private sector expanding. The government should provide regulatory oversight and quality assurance and play a more facilitative role providing appropriate extension and technology dissemination services, so that private sector continues to innovate and invest in the supply chain.

**Fish quality assurance:** For quality control, laboratory capacity of DoF and other GoB agencies should be enhanced, not only by procuring equipment, but also with trained manpower and provision of operating expenses. The processing plants should be compelled to establish and manage own QC labs and follow international accreditation system. This strategy has been proven successful in China and

is likely to yield good result in Bangladesh. These should include adequacy of policies, appropriateness of institutional framework and human resource development capability.

In addition, the Department of Fisheries should take action for deteriorating open water capture fisheries which include:

- i. consider environmental carrying capacity;
- ii. improve brood stock management and quality seed production;
- iii. conserve genetic diversity;
- iv. rationalize fish species and technology for aquaculture;
- v. improve food safety issues and bio-safety measures;
- vi. maintain minimum water depth and water flows;
- vii. establish and rehabilitation of fish sanctuary;
- viii. operate beel nursery and stocking of endangered species;
- ix. develop and implement fisheries management regulations;
- x. promote integrated coastal resource management;
- xi. maintain ecosystem; and xii. control pollution.

**Research and development:** The overall research, training and management activities are carried out in close cooperation and linkages with various national and international organizations/agencies by the BFRI. Among the national collaborators, the main focus implies to the DoF followed by BARI, BRRI, DAE, Department of Forest and joint research with different NGOs. The national universities including BAU, CU, RU and CVASU are linked with BFRI through contract research programmes and exchange of expertise and training.

### 3.3.10 Estimation of Resource Allocation/Requirement

The fisheries sub-sector so far accomplished under projects, funded by bilateral or multilateral Development Partners and the trend is likely to continue in the future. However, some projections for future can be made on the basis of trends observed in the recent past. In the light of this experience, SAP targets have been developed for the 8<sup>th</sup> five years plan (Table 27).

**Table 28: Project Allocation for the Year 2021-2025**

Sl.	Name of programme	Total Allocation Lakh BDT)
1	National Agricultural Technology Programme Phase II (NATP-2)	38,828.00
2	Greater Jessore District Fisheries Development Project	3,916.44
3	Brood Bank Establishment (Phase III)	6,225.58
4	Enhancement of Fish Production Through Restoration of Water-bodies	9,215.09
5	Greater Cumilla Fisheries Development Project	21,131.00
6	Expansion of Aquaculture Technology Services up to Union Level Project (Phase II)	27,058.00
7	Enhanced Coastal Fisheries (ECOFISH)	3,022.00
8	Fisheries Development Project in Rangpur Division	6,997.00
9	Fisheries Resources Development Project in Rajshahi Division	4,747.00



Sl.	Name of programme	Total Allocation Lakh BDT)
10	Sustainable Coastal and Marine Fisheries Project In Bangladesh	18,6887.00
11	Hilsa Fisheries Development and Management Project	21,483.00
12	Development and Management of the Natural Breeding Ground of Halda River	7,787.00
13	Chattogram Hill Tracts Fisheries Resources Development Project	15,056.00
14	Conservation and Development of Indigenous Fish and Snail Project	31,260.94
15	Promoting Safety Compliance of Fish and Fishery Products in Bangladesh	21,735.00
16	Development of Fisheries Resources in Inland Open Water bodies Project	1,48,571.50
17	Aquaculture and Fisheries Management Project in Haor Area (Phase II)	34,090.00
18	Infrastructure Development for Increasing Safe Fish Production	,58,095.00
19	Pilot Project on Tuna and Similar Pelagic Fishing in Deep Sea Project	14,007.00
20	Management of Shrimp and Finfish Aquaculture in the Coastal Area	57,893.00
21	Community-based Climate Resilient Fisheries and Aquaculture Development in Bangladesh	12,500.00
22	Climate Smart Agricultural Water Management Project (DoF Part)	10,125.00
23	Fisheries Development Project in Mymensingh Division	17,000.00

### 3.3.11 Action Plan Framework

Action Plan is to provide a comprehensive picture of goals, performances, opportunities, challenges, and identify the policies and strategies with elaborate actions and tentative budget that support the upcoming 8<sup>th</sup> Five Year Plan and visions of the government. For addressing challenges of fisheries sub-sectors, diverse action would be taken for short, medium and long term basis starting from the launching of 8<sup>th</sup> five year plan (2021-2025). In order to enhance the implementation of the Fisheries sub-sector Action Plan, eight thematic categories and eight major thematic areas have been identified. The following Action plan (Table 28) along with responsible organizations and indicative budget is suggested. Analyzing the scopes and investment of the SAPA under different thematic areas, the key implementing agencies and partners involved are DoF, BFRI, BFDC, MFA, and etc.

**Table 29: Fisheries Sub-sector Action Framework and Investment Plan**

Thematic Category	Thematic Area	Action Plan	Area/ Zone	Indicative Budget (Lac BDT)	Performance indicator/ Targets		Implementing period	Risk/ Assumption	Implementing agency
					SDGs targetss	BDP 2100 goals			
TC1. Biodiversity	TA1. Productivity Enhancement	Conservation and development of indigenous fish and snail	Fresh water zone	31,260.94	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	1, 3, 6; hotspot-river system, estuaries	5 years (July 2023 -June 2027)	Habitat degradation	DoF, BFRI
TC2. Blue Economy	TA2. Coastal Fisheries	Sustainable coastal and marine fisheries in Bangladesh including sea weeds	Coastal water zone	1,86,887.00	1.1, 1.2, 1.3, 1.5, 2.1, 2.3, 2.5, 14.2, 14.4, 14.5, 14.7, 14.c	1, 5, 6, coastal zone hotspot	3 years (July 2023-June 2025)	Quality control	DoF

Thematic Category	Thematic Area	Action Plan	Area/ Zone	Indicative Budget (Lac BDT)	Performance indicator/ Targets		Implementing period	Risk/ Assumption	Implementing agency
					SDGs targetss	BDP 2100 goals			
TC2. Blue Economy	TA3. Marine Fisheries	Enhanced coastal fisheries (ECOFISH)	Coastal water zone	3,022.00	-	1, 5, 6, coastal zone hotspot	5 years (July 2023-June 2027)	Scarcity of quality feed and seed	DoF
		Pilot project on Tuna and similar pelagic fishing in deep sea	Marine water zone	14,007.00	1.1, 1.2, 1.3, 2.1, 2.2, 2.5, 14.2, 14.4, 14.5, 14.7, 14 .c	5, 6; coastal zone hotspot	3 years (July 2023-June 2025)	Preservation and transportation	DoF, BFDC
TC3. Capacity Development	TA4. Fisheries Extension	Expansion of aqua-culture technology services up to union level (P-II)	Fresh water and coastal water zones	27,058.00	1.1, 1.2, 1.3, 1.5, 2.1, 2.3	1, 6	5 years (July 2023-June 2027)	Monitoring	DoF, BFRI
	TA5. Food Safety	Infrastructure development for increasing safe fish production	All over the country	1,58,095.00	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	1, 6; geographically hotspots	5 years (July 2023-June 2027)	Environment	DoF, BFRI, BFDC
TC4. Climate change	TA6. Climate Adaptation	Community-based climate resilient fisheries and aquaculture development	Fresh and coastal water zones	12,500.00	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	1, 3, 4, 6; coastal zone, river system and estuaries hotspot	3 years (July 2023-June 2025)	Skilled manpower	DoF, BFRI
TC5. Conservation	TA7. Productivity Enhancement	Enhancement of fish production through restoration of water bodies	Fresh water zone	29,215.09	1.1, 1.2, 1.3, 1.5, 2.1, 2.3	4, 6	5 years (July 2023-June 2027)	Degradation of habitats	DoF
	TA8. Gene Pool Conservation	Development, and management of pollution for control for natural breeding ground of Halda River and Sundarban area	Open water	7,787.00	1.1, 1.2, 1.3, 1.5, 2.1, 2.3, 2.5	3, 4, 6, hotspot river system	5 years (July 2023-June 2027)	Habitat degradation	DoF, BFRI
TC6. Coastal aquaculture	TA9. Productivity Enhancement	Management of shrimp and finfish aquaculture in the coastal area	Coastal water zone	57,893.00	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	5, 6; coastal zone; river system and estuaries hotspot	3 years (July 2023-June 2025)	Skilled personnel	DoF, BFDC

Thematic Category	Thematic Area	Action Plan	Area/ Zone	Indicative Budget (Lac BDT)	Performance indicator/ Targets		Implementing period	Risk/ Assumption	Implementing agency
					SDGs targetss	BDP 2100 goals			
TC7. Food security	TA10. Food Safety	Promoting safety compliance of fish and fishery products in Bangladesh	All over the country	21,735.00	1.1, 1.2, 1.3, 2.1, 2.3, 8.2, 12.3	1, 3, 4, 6; coastal zone, river system and estuaries hotspot	5 years (July 2023-June 2027)	Improved remarkably	Technology dissemination
TC8. Open water Fisheries	TA11. Hilsa Fisheries	Hilsa fisheries development and management	Marine and coastal water zone	21,483.00	1.1, 1.2, 1.3, 1.5, 2.1, 2.3, 2.5	3, 4, 5, coastal zone hotspot	5 years (July 2023-June 2027)	Stakeholder rehabilitation	DoF, BFRI
	TA12. Productivity Enhancement	Aquaculture and fisheries management in haor area (P-II) including small indigenous fishes	Marine and coastal water (open water)	34,090.00	1.1, 1.2, 1.3, 2.1, 2.2, 2.5	1, 2, 4, 5, 6; hotspot-haor and flash flood areas.	5 years (July 2023-June 2027)	Transportation	DoF, BFRI, BFDC

### 3.3.12 The Way Forward

Based on the data, reports, KIIs, discussion with policy makers and experts the following recommendations are suggested.

**Social security:** Strengthen social/ food security programmes for the fishermen as well as poor fishermen during seasonal unemployment through proper coordination among MoFL, DoF, BFRI, BFDC and private sector. Develop small-scale aquaculture through access to quality inputs, advice and skills: Proposed prioritized interventions as well as promotion of small-scale aquaculture practices with quality feeds, fingerlings and drugs and the enhancement of disease diagnosis facilities in the field offices of DoF will be enhanced. Backyard ponds for smallscale aquaculture should be developed by addressing the constraints faced by stakeholders.

**Improve management of fisheries resources:** Priority interventions including community-based management of open-water fisheries through training and access to credit; excavation of water bodies for fish breeding; and the establishment of local hatcheries to ensure the supply of quality brood stock/fingerlings will be improved.

**Develop public-private partnerships for infrastructure and services development:** Development of partnerships is proposed to promote the establishment of hatcheries, feed and fish processing industries with backward and forward linkages; the establishment of cold storage and cold chains; and the production of quality fingerling, feed and drugs.

**Promote production of shrimp through community-based management:** Promote production in the southern region through sustainable shrimp and prawn development and community-based co-management of wetlands. In this regard, proposed interventions are: marine and brackish water fisheries resources management and capacity development; zoning of land for shrimp production; development of fish breeding grounds in the brackish water system; diversification of coastal aquaculture (crab, mussels, seaweeds, shrimp, tilapia etc.) and promotion of technology for integrated use of embankment areas for fish production.

**Collaboration/Consideration:** Collaboration between the Ministry of Fisheries and Livestock and Ministry of Water Resources is essential. The DoF, Bangladesh Fisheries Development Corporation, Bangladesh Fisheries Research Institute, universities and the private sector should also participate in the proposed interventions. It will be important to involve community-based organizations as well as the private sector. An enabling policy environment will be needed for promotion of public–private partnerships and enhanced participation of private sector entrepreneurs. In particular, the sustainability of lease arrangements must be improved to enable effective community-based management of open-water fisheries.

**Sustainable Marine Fisheries Harvesting:** The marine fisheries resources will be harvested on the sustainable basis of demand for export and local consumption.

**Internet of Things (IoT) Device:** It will be better to include IOT Device for fisheries productivity for diversifying it to the stakeholders. The device can be programmed to check water qualities such as temperature, pH, DO and other water parameters. IOT technologies have revolutionized fish farming process and impacted in many ways, including receiving real time data about water quality and aqua life.

**Diversity in Fisheries Production:** The Ministry of Fisheries and Livestock as well as the Bangladesh Fisheries Development Corporation will have to be taken necessary initiatives to diversify the fisheries products for export and local consumption, so the value add will be linked.

### Annex-1: Proposed Projects With Indicative Budget Over the Year based on Sector Action Plan (SAP)- Fisheries Sub Sector

Thematic Area (TA)	Name of the Proposed Project (Total Project Value = TA1 2650 + TA2 1435 + TA3 2700 + TA4 3875 + TA5 250 = 10,910 Cr)		Indicative Budget (Crore Taka)		
			2024	2025	2030
<b>A. Inland Fisheries</b>					
<b>a. Inland open water fisheries</b>					
TA 1	1.	Strengthening Fisheries Resources Survey System (FRSS) for resources assessment, mapping, zoning and developing Inland Fisheries Master Plan (2025-2050) & BDP-2100	10	25	125
	2.	Sustainable inland open water fisheries management for improved productivity, food & nutrition security of small artisanal fishers and livelihood transformation with CC	25	35	175
	3.	Establishment of long-term/permanent Fish sanctuaries in selected open water bodies (1000 nos/50,000 ha in Beel /Baor/Haor/rivers) for habitat restoration, accessibility to natural breeding, growing and preserve genetic resources of indigenous fish species	50	150	750
	4.	Develop Integrated climate resilient Fisheries Resources Management in Haor Area	25	75	350
TA 1	5.	Development and Management of the natural breeding grounds of Indian Major Carps in Halda (Phase-2) and other riverine systems for conservation of genetic resources	20	50	250
TA 1	6.	Strengthening Monitoring, Control and Surveillance (MCS) of inland open water Fisheries through increasing regulatory enforcement and awareness building	25	50	250
	7.	Development of participatory climate resilient eco-friendly floodplain fisheries management for sustainable productivity enhancement, employment and livelihood	25	60	200
TA 1	8.	Immediate protection of important mother fisheries and establish sustainable connectivity of migration routes between rivers and beels (as Ref. in Fish Act, 1950)	10	120	300
TA 1	9.	Develop Institutional Mechanisms for Effective Fisheries Governance for SA fisherman	10	25	75

Thematic Area (TA)		Name of the Proposed Project (Total Project Value = TA1 2650 + TA2 1435 + TA3 2700 + TA4 3875 + TA5 250 = 10,910 Cr)	Indicative Budget (Crore Taka)		
			2024	2025	2030
TA 1	10.	Improving Food Safety, quality and traceability of Inland fishes catch value chain	20	30	175
	11.				2650
<b>b. Inland Closed Water Fisheries (Aquaculture)</b>					
TA 2	1.	Optimization of commercial pond aquaculture technologies for cost effective, eco-friendly, safe production of fish/shrimps maintaining soil water health through diversification and intensification of farms with mechanization, automation with IoT	25	50	650
	2.	Improving food safety, quality and traceability through GAP in aquaculture value chain along with close monitoring, supervision, records keeping, auditing and certification for better export market compliances and increase IRR in commercial aquaculture	35	65	250
	3.	Promote climate-smart, nature based green aquaculture technologies (IAA) for small and medium scale farmers using locally available inputs for safe fish/shrimp production to enhance food security and reduce climate vulnerabilities	25	50	125
	4.	Drought Prone & Barind Tract Area Fisheries Resources Development Project	15	25	210
	5.	Developing E-Commerce Platforms for Efficient Fisheries Value Chain Management	10	25	100
	6.	Policy and regulatory reformation for safe aquaculture practices and marketing	50	75	100
	7.				1435
<b>c. Coastal Fisheries (Including Sundarban) – Blue Economy</b>					
TA 3		Resources mapping, Zoning and assessment of Coastal Fisheries resources (including Sundarban and peripheral estuaries) to estimate current stocks, CPUE, trends, breeding cycle and determine MSY for conservation of genetic resources and Biodiversity	75	125	125
	2.	Enhancing sustainable coastal aquaculture productivity through species diversification and intensification of Coastal shrimp farms introducing climate resilient technologies	50	150	650
	3.	Research and development of breeding, nursery and culture technologies of potential coastal fin fishes, crustaceans, mollusks and other non-conventional species for diversifications in coastal aquaculture	25	50	250
	4.	Assessment, conservation and management of Sundarban Mud Crabs value chain supporting commercial crab aquaculture (for enhancing productivity, export earning and livelihood improvement of climate victim coastal community) (PPP/JV)	50	75	750
	5.	Integrated Forestry-Fisheries Biodiversity and Genetic resources conservation Program promoting coastal and marine fisheries resources for enhancing stocks, MSY & catch	30	70	250
TA 3	6.	Climate resilient fisheries management and improving dry fish processing value Chain in Dubla and neighboring Char areas for livelihood development of coastal fishermen	50	75	100
TA 3	7.	Introducing Silvo-aquaculture in adjacent mangrove areas of coastal region through ecosystem approaches management of mangrove conversation	25	50	100
TA 3	8.	Capacity Building of the farmers and all stakeholders for improving food safety, quality and productivity of shrimp/fishes coastal aquaculture value chain for better market access to enhance export earnings, employment and CC victims rehabilitations.	50	50	350
	9.	Strengthen Regional Cooperation to initiate quick policy decision regarding Trans- Boundary issues like rivers/estuaries, joint management of Sundarban ecosystem, synchronizing fishing ban period, livelihood improvement, safety & security etc.	25	25	125
					2700

Thematic Area (TA)	Name of the Proposed Project (Total Project Value = TA1 2650 + TA2 1435 + TA3 2700 + TA4 3875 + TA5 250 = 10,910 Cr)		Indicative Budget (Crore Taka)		
			2024	2025	2030
<b>d. Marine Fisheries Resources - Blue Economy</b>					
TA 4	1.	Survey and assessment of the marine fisheries resources for planning and development of Bangladesh Blue Economy Master Plan (2025- 2050) and BDP-2100	125	125	500
	2.	Resource Mapping, Zoning and Marine Spatial Planning for promoting aquaculture, biodiversity conservation and enhance species abundance in shoreline ecosystem	25	25	150
	3.	Strengthening Monitoring, Control and Surveillances (MCS) system for effective marine fisheries management and combating IUU fishing in Bangladesh	50	50	350
	4.	Development of Climate Resilient, cost effective Mariculture technologies for enhancing productivity and livelihoods improvement fishers/poor coastal community (small and medium scale aquaculture for employment, alternative income generation, food & nutrition security, CC adaptation and reducing fishing pressure)	50	50	350
	5.	Research, development and piloting of breeding and aquaculture technologies of important marine fin fishes, crustaceans, mollusks for promoting commercial mariculture. (PPP) (seabass, mullet, mugil, catfishes, crabs, lobster, mussels, eels etc)	50	100	250
	6.	Strengthening safety and quality of marine catch fisheries value chain with Good post harvest handling, preservation and storage for reducing losses & good market access	25	50	300
	7.	Develop seafood processing technology for safe, nutritious, diversified value added fish & fisheries products for domestic human consumptions and export market (PPP)	25	50	200
	8.	Research and development of technologies for maximum utilization of Fisheries by-products/ waste as renewable bio-resources for industrial uses in pharmaceuticals, cosmetics, feed additives and other uses (PPP for domestic uses and export)	25	50	375
	9.	Develop farming technology of potential seaweeds (with multi-stratum aquaculture) enhancing blue food production for industrial uses and livelihood improvement of climate vulnerable coastal community	10	25	100
	10.	Experimental fishing for rapid assessment, MSY, TCA management and exploration of Deep Sea Fisheries Resources (Tuna & Pelagic fishes) promoting sustainable industrial fishing for BE (PPP/JV/TCP)	100	150	750
	11.	Institutional strengthening for sustainable assessment, management and exploration of coastal and marine resources (Capacity building, HRD, Infrastructure and logistics)	25	25	250
	12.	Reforming policy, regulatory issues and strengthen national/regional coordination for planning, implementation and Good governance in maritime affairs, IUU, TCA & trade	25	50	100
	13.	Implementing Ecosystem Approach in Marine Fisheries Management (EAMF) in Bay of Bangle Large Marine Ecosystem (BoBLME) for conservation, climate resilient management and livelihood improvement of Ruhinga/coastal/marine fisher community	10	25	100
	14.	Determination and implementation of Marine Reserve, Marine Protected Area, Marine Sanctuaries and endangered marine ecosystem (including Saint Martin) for habitat restoration, CC adaptation and biodiversity conservation.	50	50	100
				3875	
TA 5	<b>Institutional Capacity Building</b>				
	1.	Institutional strengthening of the fisheries sector for attaining FYPs, SDGs, Vision 2021 and BDP-2100 (Fisheries Policy & strategies update, HRD of DoF, manpower, logistics, infrastructure and finance), redefine roles & responsibilities of DoF, BFRI, BFDC, BORI and aligned institutions, strengthen coordination with Donors/Partners	50	100	250



## Livestock







## 3.4 Livestock Sub-sector Action Plan

### 3.4.1 Introduction

According to article-18 (1) of the constitution of Bangladesh, one of the principal functions of the state is to improve the nutritional level and development of public health. Under the purview of the direction of the constitution the Department of Livestock Services (DLS) is playing a very important role to meet the animal protein need of the people as well as for the poverty alleviation of the country. The aim of DLS is to increase the production and productivity of livestock to accomplish the requirement of milk and milk products (200g/head/day), meat (120g/head/day) and egg (17g/head/day) of the population (ICMR, 2022 and BBS, 2023). DLS also playing an undeniable role to create healthy, energetic and talented generation by providing the essential protein and nutrient requirements of the people of the country through increased production of meat, milk and eggs. Besides, DLS also contributing significantly to eradicate poverty, generate employment, and to earn foreign exchange by exporting leather and leather products. As a part of these, the department is working for economic development of the country by increasing the productivity of milk, meat and egg through the conservation of improved breeds, development of beef breed, innovation of new strains of poultry and cattle development. DLS has taken different initiatives to increase women's engagement in these sectors to ensure women's empowerment and therefore, implement the strategic plans of the government to develop gender balance. Bangladesh has targeted 8.51 per cent economic growth for the 8<sup>th</sup> Five Year Plan (FYP). To accommodate this growth target, the extra investment needs to be raised to 36.59 per cent of GDP by FY 2025. To achieve this goal, along with other components of Agriculture need to invest a remarkable amount of money in livestock sub-sector. To achieve the targets of livestock sub-sector in 8<sup>th</sup> FYP, along with other 26 programs/projects, DLS has initiated World Bank financed a mega project of amounting US\$ 500.00 million from FY 2019. To get maximum success of this sub-sector, livestock sub-sector action plan along with perspective plan and resource allocation is very important.

### 3.4.2 Situation Analysis

The livestock component of agriculture sector is an integral part of agriculture in Bangladesh and in the era of “ever green revolution”, significance is further increasing. Livestock plays an important role in the national economy and in the socio-economic development of Bangladesh. Livestock includes cattle, goat, sheep, horse, pig and poultry of which are very popular in Bangladesh. South Asia is blessed with high diversity of animal genetic resources (AnGRs) and there are many potential animal breeds found in this region. During the past three decades, the number and production of livestock both ruminants and poultry increased almost to double (FAOSTAT). However, the productivity of poultry increased rapidly but the productivity of the ruminants did not increase in the similar manner. In the 7<sup>th</sup> Five Year Plan, the objectives of the livestock sub-sector were to promote: (i) sustainable improvements in animal productivity in the dairy and meat production, including increased product processing and value addition; and (ii) sustained improvements in income and employment opportunities for the landless, small and marginal farmers, and women in livestock rearing.

The Bangladesh Livestock Research Institute (BLRI), is responsible to identify the livestock and poultry production constraints at the national and farm level, seek solutions to those problems through multi and inter-disciplinary inter-institutional research and development, which may help to food and nutrition security, poverty alleviation, employment and income generation, and reduced environment pollution. While, Department of Livestock Services (DLS) is responsible to disseminate the livestock, production and disease control technologies throughout the country. Although, an impressive

success achieved during the last 7<sup>th</sup> Five Year Plan, the livestock sub-sector is still constrained with several challenges. The 8<sup>th</sup> Five Year Plan has already published and this report aims to address those challenges and develop another plans to fulfill the milk, meat and eggs requirement of our 170 million populations. Livestock sub-sector is the integral part of agriculture and it contributes to food and nutritional security, income generation, and forms an important livelihood base for millions of resource-poor livestock keepers in Bangladesh. The livestock sector, whose contribution to GDP was 1.83% during 2010-2020 (BBS, 2020), currently employs around 20% of rural workforce and serves as a major source of protein. From a 2.0% growth during 1980s, its growth rate was 3.04% during 2019-2020 (BBS, 2020). The rapid population growth, urbanization and the associated increase in the demand for animal products have presented huge opportunities to the livestock industry. Though Bangladesh has high cattle and goat density, yet the current production of milk and meat of cattle and goat were quite inadequate to meet current requirement, and in the 7<sup>th</sup> FYP, the deficits was estimated 57% and 33%, respectively. The average size and weight of local cattle are also low and ranges from 100 kg to 150 kg for cows and from 150 kg to 250 kg for bulls, which are 25% to 35% less than the Indian cattle. Milk yields are also extremely low: 200 liters to 250 liters during a 10-month lactation period in contrast to 800 liters for Pakistan, 500 liters for India and 700 liters for other Asian countries. In poultry, there is also large dearth in the availability of meat and eggs.

The current production of these commodities needs to be increased remarkably by 2025 to feed the growing population in the country. Moreover, need to reduce the production cost of the poultry. Main challenges in the livestock sub-sector are low productivity; scarcity of quality feeds and fodders; emerging and re-emerging diseases; insufficient veterinary and animal healthcare services; limited access to credit adverse impacts of climate change and natural disasters; and poor marketing system. With this view in mind, the Government of Bangladesh (GoB) through AWRID has undertaken Sector Action Plan on “Agriculture” to achieve the goals set in the 8<sup>th</sup> FYP (2021-25). The objective of preparing livestock sub-sector Action Plan is to provide a comprehensive picture of sectorial goals, performances, opportunities, challenges, and above all identify policies and strategies with elaborate actions and tentative budget that support the 8<sup>th</sup> FYP and visions of the government. The 8<sup>th</sup> FYP provided framework for identification of public policy initiatives and projects for the public sector intervention, including the role of government agencies in developing livestock sub-sector in partnership with other government institutions, private sector development partners, local government bodies and non-government organizations. In the report, action plan of livestock sub-sector annual development plan, perspective plan, and resource allocation plan, and finally planning to develop a strategic intervention document to get maximum success of this sub-sector, are critically evaluated.

### Overall Achievement of Livestock Sub-sector

Livestock is a key component of the agricultural economy of Bangladesh. It contributed to 1.47% of agricultural GDP in 2018-19. During the first four years of the 7<sup>th</sup> FYP, the sector expanded at an average annual rate of 3.4%, which is considerably higher than 6<sup>th</sup> FYP of 2.8%. During the 7<sup>th</sup> FYP period, Bangladesh achieved self-sufficiency in meat production and near self-sufficiency in the production of eggs. The production of meat reached 7.51 million MT in 2018-19 from 5.86 million MT in 2014-15. Milk production during this time increased from 6.97 million MT (2014-15) to 9.92 million MT (2018-19) - an increase of 42%, while production of eggs grew by 55%. With increasing production, per capita availability of milk, meat and eggs rose to 161.69 ml/person/day, 122.47 gm/person/day and 101.78 piece/person/year, respectively in 1918-19 (Table 29).

**Table 30: Demand, Production, Deficiency and Availability of Milk, Meat and Eggs**

Product	2014-15				2018-19			
	Requirement	Production	Deficiency/ Surplus	Demand	Production	Requirement	Deficiency/ Surplus	Availability
Milk (Million T)	14.48 (250 ml/day/ head)	6.97	-7.51	122.00 (ml/day/ head)	15.34	9.92	-5.42	161.69 (ml/ day/ head)
Meat (Million T)	9.95 (120 gm/day/ head)	5.86	-1.09	102.62 (gm/day/ head)	7.36	7.51	+0.15	122.47 (gm/ day/ head)
Egg (Million Num- bers)	16504.8 (104 nos./year/ head)	10995.2	-5509.6	70.26 (nos./year/ head)	17482.07	17109.70	-372.37	101.78 nos./ year/ head)

Source: Department of Livestock Services

Projected Production and Demand under 8<sup>th</sup> FYP: The projected production and demand of milk, meat and eggs are shown in Table 30.

**Table 31: Projected Production and Demand of Milk, Meat and Eggs**

Sl No	Item	2020-21		2024-25	
		Demand	Production Target	Demand	Production Target
01	Milk (million MT)	15.84 (250ml/ P/D)	15.84 (250ml/ P/D)	16.36 (250ml/ P/D)	16.36 (250ml/ P/D)
02	Meat (million MT)	7.61 (120g/P daily)	7.93 (125g/P daily)	7.85 (120g/P daily)	8.51 (130g/P daily)
03	Egg (million piece)	18055 (104/Y/P)	18576 (107/Y/P)	19407 (104/Y/P)	22393 (120/Y/P)

Source: Department of Livestock Services (DLS) projections

### 3.4.3 Vision, Mission, Overall Objectives and Targets

#### Constitutional Obligation

According to the article 15 of the constitution of Bangladesh- it shall be a fundamental responsibility of the state to securing citizens with (i) provision of the basic necessities of life, including food, and (ii) right to work or right to guaranteed employment at a reasonable wage. In view of this note: (i) it is a fundamental responsibility of the state to ensure availability of required quantity and quality of milk, meat, eggs for the citizen and the livestock sector contributes to (ii) through creation of employment opportunities.

#### Vision

To facilitate the livestock raising for safe and secure animal protein for all and for income generation.

#### Mission

Meet the demand of animal protein by enhancing production, productivity and value addition of livestock products.

## Strategic Objectives

The objective of the 8<sup>th</sup> FYP plan is to meet the increasing demand of animal protein by sustainably enhancing production, productivity and value addition of milk, meat and eggs. The specific objectives are to:

- Promote sustainable production of milk, meat and egg including processing products;
- Ensure a nutrition-sensitive production system to tackle malnutrition among poor and vulnerable population groups, including the children and women;
- Promote sustained income generation and employment opportunities for the landless, small and marginal farmers;
- Ensure prevention and treatment of emerging and re-emerging diseases;
- Promote conservation and up-gradation program of indigenous livestock;
- Generate need-based technology and improve livelihood of livestock farmers through adaptive research and to transfer developed technologies to users through training of extension workers, planners, livestock farmers and other stakeholders;
- Develop climate resilient and low-cost feeds and fodders production; and
- Facilitate entrepreneurship and increased participation of the private sector in the production, marketing and export of livestock products and by-products as a commercial basis.

## Targets

The 8<sup>th</sup> FYP target to attain: The 8<sup>th</sup> FYP plan sets a target to expand the production of milk from 9.92 million metric tons in 2018-19 to 16.37 million metric tons in 2025-26; meat production from 7.5 million MT to 8.51 million MT and egg production from 17,109.7 million to about 22,400 million pieces. These targets will be achieved through enhancing productivity by introducing more productive breeds/strains, by using modern biological techniques, adopting appropriate disease diagnosis and treatment, and by addressing climate smart livestock interventions for safeguarding nutritional food security.

### 3.4.4 Policies and Strategies for Supporting Livestock Sub-Sector

During the past three decades, production of livestock (ruminant, non-ruminant and poultry – increased significantly). Cattle, which consisted almost half of the total ruminant population until the early 1990s, is replaced by small ruminants, particularly goats, which is currently around 70% of the total livestock population. Total population remained almost unchanged, which may attribute to the gradual decline in the use of cattle as animal power in farming. Among poultry population, around 80% is chicken and the share remained almost unchanged. The development strategies and policies of 7<sup>th</sup> FYP of livestock were as follows:

**Livestock extension:** DLS updated, extended and allocated the resources for public goods services, viz regulatory measures, quality assurance and control, monitoring function, food safety function, disease surveillance, while private sector, NGOs and community-based organizations (CBOs) were encouraged to provide more of the livestock services viz veterinary services, vaccination etc.

**Dairy development:** Department of Livestock Services (DLS) has launched the Livestock and Dairy Development Project (LDDP), a big project amounting 499,831 thousands USD in order to reduce the demand and supply gap, the supply chain based production, processing and marketing of milk and milk

products, including co-operative dairy development (Milk Vita model) was strengthened. Smallholder dairy farming integrated with crop and fish culture has been promoted. DLS is working to form Dairy Development Board.

**Meat production:** To meet up the demand-supply gap of meat, frozen semen of world popular beef cattle of Brahman has been imported from USA and was supposed throughout the country. Simultaneously, cattle fattening program was also taken. As a result, beef production increased rapidly in last few years and Bangladesh need not to import cattle from outside during the period of big festival Eid-ul-Azha. To meet up the scarcity of breeding bucks of “Black Bengal Goat” throughout the country DLS has taken a project on “Black Bengal Goat Development and Extension Project”. Besides during the last five years, buffalo and sheep farming program has also been strengthen by DLS and BLRI.

**Poultry development:** Private sector has been investing in poultry farms with positive results but during last four years, poultry sector faces serious negative pressure due to COVID-19 pandemic situation. For technology transfer, poultry farms of the DLS has taken initiative in the area of breeding and multiplication farms for smallholder training, technology testing and demonstration. To ensure quality of poultry products, DLS has introduced production guidelines and has ensured supply of quality day-old chicks, and quality control of poultry feeds and feed ingredients. Bangladesh Livestock Research Institute (BLRI) has launched ‘Strengthening of Poultry Research and Development’ project in order to reduce the demand and supply gap, the supply chain based production, processing and marketing of eggs and poultry meat and also developed the National Reference Laboratory for detection of Avian Influenza virus and other emerging diseases.

**Breeds development:** Conservation and improvement program of indigenous chicken has taken by BLRI and they got tremendous development. BLRI has also continued their conservation and improvement program of Red Chittagong Cattle and they are almost at the point to declare, as the cattle breed of Bangladesh. For improvement of cattle, Artificial Insemination (AI) and Embryo Transfer program has further strengthened by DLS.

**Livestock research:** Research capacity of BLRI and Universities/Institutes, including human resource capacity, has strengthened to address the national priority and untapped potential of regional livestock resources, and to ensure safe production of animal products and by-products, fodder production, animal protein supplement, feed additives, premixes, probiotics and mineral and vitamin supplements as inputs for poultry and livestock development. As the private organization, American Dairy Ltd has also initiated research on dairy cattle improvement.

**Veterinary services and animal health:** Policy support has provided to accelerate the development of private and community-based veterinary services, including compliant private veterinary diagnostic centers, clinics and hospitals. Initiative has taken to establish an autonomous Quality Control Agency to ensure the quality of veterinary drugs, vaccines, feeds, feed ingredients and breeding tools and materials.

**Feeds, fodder and animal management:** BLRI has taken the long-term fodder development program throughout the country, including large-scale private sector participation, to minimize the acute shortage of feeds and fodder. A strategy has been initiated for community-based fodder cultivation along the roads and highways, rivers and embankments, in ‘Khas’ lands and in combinations with crops. An Animal Feed Act has also approved to ensure feed quality.

Hides and skins: An autonomous agency has been established for quality control and certification of hides and skins, and environmental legislation on slaughter and tannery operations. BLRI has also taken initiative to train butchers and merchants (Farias, Beparis and Aratdars) on basic knowledge of flaying, curing and storing for improved management and quality of hides and skins.

Marketing of animal products and value chain development: Through LDDP project, DLS has initiated traditional animal products marketing system throughout the country by linking products to market and processors. This will prevent the post-harvest loss of the animal products and farmers will be benefited.

Access to credit and incentive: Smallholder dairy producers and entrepreneurs have facilitated with bank loan at an affordable rate of interest. As 20% population are directly and 50% are indirectly involved in poultry and livestock for their livelihood. Therefore, to eradicate poverty of major portion of the rural people, remarkable amount of subsidy has been distributed among the marginal farmers. To meet up the depression provoked by COVID-19 pandemic, government provided incentives to the livestock farmers through LDDP.

### Strategies

The following strategies have been taken to achieve the objectives of livestock development:

Enhancing productivity through research and development: Productivity may be enhanced through extensive research and development activities. Research capacities of BLRI and other universities/institutes undertaking the relevant research activities will be enhanced to address the national priority and harness the untapped potential of regional livestock resources, and to ensure safe production of animal products and by-products, animal protein supplement, feed additives, premixes, probiotics and mineral and vitamin supplements as inputs for poultry and livestock development. Initiatives will be taken to encourage and support private agencies and NGOs to undertake livestock research.

Developing good quality breed: Bangladesh has one of the highest livestock densities in the world, where the growth in population largely comes from commercial poultry and small ruminants. However, the productivity of local breeds is very low. Breed development through crossbreeding of local variety with suitable exotic variety should be of utmost priority. For backyard farming, where investment potential is limited, local breeds that have relatively higher productivity and hardy in nature will be promoted. Besides, Artificial Insemination (AI) programs need strengthening in promoting quality breeds of livestock. Along with these, the original variety breed those are high-yielding needs to be conserved and promoted. For instance, the Black Bengal goat (Bangla goat) is known for its relatively low demand for feed, high reproduction rate, and disease resistance and is thus a traditional choice of asset for many poor and vulnerable households. Special program should be taken on “Frozen semen production and popularization of artificial insemination (AI) in Black Bengal Goat”.

Extension and veterinary services: (i) Livestock Extension Officer (LEO) post should be created in upazila level; (ii) Measures will be taken to extend veterinary services up to union level with adequate service provider and infrastructural facilities; (iii) A massive program should be taken on disease prevention, cattle control and poultry diseases, awareness building and mass program for de-worming of animals against parasitic diseases will be designed; (iv) An autonomous quality control agency would be established to ensure quality of veterinary drugs, vaccines, feeds, feed ingredients and breeding tools and materials; and (v) Policy support will be provided to accelerate the development of private and community-based veterinary services, including compliant private veterinary diagnostic centers, clinics and hospitals.

**Promoting poultry and livestock farming:** While there are several government initiatives for providing multiple incentives for the farmers in crop production, there is ample room for strengthening policy support mechanisms for poultry and livestock production. Considering the need for protein and diet variety on the one hand and creating employment opportunities on the other, policy incentives for the livestock and poultry subsectors can have important and far-reaching development implications. To meet the huge target of milk, meat and egg production by 2025, many small growers will need to have improved access to finance. Short-to-medium term collateral-free loan facilities at subsidized interest rates, amongst others, should be introduced for poultry and livestock farmers. Besides, policy options for vaccine coverage for poultry and farm animals and ensuring quality feed supplies should be looked into. **Supporting small and medium farmers:** Immediate actions will be taken to address the constraints of smallholders in livestock rearing. Support to small and medium size livestock and poultry unit will be emphasized along with large business enterprises. Private initiatives will be encouraged and supported for producing inputs like feed, medicines, vaccines and biological products, genetic stocks and materials for the small and medium size enterprises. All possible supports should be extended to them also for processing and exporting livestock products. Smallholder poultry and dairy producers and entrepreneurs will be facilitated through allowing access to bank financing at an affordable rate of interest with low or no collateral.

**Improving management practice:** Better management practices such as quality assurance of feedstuff including water, disease and pest control, hygienic processing of products and environmentally safe disposal of wastes are important strategies. These also have implications for food safety. The DLS has a role in developing human capital through training on appropriate feed mixture, breeding, vaccination and adherence to bio-security guidelines. The supply of quality day-old chicks is important for small-scale commercial poultry farms. The strategy should be addressed to the main determinants of production, namely ensuring that animals are disease-free and well-fed with cost effective and balanced forms of animal feed. Introduction of insurance schemes, at least for large commercial farms, will also be an important consideration. Veterinary and extension services are critical for livestock farming, although the DLS offices do not exist beyond the upazila level. The lead farmer approach will be continued with more training and incentives for the farmers. Better management practices such as quality assurance of feed stuff including water, disease and pest control, hygienic processing of products and environmentally safe disposal of wastes are important strategies.

### **3.4.5 Institutional Capacity and Coordination of Livestock Sub-sector**

**Institutional capacity development:** The livestock sub-sector pays much importance in strengthening the capabilities of its officials, researchers and administrative personnel throughout the country and overseas long term (MS and PhD) and short-term training programs, study tours and sabbatical leave with the support from national and international agencies including BARC, IDA, BTA, MONBUSHU, USAID, FAO/UNDP, ILRI etc. The short term training programs on research and/or project planning/ designing and management, livestock extension program, office management, computer programming, etc. will be developed for their research skill and development activities in the sub-sector.

**Human Resources Development (HRD):** Work force planning and strengthening has not emphasized earlier in this sub-sector. The HRD is an important component of any development planning. In fact, it should be very clear to the government that the funding support and the infrastructures could built in a very short time, technologies can be transferred in short time, but the HRD takes at least a generation. Therefore, it is important to have proper manpower and planning for livestock sub-sector and have matching program for HRD. The HRD is required at all levels starting from grassroots farmers, land less

labor, women, unemployed rural youths at the primary level to technicians, managers, entrepreneurs, at the secondary level and scientists, lecturers and teachers at the university level. Primary level training should be organized nationally; the secondary level may be in the region and tertiary on the global basis. Trained in secondary and tertiary levels in specific field provides ample opportunities career advancement, otherwise they leave for better opportunities elsewhere and the sector loses a trained hand which become counter productive for the actual development of the sector.

### 3.4.6 Gaps Identification

Table 31 shows the provisions, present situation and gaps of different programs of livestock sub-sector.

**Table 32: Identification of Gaps in the Sub-sector**

SI No	Program	Provision	Present situation	Gap
01	Training for livestock farmers	Livestock farmers should continue to be provided with livestock management training and support to develop their own skills	There is not enough technical training available to compensate the livestock farmers in field level	The technical training needs to be expanded in field level with sufficient support
02	Food security for Livestock farmers	The farmers due to seasonal variation of the products price face seasonal economic depression. During this period, they need special support program	The DLS is trying to create a database in this regards. The MoDMR implements the VGF program for the marginal farmers	Proper coordination is required between MoFL and MoDMR for organizing programs for the marginal farmers
03	Quality assurance	Challenges for the public sector to provide regulatory oversight and quality assurance, and play facilitative role with appropriate extension and technology dissemination, so the private sector continues to innovate and invest in the supply chain	The product quality control measures were limited to export, particularly of meat. It is not possible adequately comply with the maintenance of world standard and experienced return of containers for detection of hazardous chemicals. For such problems, meat exporting not getting popularity.	To overcome the situation, laboratory facilities of DLS and other GoB agencies are enhanced with trained manpower. The processing plants should be compelled and an international accreditation system should be established
04	Linkage/ collaboration	Collaboration between the Ministry of Fisheries and Livestock and Ministry of Commerce is essential	DLS, Bangladesh Livestock Research Institute (BLRI), universities and the private sector should also participate in the proposed interventions	An enabling policy environment will be needed for promotion of public-private partnerships and enhanced participation of private sector entrepreneurs
05	Capacity building on manpower and budget	Livestock production, health management and extension services manpower need to increase	BLRI and DLS has lack of adequate capacity to address the problem of livestock production and veterinary services	To overcome the situation, manpower of BLRI and DLS need to increase. Livestock Extension Officer (LEO) post need to introduce in the upazila of DLS organogram. Need to increase the budget.



SI No	Program	Provision	Present situation	Gap
06	Livestock policies	Livestock policies of breeding, feed, dairy, disease management etc. not updating regularly.	Livestock professional organizations like Bangladesh Animal Husbandry Association (BAHA), Bangladesh Society for Animal Production Education and Research (BSAPER), Bangladesh Nutrition Society, and Bangladesh Veterinary Association should participate in the proposed interventions.	Regular updating of different policies in livestock production and disease management is a must.
07	Veterinary services	Veterinary services in our country not modern	Veterinary services throughout the country should modernize	Modernization is require both in government and private sectors
08	Quality and price of feed raw materials	Low quality and fluctuation of the price of feed raw materials	Quality and price of the feed raw materials throughout the year should assure	Quality and price of the feed raw materials should monitor by regulatory team
09	SDGs	The livestock sub-sector develop under the targets of SDGs	DLS and BLRI has taken different policies and action plan to achieve the targets of Sustainable Development Goals (SDGs)	To follow the SDGs in the sector, a relation will develop among DLS, BLRI, and private sector
10	BDP 2100	BDP 2100 is important to develop livestock sub-sector	Different programs of DLS and BLRI is aligning with BDP 2100 to achieve the goal	The programs of DLS and BLRI further concretely aligning for achieving the BDP2100 goals

**Mechanism for improving capacity development in the sub-sector:** Implementation of Institutional Mechanism:

i) 8FYP target to attain, ii) covering input indicators (resources, policy changes etc.), iii) covering output indicators, and iv) covering impact indicators are shows in (Table 32).

**Table 33: Mechanism for Capacity Development**

SI No	8FYP target to attain	Input indicator (resource/policy changes etc.)	Output indicators	Impact indicator
01	Attain self-sufficiency in milk, meat and egg production and surplus quality production for export	<ul style="list-style-type: none"> <li>Establish small and commercial goat, dairy, beef and poultry farms;</li> <li>Farmers training;</li> <li>CBOs assisted, number of benefited members; and</li> <li>Marketing of meat, egg, milk and their products, feed and other inputs</li> </ul>	<ul style="list-style-type: none"> <li>Production and yield (L/lactation; kg/Animal; number/clutch) by production system, species, location and trend;</li> <li>Export quantity by major items and export value, trend over the years; and</li> <li>Per capita milk/meat/egg consumption</li> </ul>	<ul style="list-style-type: none"> <li>Increased income of livestock farmers;</li> <li>Poverty reduced among livestock farmers; and</li> <li>Increased employment in livestock farming</li> </ul>

SI No	8FYP target to attain	Input indicator (resource/policy changes etc.)	Output indicators	Impact indicator
02	Improve conservation of livestock biodiversity	<ul style="list-style-type: none"> <li>Number of small, medium and commercial farms and sustainable livestock management approach;</li> <li>Number of livestock household assisted and direct assistance each farm;</li> <li>Species wise quantity of livestock products;</li> <li>Number of small, medium and commercial livestock farms; and</li> <li>Livestock production friendly regulators established and functional</li> </ul>	<ul style="list-style-type: none"> <li>Species and product wise production by season, area and trend over the years;</li> <li>Production per unit effort by season, area and trend; and</li> <li>Income of livestock households improved</li> </ul>	<ul style="list-style-type: none"> <li>Species and products diversity improved;</li> <li>Poverty reduced among in the livestock producers; and</li> <li>Livestock production attain sustainability.</li> </ul>
03	Enhance milk, meat and egg production	<ul style="list-style-type: none"> <li>Farms under sustainable management approach;</li> <li>Number of livestock farms assisted and direct assistance per farm; and</li> <li>Farm production assessment</li> </ul>	<ul style="list-style-type: none"> <li>Product wise production by season, area and trend over the years;</li> <li>Production per bird/ animal effort by season, area and trend; and</li> <li>Income of livestock farmers improved</li> </ul>	<ul style="list-style-type: none"> <li>Species diversity improved;</li> <li>Poverty reduced among the livestock farmers; and</li> <li>Livestock production attain sustainability</li> </ul>
04	More income and equitable distribution of benefits	<ul style="list-style-type: none"> <li>Number of farmers and livestock farmer households assisted particularly female-headed and other distressed households;</li> <li>Number of livestock farmers as- sisted, number of women mem- bers in livestock farming; and</li> <li>Number of livestock farmers trained, provided inputs and benefits</li> </ul>	<ul style="list-style-type: none"> <li>Increased income- % increase; and</li> <li>Number of self and employment created by sex and IGA category</li> </ul>	<ul style="list-style-type: none"> <li>Poverty reduced in the target communities; and</li> <li>Biodiversity of livestock farming increased</li> </ul>
05	Improve food safety	<ul style="list-style-type: none"> <li>Restrict the use of hazardous chemicals in livestock and poultry feed, hatcheries, farms, processing and preservation;</li> <li>Number of drives to enforce such restriction, offences identified, punished, penalty amounts realized and number imprisoned; and</li> <li>Number of farms, farmers groups, depots, processing plants, feed mills, traders, etc. in the supply chain linked to quality control and Traceability System</li> </ul>	<ul style="list-style-type: none"> <li>Number of rejection in the foreign ports reduced;</li> <li>Number of exporter and processors complying international standards increased and their share in export increased; and</li> <li>Percentage of sample tested for quality in the local markets increase over the years</li> </ul>	<ul style="list-style-type: none"> <li>Country Image improved for exporting quality product; and</li> <li>Local consumers' have better access to safe livestock products</li> </ul>

SI No	8FYP target to attain	Input indicator (resource/policy changes etc.)	Output indicators	Impact indicator
06	Strengthen implementation capacity of the concerned GoB agencies, NGOs, and LGBs	<ul style="list-style-type: none"> <li>Number of vacancies in the professional level and in the districts, Uupazila, research stations, training institutes etc. below 10%;</li> <li>Laboratory, offices, projects etc. have required equipment, logistics, operating fund and authority to execute project/program without fear;</li> <li>Number of officers and support staffs are trained, have needed skills, understanding of rules and procedures, delegation of authority etc. so that are comfortable to work without hesitation and fear; and</li> <li>Number of GoB agency officer/ staff reoriented to added role in facilitation, GO-NGO collaboration, public-private partnership, and NGO capacity building and networking; rather than direct implementation or control of anything and everything</li> </ul>	<ul style="list-style-type: none"> <li>Average time (month) needed to prepare/ revise TPP/DPP, briefing reports, proposal for creating new posts, revenue program; monthly and quarterly progress report etc.;</li> <li>Average time (days) needed to process and approve proposals in the ministry and agency level;</li> <li>Average time needed to prepare procurement plan and procure goods, works, services (months); and</li> <li>Physical and financial progress of projects and programs improved 90-100% by end of the year.</li> </ul>	<ul style="list-style-type: none"> <li>Decision making smoother, faster and transparent;</li> <li>Services delivered more efficiently; and</li> <li>Extension service delivery (number of livestock farmers and farmers served) increase at least 10% annually</li> </ul>

### 3.4.7 Challenges of Livestock Sub-sector

Although, an impressive success achieved during the last plan period, the livestock sector is still constrained with the several following challenges.

**Disruption of production and markets due to COVID-19 pandemic:** The livestock sub-sector has been affected by the economic shutdown measures to contain the spread of COVID-19. Towards the fag end of the 7FYP, the virus-related disruptions caused the demand for poultry meat and milk to fall sharply, negatively affecting prices and the existing productive capacities in the sector. In rural areas, about 40-50 per cent decline in prices of milk, eggs and poultry were reported, causing huge economic loss for the smallholders. Many farmers reportedly stopped procuring new cycles of production of poultry birds and eggs which might have an impact on food and nutrition security in the coming days. The commercial dairy milk producers at high risk. During the prolonged economic shutdown period, a huge amount of milk, which was used in confectionaries and other food-processing firms, remained unsold, eventually causing supply-side shocks. Besides, the production of feed for livestock and fisheries reportedly declined because of the crisis in the supply of raw materials. If appropriate measures are not taken in helping with the recovery process of the sector, the crisis could have long term implications for livestock production, food security and nutrition.

**Low productivity:** Although in terms of number of live animals, Bangladesh ranks in the quintile of top 10 per cent for buffaloes, cattle, goats, chicken and duck, the yield rates of different livestock products over the past three decades have remained stagnant. This implies that the production growth is mostly

attributed to increasing number of animal population. The productivity of all the major three types of livestock in Bangladesh is notably lower than those of neighboring countries such as Bhutan, India, Nepal and Pakistan (FAOSTAT, 2020).

**Price and availability of quality feeds and fodders:** Feeds and fodders are important inputs for livestock rearing. Naturally grown grasses and crop residues are the main source of feed for cattle in Bangladesh. The shortage of natural feed and high price of processed feed are major challenges for small holder's rearing livestock. Scarcity of land for fodder production, seasonal fluctuations in supply of feeds and fodder, low quality feed, and poor husbandry practices. The coastal region in the south used to be regarded as a large source of natural feed as there are plenty of uncropped areas. However, in recent times, due to salinity, the scarcity of grasses started in this region, resulting a decline in buffalo production. Increased salinity in coastal area is a potential threat to natural growth of grasses in the char lands for grazing of 178 animals. The pastureland has been reduced significantly all over the country due to cultivation of high yielding varieties (HYV) of rice and other crops. Climate change is causing unusual behavior in temperature, rainfall, flooding pattern etc., and affecting either natural growth or damaging the pasture grasses. Besides, adulteration and inadequate or lack of quality control system of commercial feed are identified as major challenges for processing animal feeds, causing harm to animal and public health as well.

**Scarcity of quality feeds and fodders:** Feeds and fodders are important inputs for livestock rearing. Naturally grown grasses and crop residues are the main source of feed for cattle in Bangladesh. The shortage of natural feed and high price of processed feed are major challenges for small holder's livestock rearing. Scarcity of land for fodder production, seasonal fluctuations in supply of feeds and fodder, low quality feed, and poor husbandry practices – all add to the problem. The coastal region in the south used to be regarded as a large source of natural feed as there are plenty of uncropped areas. However, in recent times, due to salinity, the scarcity of grasses started in this region, resulting a decline in buffalo production. Climate change is causing unusual behavior in temperature, rainfall, flooding pattern etc., and affecting either natural growth or damaging the pasture grasses. Besides, adulteration and inadequate or lack of quality control system of commercial feed are identified as major challenges for processed animal feeds, causing harm to animal and public health as well.

**Insufficient livestock extension officers:** In the Department of Livestock Services (DLS), for extension activities in livestock production entry level Thana Livestock Officer (TLO) was available in the Thana. During the period of President Ershad Thana upgraded as upzila and TLO post renamed as Upazila Livestock Officer (ULO) and this post upgraded in the higher scale without creating the entry post Livestock Extension Officer (LEO). This post should be introduced in the Upazila level for livestock production extension activities.

**Adverse impact of economically important emerging and re-emerging diseases:** Occurring and re-occurring of diseases are a major concern for livestock farming. Every year about 15 per cent of animal and 20 per cent of poultry die from different diseases causing a huge economic loss to the farmers. Anthrax, Hemorrhagic Septicaemia (HS), Black Quarter (BQ), Foot and Mouth Disease (FMD) in cattle and Peste de Petits Ruminants (PPR) and Goat Pox in goats, New Castle Disease (ND), Infectious Bronchitis (IBD) and Gumboro in chicken and Duck plague and Duck virus Hepatitis in ducks are the major animal diseases in Bangladesh. The cattle and poultry also suffer from protozoan disease including toxoplasmosis, amebiasis, giardiasis, leishmaniasis, cryptosporidiosis, and parasitic infestation due to moist humid climatic condition in Bangladesh. Parasitic diseases can be easily controlled by improving management and regular de-worming with appropriate medicine, which is not so much expensive.

Almost all animals are infested with one or more parasitic diseases in Bangladesh. Nutritional disorders are common in livestock and poultry birds due to shortage of feeds and fodder and also due to lack of knowledge of the farmers.

**Insufficient veterinary and animal health care service:** Veterinary and Animal Health Care Service are inadequate in the country. Public veterinary services are available at the upazilla level, however, there is shortage of veterinary and animal health care professional at the root level, which is the major hub of livestock farming. The Bangladesh Livestock Research Institute (BLRI) is responsible for producing vaccines for animal care. The quantity of vaccines is inadequate and the quality is also a major concern. The use of subsidies in vaccine production needs to be rationalized to encourage private investors. Quality control for standard vaccination needs to be developed for both local and imported varieties. The facilities of disease diagnostic are also limited and there is a shortage of skilled manpower for this.

**Inadequate multi-sectorial collaboration:** Collaboration between the Ministry of Fisheries and Livestock, Ministry of Cooperative and Ministry of Commerce is essential. The DLS, BLRI, Milk Vita, related universities and the private sector should also be included in the collaboration. An enabling policy environment need to be promoted through public-private partnerships and enhanced participation of private sector entrepreneurs. In particular, effective livestock farm management system needs to be introduced for sustainable livestock production. Research and extension facilities need to be extended to achieve the SDGs and Bangladesh Delta Plan 2100 targets.

**Limited access to credit:** Development of small and medium scale farms for animal and poultry rearing require significant investment while access to credit for small holders in livestock is very limited and requires high collaterals. The following challenges in accessing credit facilities are notable: (i) insufficient funds; (ii) inappropriately packaged loans for production cycles of livestock; (iii) collateral requirements effectively reducing credit access for smallholders, particularly for the poor; (iv) inadequate loan supervision; (v) insufficient training in financial management and business planning (applies to both loan providers and takers); (vi) inadequate technical support; and (vii) smallholders' vulnerability and risk from natural and man-made disasters.

**Price security of consumable animal products:** The underdeveloped marketing system for livestock products is considered as a major constraint for the development of this sector. The marketing network and information system for dairy milk and eggs has not been developed in rural areas. Production and prices mostly depend on the local demand and supply conditions and are not integrated with a comprehensive nationwide marketing network.

**Other challenges:** Among other challenges that include limited knowledge and technical skills of smallholder dairy farmers; limited milk collection and processing facilities and low prices at collection points; lack of insurance coverage; absence of market information; lack of appropriate breeds and knowledge gaps of farmers; lack of quality control facilities for medicine, vaccines and biological products, feed and feed ingredients, chicks, eggs and birds; and absence of an effective regulatory body etc. In addition, most meat production is handled (including slaughtering of animals) under unsatisfactory sanitary conditions in both rural and urban areas.

### 3.4.8 Projects and Programme for Intervention

The 8<sup>th</sup> FYP sets a target expand the milk, meat and egg production will be 16.37 million metric ton, 8.5 million metric ton and 22,400 million pieces, pieces respectively at the terminal year 2025-26. Table 33 shows the interventions to achieve the targets project and program for intervention.

**Table 34 : Programs/Projects/Action to Achieve the Targets of 8<sup>th</sup> FYP (indicative cost in lac BDT)**

SI No	Name of the activities (policy/program/project/action)	Indicative cost (Lakh BDT at FY 2019-20 prices)	Link to	
			SDGs Target	BDP 2100 Measures
<b>A. Department of Livestock Services (DLS)</b>				
01	Livestock and Dairy Development Project (01/01/2019-31/12/2023)	55,000.00	1.1; 1.2; 1.3; 1.5; 2.1; 2.3; 12.1, 3.3 2.5; 8.1; 12.1, 17-18	Comply with Goal 1, 6.
02	Buffalo Development Project (2nd Phase) (01/10/2018-30/09/2023)	3,500.00	1.3; 2.1; 2.3, 2.5, 12.1	Comply with Goal 1, 6.
03	National Agricultural Technology Programme-Phase-2 Project (NATP-2), DLS Component (01/10/2015-30/09/2021)	9,251.00	1.1; 1.2; 1.3; 2.1; 2.3	Comply with Goal 1, 6; Cover six geographical hotspot
04	Artificial Insemination Activities Extension and Embryo Transfer Technology Implementation Project (3rd Phase (01/01/2016-31/12/2020))	5,000.00	2.3, 2.5	Comply with Goal 1, 6
05	Establishment of Quality Control Laboratory for Livestock Inputs & its Food Products (EQCLIFP) (01/07/2016-31/12/2020)	2,476.00	3-3	Comply with Goal 1, 6.
06	Eradication of PPR & control of FMD project (01/01/2019 - 31/12/2022)	1,555.00	3-3	Comply with Goal 1, 6; Cover six geographical hotspot
07	Black Bengal Goat Development and Extension Project (01/01/2018-31/12/2021)	1,500.00	1.3; 2.3; 2.5	Comply with Goal 1, 6.
08	Preparation of Master Plan of Bangladesh National Zoo and Rangpur Zoo and Infrastructure Development & Renovation Project (01/07/2018-30/06/2020)	2,465.00	9.5	Comply with Goal 1, 6
09	Cattle Fattening through Modern Technology Project (01/01/2019-30/06/2021)	300.00	1.1; 2.1; 2.3, 12.1	Comply with Goal 1, 6.
10	Breed Up-gradation Through Progeny Test Project (2nd Phase) (01/07/2014-30/06/2020)	800.00	1.3; 2.1; 2.3, 2.5, 12.1	Comply with Goal 1, 6.
11	Establishment of Institute of Livestock Science and Technology Project (01/07/2014-30/06/2020)	7,500.00	9.5	Comply with Goal 1, 6.
12	Integrated Livestock Development in coastal area project) (01/07/2018-30/06/2021)	3,500.00	1.1; 1.2; 1.3; 1.5; 2.1; 2.3; 2.5, 13.1, 13a	Comply with Goal 1, 6.
13	TA Project: Improvement of Food Security and Public Health through Strengthening Veterinary Services and Controlling Emerging infectious Diseases throughout Bangladesh (01/07/2016-30/06/2020)	2,500.00	2.1; 2.2; 2.5; 3-3	Comply with Goal 1, 6.
14	Preventing Anthrax and Rabies in Bangladesh by Enhancing Surveillance and Response Project (01/05/2018-30/09/2020)	460.00	3-3	Comply with Goal 1, 6.
<b>B. Bangladesh Livestock Research Institute (BLRI)</b>				
01	Dairy Development Research Project	3,602.00	2.1	Comply with Goal 1, 6.
02	Red Chittagong Cattle (RCC) Improvement and Conservation Project (2nd Phase)	3,442.00	2.1	Comply with Goal 1, 6.
03	Combating the threats of antimicrobial resistance and zoonotic diseases to achieve the GHSA in Bangladesh	882.31	2.1	Comply with Goal 1, 6.
04	Strengthening of Poultry Research Development Project	12,335.00	1.1	Comply with Goal 1, 6.

SI No	Name of the activities (policy/program/project/action)	Indicative cost (Lakh BDT at FY 2019-20 prices)	Link to	
			SDGs Target	BDP 2100 Measures
05	Black Bengal Goat Conservation Development & Research Project	3,132.00	1.1	Comply with Goal 1, 6.
06	Zoonosis and Trans boundary Animal Diseases Prevention and Control Research Project	15,042.00	2.1	Comply with Goal 1, 6.
07	Buffalo Research and Development Project	6,317.00	2.1	Comply with Goal 1, 6.
<b>Proposed projects (ADP)</b>				
01	Strengthening of Deshi Chicken Research, Conservation and Improvement Project	11,610.64	1.1	Comply with Goal 1, 6.
02	Duck Research, Conservation and Development Project in the Haor and Low Laying Areas	12,173.82	1.1	Comply with Goal 1, 6.
03	Strengthening of infrastructure & Research Capabilities of Bangladesh Livestock Research Institute (BLRI)	37,753.29	2.a	Comply with Goal 1, 6.
04	Conservation and improvement of Gayal in the Hill Tract Area Research Project	8,906.49	2.1	Comply with Goal 1, 6.
05	High yielding bee breed development and research project	50,025.00	2.1	Comply with Goal 1, 6.
06	Upgradation and diversification of value addition technologies of livestock products & by products project	10,000.00	1.1 & 2.1	Comply with Goal 1, 6.

### 3.4.9 Linkage and Cross-cutting Issues between Institutions and Agencies

The overall research, training, extension and management activities and the linkages with various national and international organizations/agencies will be developed. The sub-sector also keeps close contact with public extension organizations, different NGOs for disseminating the technologies and obtaining feedback from them. The BLRI and DLS should be collaborated with national/international livestock research and extension organizations and maintains close liaison for livestock research and development includes: the World Bank (WB), International Development Agency (IDA), International Livestock Research Institute (ILRI) and Food and Agriculture Organization (FAO). Among the national collaborators, the focus implies to DLS followed by Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Department of Agriculture Extension (DAE), Department of Environment, Department of Forest; and close cooperation, linkages, joint research, and development programs with different NGOs. The national universities including Bangladesh Agricultural University (BAU), Chittagong University and Chittagong Veterinary and Animal Science University, Rajshahi University, etc. are linked with BLRI through contract research programs and exchange of expertise and training.

#### 3.4.10 Estimating Resource Allocation and Gap Analysis

The livestock sector, whose contribution to GDP averaged at 2.5% during FY11-FY13, currently around 20% of rural work force and services as a major source of protein. From a 2% growth during 1980's, its growth averaged 4.4% per year during FY05, FY09, but fell by roughly one percentage point during FY11-FY13. Over the last five years, since formulation of the National Livestock Development policy, Bangladesh has progressed a lot in terms of milk, meat and egg production. The milk, meat and egg production respectively for FY15 had been 6.97 MMT, 4.86 MMT and 10,995.2 million, compared to 2.65 MMT, 1.04 MMT and 5,653 million respectively for FY 08 and 1.78 MMT and 4,424 million respectively for FY01. This data illustrate that the sized of the livestock sub sector increased almost 1.00 to 1.50 times between

FY01 to FY01 to FY08 and 3 to 4 times between FY01 to FY15 (7<sup>th</sup> FYP, 2015). Performance of Livestock Sub-sector under 7FYP: Livestock contributed 1.47 percent of GDP and 13.6 percent of agricultural GDP in 2018-19. During the first four years of the 7FYP, the sector expanded at an average annual rate of 3.4 percent, which is considerably higher than that of the 6FYP of 2.8 percent. Livestock service and essential role as a source of protein, employment generation, export earnings, and provision of food security. During the 7FYP period, Bangladesh achieved self-sufficiency in meat production and near self-sufficiency in the production of eggs (8<sup>th</sup> FYP, 2020). The production of meat reached at 7.51 million MT in 2018-19- up from 5.86 million MT in 2014-15 (8<sup>th</sup> FYP, 2020). Milk Production during this time increased form 6.97 million MT to 9.92 million MT – and increase of 42 percent, while production of eggs grew by 55 percent. With increasing production, per capita availability of milk, meat and eggs rose to 161.69 ml/person/day, 122.47 gm/ person/day and 101.78 piece/person/year respectively in FY19. Projected requirement shows in Table 34.

**Table 35: Projected requirement of meat and required number of ruminant and poultry to be slaughter in 2025**

Parameters	Year 2023	Year 2025	Year 2030	Year 2035	Year 2040
Projected human population	173.0	176.4	184.4	191.2	196.5
Projected meat requirement (million ton)	2.526	2.640	3.029	3.420	3.801
Red meat requirement (million ton)	1.263	1.267	1.363	1.368	1.407
White meat requirement (million ton)	1.263	1.373	1.666	2.052	2.3948
Total ruminant to be slaughtered (million)	29.187	29.284	31.499	31.612	32.505
Total poultry to be slaughtered (million)	1263	1373	1666	2052	2471

Calculated on the basis of HIES, 2022 and BBS 2023

To fulfil the projected requirement of meat and required number of ruminant and poultry to be slaughtered in 2025, 2030, 2035 and 2040 government agencies need to give extra emphasis in livestock sub-sector.

### 3.4.11 Livestock Sub-sector Action Plan with Priority and Intervention

For addressing challenges of livestock sectors diverse actions would be taken for short, medium and long term basis starting from the launching of 8<sup>th</sup> five year plan (2021-2025) or might be extended for another 1-2 years. The following Action Plan (Table 35) along with locations, responsible organizations, and rough indicative budget is suggested. In 15 major areas 35 action plans have been proposed to diversify and intensify livestock sub-sector for providing safe food, and nutrition to growing population of Bangladesh in the context of climate change, decreasing production and commercialization of livestock production.



**Table 36: Action Plan and Monitoring & Evaluation Framework**

Thematic Area	Name of Action Plan	Location AEZ no.)	Assigned agency	Duration	Indicative budget (Million BDT)*	Comments
TA1. Establishment of mini dairy farm for demonstration and training for the rural farmers	1. Establishment of auto- mated and IOT based mini dairy farm (20-50 high yield dairy cows)	All districts	DLS	Short term (July 2023 - June 2025)	500,000 + 500.000	Will act as the demonstration farm and training center for the farmers
TA2. Initiation of Frontier research for breaking present yield ceiling of different farm animalstools	2. Undertaking frontier research for high yielding genotype development of livestock (such as increasing growth rate, milk production, disease prevention and development of disease resistance genotypes of livestock	All AEZ	BLRI, BAU, BSMRAU, SAU	Medium term (July 2023 - June 2027)	20,000	Need logistics supply, lab development, chemical supply and scientists/technicians capacity building. Transgenic animal production.
TA3. Prevention and control of economically important emerging and re-emerging diseases	3. Research and production of vaccines of economically important livestock diseases	All AEZ	BLRI, LRI	Medium term (July 2023 - June 2027)	5,000	Will do research and production of vaccines
	04. Community based treatment of livestock and privatization of veterinary services	All AEZ	DLS	Short, medium,	5,000	Veterinary services and training for local veterinary service providers.
TA4. Conservation of indigenous genetic resources of livestock	5. Red Chittagong cattle and other indigenous genotypes (Pabna breed, Mirkadim, Achil, Hilly Chicken etc) conservation; and	Chottogram, Pabna and BLRI, Saver	DLS	Medium term (July 2023 - June 2027)	5,000	In situ conservation farms.
	6. Development and fabrication of environmental control houses and livestock processing plant.	All divisions	DLS	Medium term (July 2023 - June 2027)	2,000	Develop awareness among the livestock farmers, reduction of processing cost.
TA5. Incentives for environment friendly livestock activities	7. Promotion of quality compost/biogas residue/ vermin-compost/bio-fertil- izer production; and	All AEZ	BLRI, BAU, BSMRAU, SAU, PSTU, HSTU	Medium term (July 2023 - June 2027)	2,000	Management of environment and soil health improvement for sustainable production.
	8. Food safety law should be implemented very strictly.	All AEZ	DLS, Food Ministry	July 2023 - June 2027	20	-

Thematic Area	Name of Action Plan	Location AEZ no.)	Assigned agency	Duration	Indicative budget (Million BDT)*	Comments
TA6. Research and development on Climate-Smart livestock production and ensuring food and nutrition security	9. Profiling existing climate- smart researchers such as introduce environmentally controlled poultry and dairy houses. Adaptation of livestock production technology/variety on coastal/saline areas and demo in coastal districts;	AEZ 13, 14, 11, 12	BLRI, DLS, NGOs	July 2023 - June 2025	200	Desktop work, literature review, physical survey, documentation.
	10. HY Fodder variety developed for higher(8-12 dS/m) soil and water salinity conditions (5 number);	AEZ 13, AEZ 14, AEZ18	BLRI, KU, DU, PSTU	July 2023 - June 2027	200	Research and development
	11. Integration of livestock in Agro-forestry system for Barind, Madhupur tract, hilly and similar regions (2-3 models) and scale-up existing technologies; and	AEZ 29, AEZ 26, AEZ 28	BLRI, BSMRAU, BAU	July 2023 - June 2027	100	Technology dissemination
	12. Yield and profit maximization for gher system (fish-fodder) of greater Khulna, Barishal, Gopalganj, Narail and similar areas. Study gher system environmental and social aspects-report within 1st year.	AEZ13, AEZ 14, AEZ 11	BLRI, DLS, DOF, NGOs	July 2023 - June 2027	200	Research and study.
TA7. Tackling low livestock productivity and	13. Updated on-farm research on poultry, dairy, goat and sheep production;	All AEZ	BLRI	July 2023 - June 2027	200	Research and development
	14. Promotion of IPNS (integrated plant nutrient system) for major fodder production systems of the country-300 on-farm trials; and	All AEZ	BLRI	July 2023 - June 2027	100	-
	15. Frozen semen production and popularization of artificial insemination (AI) in Black Bengal goat and buffalo	All AEZ	DLS, Food Ministr	July 2023 - June 2027	200 + 200	-

Thematic Area	Name of Action Plan	Location AEZ no.)	Assigned agency	Duration	Indicative budget (Million BDT)*	Comments
TA8. IVolatile market price at farmers level	15. Develop/improve infrastructure of model market having farmers product marketing facility, preservation facility, cooling van, fair transport cost and minimal toll (including prohibition of unofficial toll by miscreant)- at least one big market in the milk pocket area and poultry production zone.	Milk pocket area and poultry production zone	LGED, DAM, DLS	July 2023 - June 2027	800	Should cover all milk pocket areas and poultry production zones.
	16. Create of farmers production group for major products particularly for marketing of perishable goods such as milk, eggs including finding better market across the country- milk pocket areas and poultry production zones.	Milk pocket areas and poultry production zones	DLS, DAM, Selected NGOs, Farmers group	July 2023 - June 2027	50	Starting from each area (at least one pilot group for 1st year).
TA9. Post-production loss reduction, value addition, industrial processing and commercialization	17. Conduct hands-on training on milk, meat processing, handling, grading, packaging, storing including application of nanotechnology, transport and marketing based on developed technology- 500 training per year. 30 participants per training;	Milk pocket areas and poultry production zones	DLS, BAU, selected NGOs, Local business association	July 2023 - June 2027	80	Would cover all milk pocket areas of the country. First develop at least one master trainer from each area.
	18. Integrate of livestock in Agro-forestry system for Barind, Madhupur tract, hilly and similar regions (2-3 models) and scale-up existing technologies;	AEZ 29, AEZ 26, AEZ 28	BLRI, BSM- RAU, BAU	July 2023 - June 2027	100	Technology dissemination
	19. Conduct research for production of milk, meat and eggs products;	Milk pocket areas and poultry production zones	BLRI, BAU	July 2023 - June 2027	100	Research and development
	20. Smart technology for production of quality semen of bull and buck;	Research station, University	BLRI, DLS, BAU	July 2023 - June 2027	200	-

Thematic Area	Name of Action Plan	Location AEZ no.)	Assigned agency	Duration	Indicative budget (Million BDT)*	Comments
	21. Construct cool chamber at community level for milk pocket zones for storing perishable good for few days/months at reduced fees (along with refrigerated delivery van); and	Milk pocket areas	MOFL, DLS, LGED, local farmers/ business association	July 2023 - June 2027	1,000	-
	22. Promote construction of international standard milk and meat products factories at milk pocket areas and poultry production zones.	Milk pocket areas	GOB, BB, MOI, MOFL, LGED, Businessmen/ industrialist	July 2023 - June 2027	1,000	With soft loan, technical help and tax exemption for certain period government can expedite the process of factory construction.
TA10. Credit for all categories of farmers	23. Allocation of sufficient amount to disburse loan to all categories of farmers including marginal, landless and contract farmers at 2 % service charge;	All AEZ	GOB, BB, Commercial bank, DLS, farmers group, NGOs	July 2023 - June 2027	40,000	-
	24. Micro-credit to farmers should be disbursed with single digit service charge. No declining rate to be applied; and	All AEZ	BB, PKSF, Grameen Bank, BRAC and NGO micro-credit, DLS	July 2023 - June 2027	1,000	Easy for farmers to get loan from NGOs, as they move to farmers doorstep. If needed government should give incentives to NGOs for serving farmers.
	25. A part of government Zakat fund (30 %) to be distributed among landless poor farmers for goat and sheep rearing.	All AEZ	MORA, Islamic Foundation, DLS	July 2023 - June 2027	n/a	-
TA11. Poor Investment in Agricultural research-extension and sub-optimal linkage of research-extension-farmers	26. Strengthening of official linkage between livestock research institutes and extension agencies should be mandatory for quick delivery of developed varieties/ technology and getting field level feed-back of researchable problems;	All AEZ	MOFL, BLRI, DLS	July 2023 - June 2027	100	-
	27. Promotion of location specific adaptive research and extension for solving local problem depending ecosystems and socio-economic conditions;	All AEZ	BLRI, DLS, NGOs	July 2023 - June 2027	1,000	-

Thematic Area	Name of Action Plan	Location AEZ no.)	Assigned agency	Duration	Indicative budget (Million BDT)*	Comments
	28. Creation of Livestock Extension Officer (LEO) post in each Upazila; and	All Upazila	GOB, MOFL, DLS	July 2023 - June 2027	500	As presently no LEO in the Upazila level.
	29. Linkage with farmers to be enhanced through hands-on training on modern technology, adaptive trial and demonstration setting at farmer's level.	All AEZ	DLS, BLRI, BAU, NGOs	July 2023 - June 2027	2,000	-
TA12. Capacity building personnel and farmers	30. Need robust capacity building of scientist in the field of breeding, feeding, management and disease control, safe food and nutrition security and ICT in livestock production in-country and foreign country	All AEZ	MOFL, BLRI	July 2023 - June 2027	1,500	Includes Short-long term professional training (1000 persons per year), MS (100), PhD (50), Post-doc for solving national problems/ learning modern technique.
	31. Professional training and capacity building of extension personnel, breeders, nutritionist, and veterinarian; and	All AEZ	MOFL, DLS, BAU	July 2023 - June 2027	500	Short-long term training on technology delivery and documentary production.
	32. Strengthening lead farmers training including women on goat and sheep rearing, dairy and poultry farming	All AEZ	DLS, BLRI, BAU	July 2023 - June 2027	100	-
TA13. Index based Insurance for livestock farmers	33. Review the protocol of Index based insurance of Green-Delta Insurance and Oxfam, IWMI, IFC and start insuring farmers- within 1st year rules drafted and passed.	All AEZ but primarily for flood prone and cyclone affected coastal region (AEZ 2, 3, 8,9, 12, 13, 14, 19, 20, 21)	BB, Sadharan Bima Company, Green Delta Insurance, BMD, WDB, DLS	July 2023 - June 2027	800	Due to climate change climate related disaster is frequent, thus farmers losing livestock and means of livelihoods. So need insurance to save them from Mahajoni loan and dire poverty.
TA14. Urban and rural livestock food production and women engagement	34. Research and promotion of urban livestock production, safe and nutritious livestock food processing and intake-1,000 farmers training per year.	All AEZ and cities	BLRI, DLS, DOF, NGOs, Agriculture Universities, City Corporation, Town Federation, Farmers group	July 2023 - June 2027	800	Present urban population is around 40%, it will gradually increase. Among them many are slum dwellers, poverty stricken, so need to be addressed.

#### Remarks:

The indicative budget allocated in different action plans are absolutely tentative and it might be changed according the exact requirement and fund available.

\* Fund might be mobilized from foreign aided projects

### 3.4.12 The Way Forward

On the basis of discussions and interactions with researchers, administrators, policy makers the following recommendations are highlighted.

**Social security:** Strengthen social/ food security programs for the livestock farmers as well as marginal farmers during market unstable season should be taken care of through proper coordination among MoFL, DLS, BLRI and private sector.

**Improve management of livestock resources:** Priority interventions including community-based management livestock farming system through training and access to credit and the establishment of local hatcheries and livestock farming to be ensured the supplying of quality chicks. The program on “Frozen semen production and popularization of artificial insemination (AI) in Black Bengal goat” and buffalo should be introduced.

**Develop public-private partnerships for infrastructure and services development:** Develop partnerships to promote the establishment of specialized livestock farms, feed and meat and milk processing industries with backward and forward linkages; establishment of cold storage and cold chains; and the production of quality chicks, feed and drugs.

**Promote production of broiler and milk through community-based management:** Promote production in the southern region through sustainable broiler and dairy production and community-based co-management of the farms.

**Collaboration/Consideration:** Collaboration among the Ministry of Fisheries and Livestock, Ministry of Agriculture and Ministry of Commerce is essential. The DLS, Bangladesh Livestock Research Institute, universities and the private sector should also participate in the proposed interventions. An enabling policy environment need to be promoted through public–private partnerships and enhanced participation of private sector entrepreneurs. In particular, effective livestock farm management system needs to be introduced for sustainable livestock production.

**Capacity building of DLS and BLRI:** Research and extension facilities need to be extended to achieve the SDGs and Bangladesh Delta Plan 2100 targets. Special attention should be given to create the post of Livestock Extension Officer (LEO) in the upazila level of the organogram of DLS.

**Formation of dairy development and poultry development board:** Formation of Dairy Development and Poultry Development board is a crying need to ensure the sustainable development of these sectors.

**Gender issue:** As women are directly involved for small scale livestock farming in Bangladesh, therefore following steps should be taken for their livelihoods improvement: (i) Encourage women participation in the farmers/producer group, livestock-based farmers field school (FFS), community based social activities; (ii) Ensure access to women in the training, technology (women friendly, time saving technology), livestock and veterinary extension services, market, finances and resources etc.; (iii) Ensure involvement of women in the livestock value chain process family level and community level; (iv) Support vulnerable livestock farmers especially women farmers in the emergency situation ensure the knowledge in the environmental safeguard issues. The following points should be addressed:

- Strengthening of regulatory services
- Automation of service delivery
- Creation of export friendly environment
- Adaptation program for climate change effects
- Extension of GAP and alternate uses of antibiotics
- Extension of eco-friendly production systems
- Development projects targeting 4th industrial revolution
- Ensuring budgetary allocation to achieve the objectives.

### Annex-1: Proposed Project of Livestock Sub-sector with Indicative Budget and Implementation Period

Thematic Area (TA)	Name of Proposed Project	Implementing period and indicative Budget (Million Taka)		
		2024	2025	2030
TA1: Establishment of mini dairy farm for demonstration and training for the rural farmers	Establishment of automated IOT based mini dairy farm (20-50 high yielding dairy cows)	50,000	20,000	5,000
TA2. Initiation of Frontier research for breaking present yield ceiling of different farm animalstools	In situ conservation and improvement of Red Chittagong, Pabna and Mirkadim cattle	20,000	20,000	2,000
TA3. Prevention and control of economically important emerging and re-emerging diseases	Frozen semen production and popularization of artificial insemination (AI) in Bangladesh	5,000	2,000	2,000
TA4. Prevention and control of economically important emerging and re-emerging diseases	1. Introduction of environmental controlled dairy house and ration in Bangladesh	5,000	3,000	2,000
	2. Promotion of quality composed/biogas residue/ vermic composed/ bio-fertilizer production in Bangladesh	5,000	3,000	2,000
TA5. Incentives for environment friendly livestock activities	1. Saline resistance HYV fodder production for costal part of Bangladesh	3,000	3,000	3,000
	2. Hybrid fodder production in Bangladesh	2,000	2,000	2,000
TA6. Research and development on Climate-Smart livestock production and ensuring food and nutrition security	Research and production of vaccines in Bangladesh	3,000	3,000	3,000
TA7. Tackling low livestock productivity and yield gap	Separation of Directorate of Livestock Services (DLS) as Directorate of Livestock Production & Directorate of Animal Health	45,000	45,000	45,000
TA8. Volatile market price at farmers level	Projects on “Formation on Farmers Production group	2,000	2,000	1,000
TA9. Post-production loss reduction, value addition, industrial processing and commercialization	Projects on “Hands-on training on milk & meat processing, handling, grading, packaging, storing, and product processing”	1,000	1,000	1,000
TA10. Credit for all categories of farmers	Projects on “Loan for landless, marginal & contract farmers at 2% service charge”	20,000	20,000	20,000

Thematic Area (TA)	Name of Proposed Project	Implementing period and indicative Budget (Million Taka)		
		2024	2025	2030
TA11: Poor Investment in Agricultural research-extension and sub-optimal linkage of research-extension-farmers	Projects on “Loan for landless, marginal & contract farmers at 2% service charge”	20,000	20,000	20,000
TA11: Poor Investment in Agricultural research-extension and sub-optimal linkage of research-extension-farmers	Projects on “Capacity building of research & extension personnel and selective farmers in Bangladesh”	10,000	10,000	10,000
TA12: Poor Investment in Agricultural research-extension and sub-optimal linkage of research-extension-farmers	Review the protocol of index-based insurance of Green-Delta, Oxfam, IWMI, IFC and introduction	5,000	5,000	5,000
TA13: Index based Insurance for livestock farmers	Projects on “Women entrepreneur intensive”	5,000	5,000	5,000
TA14: Urban and rural livestock food production and women engagement	Training to the farmers and women entrepreneurs for livestock food production and processing.	5,000	6,000	7,000

#### Remarks:

The indicative budget allocated for different projects are absolutely tentative and it might be changed according to the exact requirement and fund available.

Fund might be mobilized from foreign aided projects.





## Water Resources





## 3.5 Water Resources Sub-sector Action Plan

### 3.5.1 Introduction

The Government of Bangladesh is committed to exploring, developing and using its water resources to the benefit of all users. To this end, the Ministry of Planning took this initiative to prepare the Water Resource Sub-sector Action Plan for ensuring optimal development and management of water that benefits both individuals and the society at large. The plan is a framework within which line agencies and other organizations are expected to plan and implement their own activities in a coordinated manner.

Bangladesh is a riverine country and the rivers are full of water during the rainy season. But the country suffers from water shortage during the dry season due to uneven distribution of rainfall. The country is located at the bottom of the mighty GBM river basin systems and as a result faces hydro-meteorological consequences originated in the Bay and the Himalayans. It also faces more than 1 billion tons of sediment deposition annually. In addition, it has water logging, salinity intrusion, river bank erosion, lack of skilled manpower, water pollution and other water related challenges. Therefore, we need to develop action plan on overall water resources development. The “Action Plan on Water Resource Sub-sector” will provide a comprehensive picture of water resource sub-sectoral goals, performances, opportunities, challenges and identify policies and strategies with detailed actions and tentative budget that support the 8<sup>th</sup> FYP.

The major challenges of water resources are : (i) availability of water in dry season; (ii) river water management, (iii) river bank erosion (iv) coastal zone protection (v) wetland conservation (vi) climatic change and its impacts (vii) cyclonic storm (viii) population growth (ix) upstream development (transboundary water issue) and (x) institutional capacity and coordination.

Water resource is a very scarce, costly and crucial factor for agriculture, human survival and overall development of Bangladesh. Water resource is also important for fisheries, navigation, industries, hydro-power, preservation of water bodies and ecological balance. The total water requirement has been estimated 45.26 km<sup>3</sup> of which 40.08 km<sup>3</sup> for agriculture, 4.14 km<sup>3</sup> for domestic use (Commonwealth Scientific and Industrial Research Organisation 2014). Since few decades, groundwater is the main source of irrigation and one of the key factors making Bangladesh self sufficient in food production. Before 1970s, surface water (e.g., pond, river), rainwater and dug wells were the main source of drinking and domestic water supplies in Bangladesh. Importance of groundwater irrigation increased with the introduction of HYV seeds in late sixties to meet the food demand for growing population. Bangladesh receives huge water during monsoon causing regular seasonal flood in it's low elevated areas and during dry irrigation season, scarcity of water threats time-bound irrigation in many areas that leads to extensive use of groundwater. The country started emphasizing groundwater irrigation in the mid-seventies with deep tube wells (DTW), but soon shifted it's priority to shallow tube wells (STW).

For highlighting the present status of the sub-sector the following points have been addressed: implementation status of the last 7<sup>th</sup> FYP; policies, strategies, laws and plans to support water resources management (WRM); availability of surface water; groundwater abstraction; current trends in research and innovation; water use pattern; water needs (consumption, industry, irrigation, fisheries, navigation etc); achievements and status of financing for water resources development and management.

The three main ministries involved with water management as related to agriculture are the Ministry of Water Resources, Ministry of Agriculture and the Local Government Division dealing with Rural Development and Cooperatives. The large flood control and irrigation projects and river management

issues are dealt by the Water Resources Ministry. The Ministry of Agriculture and the Local Government Division deal with minor irrigation and flood control schemes. BWDB, BADC, BMDA, LGED, DPHE, and City Corporation are responsible for implementation of water resource development projects under the guidance of concerned ministries and has made impressive development. Although an impressive success achieved during the last plan period, still need to explore the potentiality and face the upcoming challenges, appropriate interventions and action should be taken for sustainable development and management of scarce water resources of Bangladesh. With this view, the sub-sector action plan addresses to explore the annual development plan, perspective plan, resource allocation plan and a strategic intervention document to get the maximum success of water resources development. An action plan framework of the water resources sub-sector has been prepared which includes water management dimensions such as flood control, water logging, river bank erosion, groundwater and surface water use, rain water harvesting, urban and rural water supply, water pollution, river dredging for inland water traffic, and preservation of environment.

### 3.5.2 Situation Analysis

Bangladesh is a land of rivers but the rivers are full of water during 2-3 months only from July to September. The country suffer from the double-edged sword “flood and drought” due to uneven distribution of rainfall. Bangladesh receives about 2.2mm of rainfall (From Google) annually but about 96% of the total rainfall occurs in April to October, leaving the remaining five months of the year essentially dry (Rashid 2006). Therefore, Bangladesh agriculture is mainly dependent on hydrological cycle. Thus, farmers need protection against flooding in wet seasons, irrigation in dry seasons, supplementary irrigation mainly in wet seasons, protection against saline water intrusion in coastal areas, proper drainage both in wet and dry seasons, protection against river bank erosion and safeguard measures against the water-related hazards (storm surge/cyclone) in the coastal belt (8<sup>th</sup> FYP).

Bangladesh is the lower most riparian country in the Ganges-Brahmaputra-Meghna basins and crisscrossed by around 700 rivers including 57 transboundary rivers. The country shares its transboundary water resources with the upper riparian countries like Bhutan, China, India and Nepal. The total catchment area of the Ganges-Brahmaputra-Meghna basins is about 1.72 million square km of which only 7% basin area falls within Bangladesh. Out of the 57 transboundary rivers of Bangladesh, 13 rivers fall under the Ganges basin fully or partially in the four hydrological regions; 11 rivers fall under the Brahmaputra basin lying fully or partially over the seven hydrological regions and 25 rivers covering six hydrological regions lying fully or partially in the Meghna Basin (8<sup>th</sup> FYP).

Water is a scarce and a costly resource. It is the single-most important resource for the well-being of people and provides livelihoods for millions of people. Water is essential for human survival, socio-economic development of the country and preservation of its natural environment. Life in riverine Bangladesh is based on water.

Water resource is a very crucial factor for agricultural and livelihoods development. It is one of the major factor which can make a crop either success or failure. Bangladesh is blessed with plenty of water from different sources. All these sources of water keep the country’s crop fields and other vegetations green and fruitful throughout the year. Though water is plenty but its distribution is uneven that causes serious problems like floods in wet season and scarcity of water in the dry season causing loss of crops, livestock, public health hazards and environmental degradation. Water is always required for agricultural, domestic as well as industrial use and for navigation, fisheries, salinity control as well as dilution of pollution. In addition, water is also necessary for maintaining the country’s

ecological balance and its protection and wetland preservation.

The importance of water resources in Bangladesh has been briefly described in the following sections:

**Water needs for consumption, irrigation, fisheries, and navigation:** Water resources management in Bangladesh is an urgent issue to satisfy multi-sector water needs with limited resources, promote efficient and socially responsible water use. Water is needed for consumption, irrigation, fisheries, navigation, industries, hydropower, reservation of water bodies and environment. There are about 7.56 Mha (million hectare) of cultivable land of which about 6.9 Mha of agricultural land can be brought under irrigation at full development (Banglapedia 2021). Mainuddin et al (2014a, in CSIRO 2014) estimated that the total irrigation water demand of Bangladesh is 33 BCM and that for domestic purpose is 2.7 BCM. The corresponding figure for industrial purpose is 0.08 BCM.

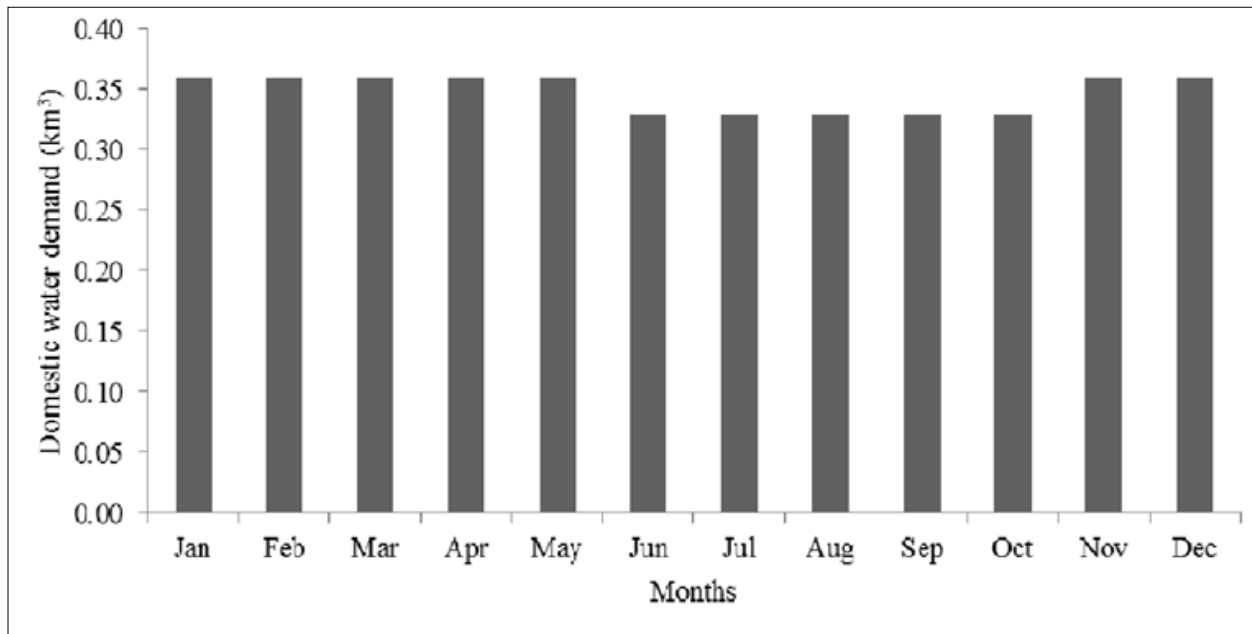
**Hydrological zone-wise monthly water demand and availability:** Water demand of the main three sectors; agricultural, domestic and industrial has been computed by Barua et al (2016) for the specific year. The agricultural water demand was estimated based on hydrologic and agronomic characteristics using in the modeling approach of Rosegrant and Cai (2002). The industrial and domestic water demand was estimated on the basis of secondary data. The availability of internal renewable water resources was estimated using long term monthly average precipitation pattern whereas that of external renewable water resources were estimated based on transboundary river flow pattern. The highest consumer of water supplies was agriculture (40.08 km<sup>3</sup>/year), followed by household use (4.14 km<sup>3</sup>/year), and industry and energy (1.03 km<sup>3</sup>/year) (Barua et al 2016). The water demand was found to be very high from November to March and the maximum demand (Table-37) occurs in March (12.44 km<sup>3</sup>). Fig-13 and Fig-14 are showing the monthly demand for domestic and industrial purpose respectively. Table 38 shows the monthly renewable water availability. Water shortage was found in the months of January to March (Table 36). The study suggests a water management plan for reserving 22.25 km<sup>3</sup> water from November and December which can mitigate the shortage from January to March.

**Table 37: Zone wise Agricultural Water Demand (km<sup>3</sup>)**

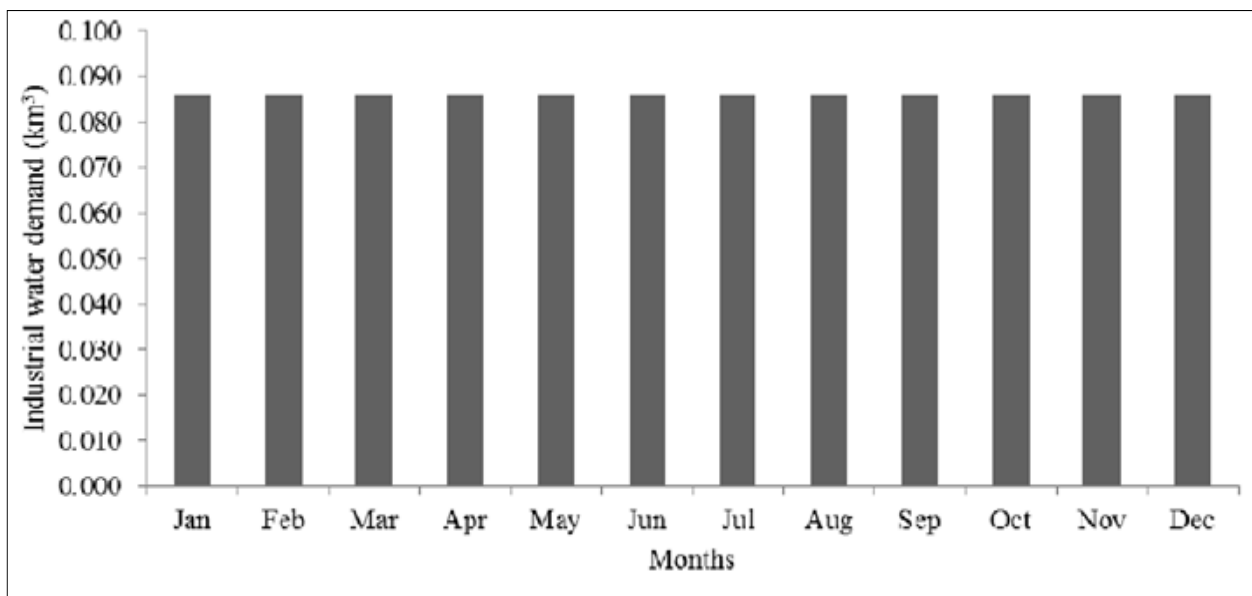
Months	North-west	North-central	North-east	South-west	South-central	South-east	Eastern Hill
January	2.373	0.794	1.114	0.705	0.566	0.677	0.292
February	3.359	1.148	1.825	1.443	0.775	0.962	0.363
March	4.267	1.356	2.381	2.021	0.715	0.971	0.285
April	1.842	0.273	0.281	1.075	0.153	0.133	0.049
May	0.159	0.005	0.002	0.282	0.006	0.001	0.002
June	0.006	0.000	0.000	0.006	0.000	0.000	0.000
July	0.401	0.060	0.034	0.321	0.251	0.009	0.006
August	0.237	0.015	0.008	0.083	0.068	0.002	0.002
September	0.102	0.015	0.008	0.083	0.068	0.002	0.002
October	0.231	0.102	0.015	0.104	0.069	0.003	0.002
November	0.481	0.041	0.053	0.168	0.137	0.023	0.038
December	1.445	0.456	0.546	0.725	0.440	0.387	0.173
Total	14.902	4.265	6.268	7.015	3.250	3.171	1.213

Source: Barua et al., 2016

(Adapted from CSIRO: Water for Health Country Flagship, Australia, May 2014)



**Fig.13: Domestic Water Demand of Bangladesh (km<sup>3</sup>)**  
 (Adapted from CSIRO: Water for Health Country Flagship, Australia, May 2014)



**Fig.14: Industrial Water Demand of Bangladesh (km<sup>3</sup>)**  
 (Adapted from CSIRO: Water for Health Country Flagship, Australia, May 2014)

**Table 38: Monthly Water Discharge and Renewable Water Resource Scenarios in Bangladesh**

Months	Ganges & Brahmaputra Discharges	Other Trans boundary Rivers Discharge	IRWR*	MRWR**	EWR Available***	
	(km <sup>3</sup> )	(km <sup>3</sup> )	(km <sup>3</sup> )	(km <sup>3</sup> )	(km <sup>3</sup> )	(km <sup>3</sup> )
January	22.5	2.32	0.33	25.15	20.42	4.73
February	16.58	1.71	0.83	19.12	18.45	0.67
March	18.61	1.92	1.97	22.50	20.42	2.08
April	26.18	2.7	4.99	33.87	19.77	14.10
May	48.75	5.04	11.68	65.47	20.42	45.05
June	95.39	9.85	20.13	125.37	19.77	105.60
July	181.6	18.76	22.81	223.17	20.42	202.75
August	222.44	22.98	18.16	263.58	20.42	243.16
September	197.9	20.44	14.05	232.39	19.77	212.62
October	111.55	11.52	8.05	131.12	20.42	110.70
November	46.39	4.79	1.61	52.79	19.77	33.02
December	29.06	3	0.39	32.45	20.42	12.03

\* IRWR = Internal Renewable Water Resource;

\*\* MRWR = Month Renewable Water Resource;

\*\*\* EWR = Environmental Water Requirement

Source : Barua et al., 2016

(Adapted from CSIRO: Water for Health Country Flagship, Australia, May 2014)

**Table 39: Water Demand vs. Availability Scenario**

Months	Water Demand (km <sup>3</sup> )	Availability of Renewable Water (km <sup>3</sup> )	Excess (+) or Shortage (-) (km <sup>3</sup> )
January	6.96	4.73	-2.24
February	10.32	0.67	-9.65
March	12.44	2.08	-10.36
April	4.25	14.10	9.85
May	0.90	45.05	44.15
June	0.43	105.60	105.18
July	1.50	202.75	201.25
August	0.83	243.16	242.34
September	0.69	212.62	211.92
October	0.94	110.70	109.76
November	1.39	33.02	31.64
December	4.61	12.03	7.41

Source: Barua et al., 2016

(Adapted from CSIRO: Water for Health Country Flagship, Australia, May 2014)

## Balancing Water Demand and Availability

In a general view, a country like Bangladesh may often be treated as water abundant. But the situation is different when the water demand and availability in a short term basis are compared. An accurate water balance is difficult to provide for the different HRs in Bangladesh. In the National Water Management Plan (2004), an overview is provided of the available water flows (static and fugitive) and water demand from key sectors (National Water Management Plan). This includes 'traditional' sectors such as agriculture, domestic use and industry. However, as pointed out by MacKirby et al (2014), the NWMP does not provide a comprehensive water balance. Nevertheless, the NWMP was the first systematic attempt to quantify supply and demand in the country from the perspective of all water uses and is still the major source of information for water planners.

The study 'Bangladesh Integrated Water Resources Assessment supplementary report: approximate regional water balances' (Mac Kirby et al, 2014) aims to tackle some of these shortfalls: "The study brings together current information on rainfall, crop areas, evapotranspiration, groundwater levels and river flow to form approximate water balances for each region". The annual average volume of rain falling on Bangladesh (excluding the eastern hills which are outside the region we considered) from 1985 to 2010 was 284 km<sup>3</sup>, of which 11% fell in the dry season from November to April. The annual average (1980 to 2009) inflows of the combined main rivers was 981 km<sup>3</sup>; the dry season (November to April) inflows were 15% of the total. The average annual recharge to groundwater is not well known, with CSIRO estimates and estimates in the literature varying from 28 km<sup>3</sup> to 65 km<sup>3</sup>. Water use in Bangladesh is dominated by irrigation with estimated annual use varying from 25 to 33 km<sup>3</sup> of which 80% is from groundwater. Domestic and industrial demand is estimated at about 2.7 km<sup>3</sup> per year, which is projected to increase to about 4.1 km<sup>3</sup> by 2050. Groundwater is overused in the Barind and around Dhaka,

A study (Barua et al 2016) quantifies the seasonal distribution of renewable water availability, sector-wise monthly consumption pattern and ultimately the water conservation required at specific month to counteract seasonal water scarcity in Bangladesh. Renewable water resources are the total amount of water resources which is generated through the hydrological cycle and is often measured for a country on annual basis. Availability of sufficient quantity of water throughout the year is necessary for food production, economic development and life. Water demand of the main three sectors; agricultural, domestic and industrial has been computed for the specific year. The availability of internal renewable water resources was estimated using long term monthly average precipitation pattern whereas that of external renewable water resources was estimated based on transboundary river flow pattern. The highest consumer of water supplies was agriculture (40.08 km<sup>3</sup>/year), followed by household use (4.14 km<sup>3</sup>/year), and industry and energy (1.03 km<sup>3</sup>/year). The water demand was found to be very high from November to March (Table-1 above) and the maximum demand occurs in March (12.44 km<sup>3</sup>). Water shortage was found in the months of January to March (Table-3 above). Maximum internal renewable water generates in July (22.81 km<sup>3</sup>) while the maximum external renewable water generates in August (245.42 km<sup>3</sup>). Renewable water availability varies throughout the year. January, February and March are the three months having very low (Table 2 above) water availability with February having the lowest (.67 km<sup>3</sup> only) available water. The study suggests a water management plan for reserving 22.25 km<sup>3</sup> water from November & December which can mitigate the shortage from January to March. The outcome of this study emphasizes on the necessity of adopting suitable mitigation strategy against water shortage.

**Water for drinking and sanitation:** Before 1970s, surface water (e.g., pond, river), rainwater and dug wells were the main source of drinking and domestic water supplies in Bangladesh. During the late



1970s and early 1980s groundwater was introduced in order to avoid contaminated surface water with pathogenic micro-organisms. Thousands of hand-operated tubewells were installed in rural areas of Bangladesh to provide pathogen-free groundwater-fed drinking water supply. The current number of privately-owned tubewells withdrawing groundwater is approximately 17 million. In addition to these private wells, an additional 1.6 million public tubewells have been installed by the Department of Public Health Engineering of Bangladesh in order to provide Arsenic-safe drinking water supply in rural areas, of which about 20% are considered deep (>150 mbgl) wells (DPHE, 2016). Therefore, the vast majority of these tubewells are private, which penetrate the shallow parts of alluvial aquifers down to depths of 10–60 mbgl (meter below ground level). Consequently, sourcing groundwater from deep aquifers, has become an effective and popular mitigation strategy for drinking-water supply over the last couple of decades for both arsenic (As) and even salinity water quality issues. More than 10 million tubewells, most of which are predominantly No. 6 pumps, are used to withdraw drinking water throughout Bangladesh. When groundwater levels in the aquifer goes below 7-8 mbgl, which is the maximum suction limit of the no. 6 pump, these low-lift pumping technologies are rendered unusable. Consequently, the domestic water supply in rural parts of Bangladesh is disrupted and the water supply becomes unsustainable.

**Water for agriculture:** Water is a very crucial factor for agricultural development in Bangladesh. It is the only factor, which can make a crop either success or failure. Boro rice is fully dependent on irrigation (Rashid 2006). Groundwater supplies 79% of the water demand for irrigation, livestock, household, and industrial usages (Mojid et al; 2019).. Therefore, surface water and groundwater irrigation development will be encouraged where feasible. In addition, use of water efficient crop technologies, conjunctive use of groundwater and surface water including rainwater harvesting and drainage water recycling will be encouraged and promoted.

**Water for fisheries:** Fisheries and wildlife are integral aspects of economic development in Bangladesh and very important for poverty alleviation, nutrition and employment generation. Therefore, availability of water for fisheries is important. Fisheries and wildlife will receive due emphasis in water resource planning in areas where their social impact is high. Water bodies like baors, haors, beels, roadside borrow pits, etc. will, as far as possible, be reserved for fish production and development. Perennial links of these water bodies with the rivers will also be properly maintained.

**Water for navigation:** Inland navigation is of substantial economic importance to Bangladesh, because it is the cheapest means of transportation. Therefore, minimum stream-flows in designated rivers and streams will be maintained for navigation after diversion of water for drinking and municipal purposes. Dredging and other suitable measures would be undertaken, wherever needed, to maintain navigational capability of designated waterways.

**Water for industries:** Pollution of both surface and groundwater around various industrial establishments of the country by untreated effluent discharge into water bodies is a critical water management issue. Therefore, location for establishment of new industries will be selected in consideration of fresh and safe water availability and effluent discharge possibilities. Effluent disposal will be monitored by relevant government agencies to prevent water pollution.

**Water for hydropower and recreation:** Bangladesh has limited potential for hydropower due to the absence of suitable reservoir area. However, it may be possible to build mini hydropower plants at small dam and barrage sites. A major environmental concern of hydropower development is the impediment to a river's natural flow imposed by structures built on it. A hydropower facility may be restrictive for fish movement also. Use of water for recreational purposes is useful for developing tourism facilities.

**Water for the environment:** Protection and preservation of the natural environment is essential for sustainable development. Accordingly, water resource management actions will take care to avoid or minimize environmental damages. Other environmental problems include: excessive soil erosion and sedimentation, water logging and salinization of agricultural land, groundwater depletion, watershed degradation and deforestation, reduction of biodiversity, wetland loss, saltwater intrusion, and coastal zone habitat loss. Therefore, all water management agencies will give full consideration to environmental protection, restoration and enhancement measures consistent with the National Environmental Management Action Plan (NEMAP) and the National Water Management Plan (NWMP). Protect against degradation of natural water-bodies such as lakes, ponds, beels, khals, tanks, etc. affected by man-made interventions or other causes and therefore, necessary steps should be taken to remove all existing unauthorized encroachments on rivers and water courses and to check further encroachments that cause obstructions to water flows and create environmental hazards.

The scenario of water resources briefly discussed in the following sections.

**Availability of surface water:** Bangladesh is endowed with plenty of surface and groundwater resources. The surface water resources comprise water available from flowing rivers and static water bodies as ponds, beels and haors. River flows have very large seasonal variations. Surface water inflows of the country vary from a maximum of about 140,000 m<sup>3</sup>/s in August to a minimum of about 7,000 m<sup>3</sup>/s in February. Two main rivers, the Brahmaputra and the Ganges account for more than 80% of stream flows. The average daily flow of the Ganges is about 10,874 m<sup>3</sup>/s., which reduces to 1,366 m<sup>3</sup>/s during dry season. The highest flow is about 44,000 m<sup>3</sup>/s which is usually received in August. The annual average discharge of the Meghna at Bhairab Bazar is approximately 4,800 m<sup>3</sup>/s and the maximum flow occurs generally around mid August. The average annual discharge of Brahmaputra is about 20,000 m<sup>3</sup>/s and the maximum discharge is about 100,000 m<sup>3</sup>/s (BDP 2100).

The total length of rivers within Bangladesh is 22,000 km. The internal renewable water resources are estimated as 105,000 Mm<sup>3</sup> per year. This includes 84,000 Mm<sup>3</sup> of surface water produced internally as stream flows from rainfall, and about 21,000 Mm<sup>3</sup> of groundwater resources (Rajmohan and Prathapar, 2013). Part of the groundwater comes from the infiltration of surface water with an external origin. Since annual cross-border river flows and entering groundwater are estimated to be 1,121,600 Mm<sup>3</sup>, the total renewable water resources are, therefore, estimated at 1,226,600 Mm<sup>3</sup> year<sup>-1</sup> (FAO 2011).

Bangladesh receives about 1,260 billion cubic meter (BCM) water annually from the trans-boundary river flows entering the country's river systems, of which the three main rivers contribute about 981 BCM (i.e. about 78%), out of which the dry season (Nov to Apr) inflow is 148 BCM (15% of total flow). Out of 148 BCM, about 111 BCM is contributed by the Brahmaputra. In March and April the Ganges flows are a little more than 2 BCM. The lowest flow (11 BCM) in Brahmaputra is received in the critical month of February. Therefore, the trans-boundary flow is inadequate to meet the water demand during the dry season.

The water resources available to Bangladesh consist of both internally generated surface water resources – through rainfall and runoff and trans-boundary inflows, and groundwater. According to FAO (2013), on annual basis, the total renewable water resources amount to approximately 1211 (bcm). Of these, 1190 bcm are surface water and 21 bcm are groundwater resources. Internal renewable water resources (those generated inside the country) are estimated at 105 bcm, of which 84 bcm originate from surface- and 21 bcm from groundwater. Externally renewable water resources total 1,106 bcm, of which 0.03 bcm from groundwater and the remainder from trans-boundary river flows. The surface water resources are not evenly distributed over the year, with about 80% of the total flow occurring during the monsoon period (between June and October).

**Groundwater availability:** Groundwater resources are available in large volumes of good quality. Developing access to these resources is simple and cheap, and often does not entail large governmental coordination or support. Due to these hydrological advantages, groundwater is the main source of irrigation and one of the key factors making Bangladesh self sufficient in food production. Groundwater is the largest store of freshwater that provides drinking, irrigation, and industrial water supplies globally (Taylor et al., 2013). CSIRO (Kirby et al 2013, in CSIRO 2014) estimated that annual irrigation water use in Bangladesh is about 25 km<sup>3</sup>, of which about 19 km<sup>3</sup> (about 80%) is supplied by groundwater and 6 km<sup>3</sup>(20%) by surface water. About 98% of drinking and 80% of dry-season irrigation water supplies come from groundwater at shallow depths (<150 m below ground level, bgl) (Shamsudduha, 2018). There are about 7.56 Mha (million hectare) of cultivable land of which about 6.9 Mha of agricultural land can be brought under irrigation at full development (Banglapedia, 2021). However, the sustainability of groundwater resources is threatened by hydrological and socioeconomic factors such as poor water quality, over abstraction, inadequate governance, and impacts of changing climate that are not well understood. Effective management of groundwater resources is critical in meeting national and international agendas for improved public health, economic development, and poverty alleviation (Conti et al., 2016).

**Groundwater recharging:** Rain water is the principal source of groundwater recharge in Bangladesh. Flood water which overflow the river and stream banks also infiltrates into the groundwater. Water from permanent water bodies (rivers, canals, wetlands, ponds, irrigated fields etc) that lie above the water table also percolates to the groundwater. The greatest scope of recharge is within the coarse grained sediments and the least is within the fine grained sediments like clay. Analysis of groundwater level and river-stage hydrographs (Shamsudduha et al, 2011) reveals that water levels in almost all river channels rise above groundwater levels in adjacent aquifers during the monsoon season (May–September). The groundwater flows generally from north to south. The BWDB-UNDP study calculated potential recharge using a hydrological balance where runoff was estimated to be 20–40% of the annual precipitation. The results of the study conducted by Shamsudduha et al, 2011 show that actual (net) recharge is higher in northwestern (Dinajpur district) and western parts (Rajshahi district) of Bangladesh than in southern (Khulna district) and eastern parts except for Cumilla district. Net recharge is high (300–600 mm) along the Rivers Brahmaputra and Ganges where potential recharge was previously estimated to be 500–700 mm (MPO 1987; MPO 1991). Net recharge in northwestern parts of the GBM Delta ranges from 250 to 600 mm and similarly approximates potential recharge. Greater increases in the net recharge are observed in north-western regions and along the rivers Brahmaputra and Ganges. Changes in recharge are limited in the rest of the country. The substantial difference between actual and potential recharge in these areas suggests that a major fraction of the available recharge is lost through surface runoff and evapotranspiration. Generally, groundwater withdrawal from the shallow aquifer for domestic and irrigation purposes during dry periods is balanced with the vertical percolation of rain water and inflow from surrounding aquifers during monsoon when pumping is ceased. No permanent declining of water table is observed, except urban areas and in the Barind tract. Seasonal water table fluctuation is more in the central and northern part of the country where groundwater irrigation is extensive and this fluctuation is low or even nil near the coastline as groundwater irrigation in the southern coast is negligible due to salinity problem in upper aquifers. In Dhaka city, permanent declining trend of groundwater level is observed due to excessive withdrawal for city water supply and around Dhaka city for industrial withdrawal. Groundwater table contour map of greater Dhaka shows that maximum depth to groundwater table in Dhaka city is more than 60 m and in surrounding industrial areas this is within 9 to 18 m during dry period. During monsoon, the groundwater table rise steadily until the levels are within 1-2 m of the surface.

**Options of satisfying increasing future water demand:** Further development of yet unexploited water sources is the most plausible option of satisfying increasing future water demand in Bangladesh. Exploiting underutilized rivers and streams, estimating aquifers' safe yields, recharging the aquifers by natural and artificial means, harvesting rain water, and utilizing wastewater are the possible scopes for this option.

**Development of BDP 2100:** Efforts to implement integrated water resource management continued in the 7<sup>th</sup> FYP with focus on flood control, prevention of river bank erosion and supply of irrigation water. River dredging to improve river navigability also continued. Bangladesh did a comprehensive long-term study on water management integrated with land use, agriculture, environmental management and preservation of bio-diversity with a view to establishing best practicing water management that minimizes the risks of natural hazards while protecting farm incomes and livelihoods. The study known as the Bangladesh Delta Plan 2100 (BDP2100) was approved by the cabinet in November 2018 for speedy implementation. BDP2100 involves water management in all its dimensions including flood control, sea-level rise, salinity, water logging, river bank erosion, irrigation, urban and rural water supply, water pollution, land reclamation, river dredging for inland water traffic, environment protection, forestry, fisheries, and preservation of bio-diversity. Availability of water in both quantity and quality is a basic human right and sound planning is necessary to ensure it. Therefore, an action plan on water resource management sub-sector is needed for its appropriate management, efficient use and sustainability. The action plan attaches special importance to the conjunctive use of ground and surface water. It is expected that all concerned government, non-government and people participators would implement this action plan for effective management of water resources of the country.

**Flood control:** Floods are normal monsoon phenomena in the deltaic plains of Bangladesh. Although the livelihood of the people in Bangladesh is well adapted to normal monsoon flood, the damages due to inundation, riverbank erosion or breach of embankment, etc. still occur in various regions in almost every monsoon. They often have disastrous consequences: major damage to infrastructure, great loss of property, crops, cattle, poultry etc and human suffering of the poor. Normal flooding in rainy season affects about 22% of the country each year; the land use and settlements are well adapted to it. The most disastrous floods, in terms of lives and livelihoods lost, typically occur in the coastal areas when high tides coincide with the major cyclones (Brammer, 1996). About 1.32 million ha and 5.05 million ha of the total cropped area is severely and moderately flood prone (FAO Aquastat, 2011, in BDP2100), making Bangladesh the most flood prone country in the world. Abnormal flooding can submerge about 60% of the land area, damaging crops and property, disrupting economic activities and causing loss of life. In the entire period 1954-2022, BWDB has implemented more than 300 projects for managing all types of floods in the country; normal and monsoon floods, and rain-fed and flash flood. Among the flood management projects, around 29% were small projects (below 1000 ha), 42% were medium projects (1000-5000 ha), 15% were large (5000-15000 ha) and 14% were very large (above 15000 ha) projects. To address the flood control issues, the government has decided to implement both structural and non-structural measures such as: construction of embankment through FCDI projects, building flood cum cyclone shelters and providing mitigation measures such as flood proofing (rather than flood control) for the vulnerable communities by raising levels of homesteads, schools, and market places in low-lying areas and in the char lands so that farmers can save their livestock and food grain. BWDB has provided flood management facilities to 6.3 million ha land and constructed 11,393 km of embankments (BDP 2100). The Flood Control Drainage And Irrigation systems, besides flood protection, also provide multiple services i.e. embankments are used as national, regional and rural roads; slopes are used for plantation; in some cases, embankments are used as flood shelter; borrow pits are used for fish culture etc.

The Flood Forecasting Warning Centre (FFWC) has issued daily flood bulletin from May to October with a forecast lead-time of 24 hrs, 48 hrs and 72 hrs, 96 hrs. and 120 hrs. (upto 5 days) along with warning messages and flood inundation maps. Also 16 new flood forecasting points has been added in the system. These are the new efforts to make more localized flood forecast. In addition to deterministic flood forecasts up-to 5-days lead time, FFWC issued medium range upto 10-days lead-time probabilistic forecasts at 38 locations. Since 93% of the GBM catchment area lies outside Bangladesh, flood forecasting and warning in our country cannot be fully effective without regional cooperation in data exchange among the co-riparian countries (India, Nepal and Bhutan). In order to make it more functional, water level and rainfall data sharing from upstream points of India should be ensured. At the moment, pilot studies are being conducted to find out the best possible means for timely dissemination of flood information to the vulnerable communities.

**Surface water irrigation scenario:** A vast area of Bangladesh suffers from scarcity of water for irrigating its agricultural lands not only in dry months but also during monsoon. To reduce the harmful effect of floods and to use the surplus water of irrigation, BWDB has constructed a number of embankments, barrages and canals. BWDB has already implemented projects to cover about 1.7 Mha land area under surface water irrigation. Ganges-Kobadak Irrigation Project, a large surface irrigation system of the country on the right bank of the river Ganges, better known as G-K Project, covers an area of 197,500 ha in south-west Bangladesh. The objectives were to increase food production, improve cropping patterns, increase cropping intensity, and improve the socio-economic conditions of the farmers. Teesta Barrage was constructed to increase agricultural production through supplementary irrigation and thereby creating employment opportunities. The construction of the Barrage was taken up in 1979 and that of canal system in 1984-85. Chandpur Irrigation Project located in Chandpur and Lakshmipur district cover a gross area of 54,036 ha. It provides irrigation facilities to 24,291 ha and drainage facilities to 21,578 ha of land. The project started in 1963 and was completed in 1978. Meghna-Dhonagoda Project is located in Matlab upazila of Chandpur district. The project provides irrigation water to an area of 14,400 ha. It includes 65 km of flood embankment, 220 km of irrigation canal, and 125 km of drainage channel. However, surface water provides less than 20% of dry season irrigation. Construction of more surface water irrigation projects can reduce stress on groundwater.

The government of Bangladesh has given emphasis for implementation of the Ganges Barrage Project for sustainable poverty alleviation and environmental conservation by providing storage water irrigation in the South-west region of the country. At present, 170,570 low lift pumps are working in Bangladesh to provide water for Irrigation (CSISA-MI Report 2). BWDB has made a total of 6.5 million hectare of agricultural land free from flood and drainage congestion. It constructed 16,262 km of embankment of which 5,757 km are in the coastal area (8<sup>th</sup> FYP). The Bangladesh Water Development Board (BWDB) is engaged in the development and management of the water resources of the country. It has created the necessary infrastructure of providing irrigation facilities to an area of 1.624 million hectares. It has been able to reclaim about 10,370 sq. km of land in the Meghna estuary through construction of cross dams. Moreover, BWDB has completed 96 projects under the Bangladesh Climate Change Trust Fund (BCCTF) of the Ministry of Environment and Forestry and Climate Change (8<sup>th</sup> FYP).

**Groundwater irrigation supply:** Since the 1960s, groundwater has been used extensively as the main source of irrigation water supply. About 79 percent of cultivated land is irrigated with groundwater (Mojid et al, 2019) and the remaining 21% with surface water. Groundwater-irrigated agriculture plays an important role in poverty alleviation and has greatly increased food production. The groundwater resource is one of the key factors in making the country self sufficient in food production. Currently, 35,322 deep tubewells, and 1,523,322 shallow tubewells are working in Bangladesh to provide water for irrigation (CSISA-MI Report 2). The shallow tubewells are mostly private sector investment.

**River dredging to improve navigability:** Bangladesh is a riverine and densely populated country with approximately 700 rivers. Therefore, dredging plays a vital role in Bangladesh. Water transport is the cheapest means of transport and communication in our country, because 20% of the population is below the poverty line and lives in the rural areas. So improvement of IWT is a necessity for the economic development of our country. But the rivers and canals are reducing day by day due to silting up by sand and clay deposits and the result is directly affecting the waterways. In this situation, it is very much essential to improve the waterways for socio-economic development of the country. Two types of dredging programs naming Maintenance Dredging and Development Dredging are generally used to improve the navigability of the inland waterways. To bring back navigability in rivers, government has also been formulating a 50-year mega plan, which will be implemented in three phases: short-term, mid-term and long-term. There is scope of potential utilization of the dredged materials obtained from river dredging. When feasible, dredged materials can be used as a resource rather than treated as a waste product. Beneficial uses can include habitat creation and restoration, beach nourishment, landfill cover and land site remediation.

**The river network:** Bangladesh is a riverine country. These rivers, with the exception of the few in the south-eastern districts of the country, are either the tributaries or the distributaries of the three mega rivers of the sub-continent, namely, the Ganges, the Brahmaputra and the Meghna. How water withdrawal upstream is causing the lower riparian Bangladesh irreparable damage to its environment and economy, here is a focus on only one area to the SW of Bangladesh.

**Table 40: Navigability loss due to Farakka Barrage**

Sl. No	Name of river	From	To	Distance	Water depth (km) during dry season
1	Padma	Godagari	Aricha	209	1.75 m
2	Padma	Aricha	Chanpur	130	2.50 m
3	Garai	Talbaria	Kamarkhali	70	Dead and dry
4	Madhumati	Kamarkhali	Hularhat	160	Dead & dry
5	Atharabanki	Manikdaha	Rajapur	40	Dead & dry
6	Kaliganga	Kushtia	Sailkupa		Dead & dry
7	Kumar	Sailkupa	Alamdanga	65	Dead & dry
8	Nabaganga	Jhenidha	Bardia	100	Dead & dry
9	Mathabanga	Gangni	Jhenidha	70	Dead & dry
10	Old Kumar	Ambikapul	Char Magura	100	Dead & dry
11	Kumar	Ambikapul	Manikdaha	105	Dead & dry
12	Chitra	Narail	Gazirhat	28	Dead & dry
13	Arialkhan	Chowdhurihat	Saheberhat	95	1.5m & 1.0m
14	Bhairab	Khulna	Noapara	35	1.75 m
15	Bhairab	Noapara	Raita	295	Dead and dry
16	Atai	Khulna	Narail	25	1.0 m
17	Bil Route	Sindiaghat	Gopalganj	45	1.0 m
18	Arialkhan	Sindiaghat	Jajira	35	1.0 m
19	Kobadak	Taherpur	Paikgacha	70	Dead and dry
20	Bhadra	Monirampur	Chalna	32	Dead and dry

Courtesy: BIWTA (Internet version)

**Upstream development:** As Bangladesh is located in the low-lying delta of the Ganges- the Brahmaputra- the Meghna basins, water resources management is complex and highly sensitive to upstream developments. As the lowermost riparian recipient of water from the Ganges, the Brahmaputra and the Meghna, which also flows through India, China, Bhutan and Nepal, any intervening development upon the river dynamics and/ or morphology; either individually or bilaterally can further aggravate the already vulnerable scenarios Bangladesh is currently facing in terms of water availability. Several developments have been made over the years in terms of trans boundary water sharing and management. Allocation of substantial amounts of water should be ensured for ecological maintenance of rivers, especially during dry season is required. Bangladesh and India have been sharing the Ganges water at Farakka since signing of the treaty in 1996. Discussions are also being held for augmentation of the dry season flows. Framework of agreement for sharing of Teesta needs to be developed as a treaty. Similarly, water sharing policy for the six other prioritized trans boundary rivers namely the Dharla, the Dudhkumar, the Manu, the Khowai, the Gumti, and the Muhuri need to be implemented at technical level.

**Table 41: Sharing of the Ganges waters at Farakka**

Availability at Farakka	Share of India	Share of Bagladesh
70,000 cusecs or less	50%	50%
70,000-75,000 cusecs	Balance of flow	35,000 cusecs
75,000 cusecs or more	40,000 cusecs	Balance of flow

**Erosion and accretion:** The GBM rivers have the largest total sediment load in the world, derived principally from the Himalayan and Indo-Burman ranges (Uddin and Lundberg 1998). The large sediment load, coupled with a dynamic hydraulic regime, causes the rivers to be morphologically very active and extremely dynamic. The Brahmaputra (and Jamuna), Ganges and Padma are braiding rivers and subject to active erosion and sedimentation processes. On average, some 6,000 ha of river bank erosion occurs in the country on an annual basis, leading to the displacement of about 50,000 people (BDP 2100). Total erosion and accretion for the period 1973 – 2013 can be found in the Table-43 below.

**Table 42: River erosion and accretion, 1973 - 2013 (CEGIS Erosion Prediction, 2014)**

River	Area eroded (ha)	Area Accreted (ha)
Brahmaputra/Jamuna	90,367	16,444
Ganges	29,842	25,009
Padma	33,229	11,545
Lower Meghna	25,820	22,265
Total	1,79,258	75,263
Net river erosion	1,03,995	

## Coastal Zone Protection and Management

**Cyclone and storm surge:** Bangladesh is a global hotspot for tropical cyclones, which hit the country's coastal regions in the early summer i.e. during April–May or late rainy season from October–November. The most common features of tropical cyclones are destructive winds, heavy rainfall and cyclone induced storm surges that can lead to flooding. The Bay of Bengal is one of the hotspots for the generation of tropical cyclones. About one-tenth of the global numbers of cyclones that form in different regions of the tropics occur in the Bay of Bengal (Gray, 1968; Ali, 1980, in BDP 2100). The entire southern boundary of Bangladesh is exposed to the Bay of Bengal and eventually to the Indian

Ocean. Nearly every year, be it less severe or devastating, cyclones hit the coast and cause damage to lives and properties of the coastal population. The cyclone that hit in 1970 at greater Barishal caused nearly 300,000 deaths. But the one with almost the same severity in terms of wind speed hit in 2007 (the SIDR) took lives of nearly 3406 people (BDP 2100). This is credited briefly to: improved cyclone warnings, more cyclone shelters, awareness building, and highly developed disaster risk management capabilities. Around 19 major cyclones hit the coast from 1960 to 2009. After SIDR an extensive program called Comprehensive Disaster Management Program (CDMP) was launched to address all the main hazards and to develop ways for disaster management in Bangladesh. In CDMP during 2013, the storm surge study was conducted, in which hazard maps were developed for all 19 coastal districts up to upazila/union level.

### 3.5.3 Vision, Mission, and Overall Objectives

#### *Vision*

Build an inclusive water security system achieving water security for environmental and livelihood sustainability.

#### *Mission*

Ensure availability of adequate fresh and affordable water by improving water resource management system, increasing water use efficiency, strengthening sustainable water control and delivery system, and using all sources of water resources.

#### *Overall Objectives*

The overall objective of the “Action Plan on Water Resource Sub-sector” is to provide a comprehensive picture of water resource sub-sectoral goals, performances, opportunities, challenges and identify policies and strategies with detailed actions and tentative budget that support the 8<sup>th</sup> FYP.

#### *Specific Objective*

The specific objective of the water resource sub-sector in the 8<sup>th</sup> Five Year Plan is to scale up existing good practices of water conservation and management and apply more widely integrated water management, including flood control and prevention schemes, flood early warning systems, irrigation improvement and demand side management as advocated in BDP 2100.

#### *Strategic Objective*

- Continuing and strengthen river dredging to enhance navigability and to facilitate water transportation;
- Increasing water use efficiency in crop production and enhance the utilization of surface water irrigation;
- Protecting riverbank from erosion through integrated long-term measures;
- Ensuring conjunctive use of surface and ground water for sustainable irrigation, securing groundwater conservation;
- Strengthening regional and international cooperation for basin-wide water resources development and management of trans-boundary rivers;



- Preventing of saline water intrusion through augmenting the freshwater flow in the southwest region including the Sundarbans;
- Developing modern early warning systems to minimize economic losses from flood and other disasters;
- Adapting of climate change mitigation strategies;
- Rain water harvesting;
- Implementing integrated coastal zone management strategies;
- Strengthening capacities of the institution in the water resource management; and
- Mainstreaming Valuing Water into Public Investment Decision Making in collaboration with Planning Commission to allow for future investment decisions which further support sustainable water resources management and thus sustainable economic development.

#### 3.5.4 Theory of Change

A theory of change provides a roadmap to get we from here to there. It is about articulating how and why a given intervention will lead to a specific change. The theory of change is best to use when we need to verify the most appropriate activities at different stages in the change process. Therefore, a theory of change was prepared (Fig 7) which contained vision, mission, objectives/outcome, outputs, strategies and interventions. There were different outputs, strategies and interventions. Each intervention was aligned with the related strategies and outputs.

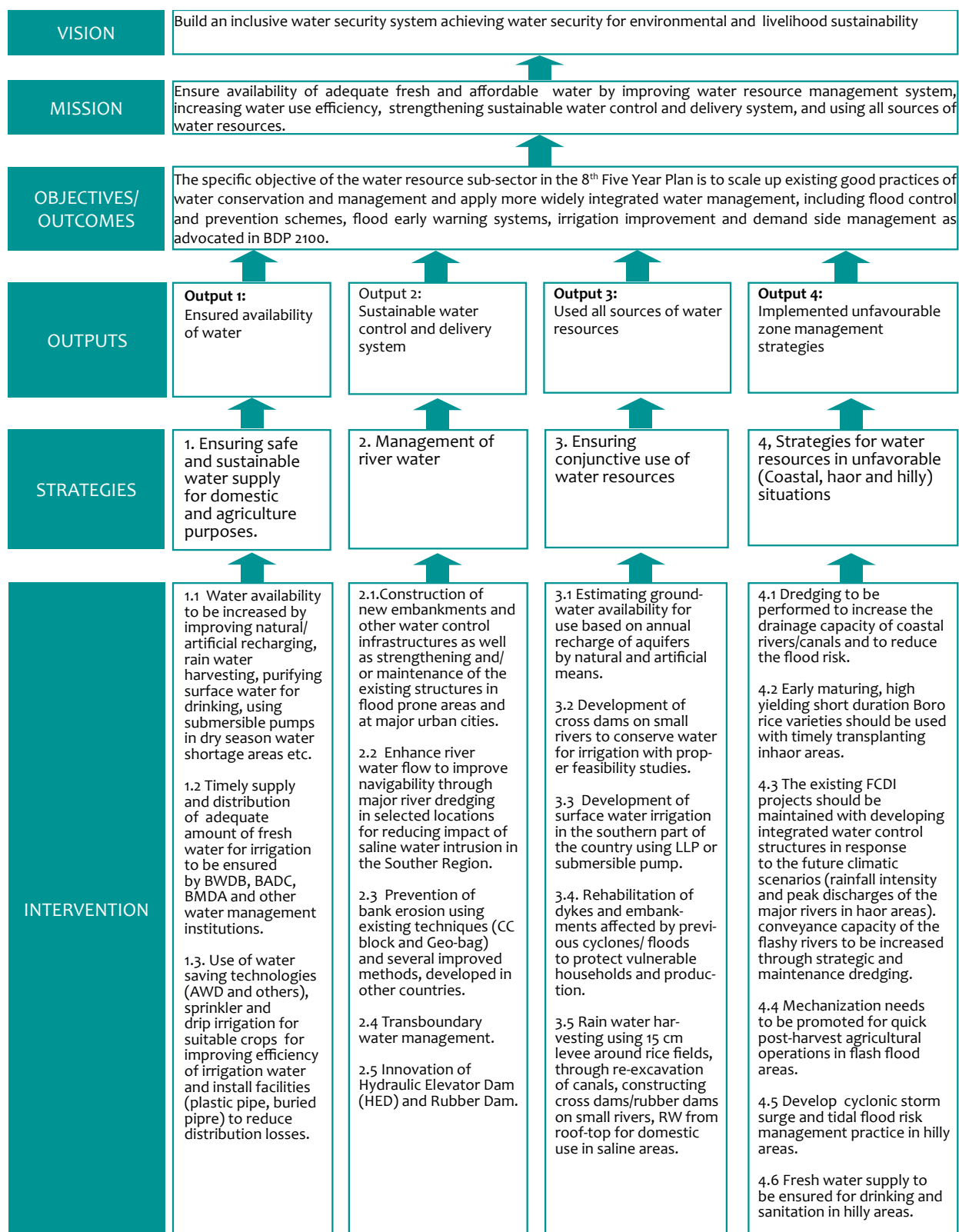


Fig. 15: Theory of Change

### 3.5.5 Policies and Strategies for Water Resources Sub-sector Development

The policies and strategies of water sub-sector of the government aims to provide direction to all agencies working with the water sector, and institutions that relate to the water sector.

**Policies for Water Resources Development:** The policies of water resources indicate the management of water resources through the concerned ministries, agencies, departments, and local bodies. They are also assigned to develop, maintain and delivery of water related services. The water policy of the government aims to provide direction to all agencies working with the water sector and institutions. As Bangladesh is a riverine country, the intention of the government is that “all necessary means and measures will be taken to manage the water resources of the country in a comprehensive, integrated and equitable manner.

The National Water Resources Council (NWRC) will coordinate all water resources management activities in the country. The main issues incorporated in the policies are basinwide planning, water rights and allocation, public health and private involvement, water supply and sanitation, fisheries, navigation, agriculture, industry and environment. The expectation is that all concerned government and non-government organizations will implement the policy for exploration, development, use and management of water resources of the country. The policies are designed to fulfill the national goals of economic development, poverty alleviation, food security, public health and safety, decent standard of living for the people and protection of the natural environment. The government will:

- Develop water resources of the major rivers for multipurpose use
- De-silt water courses to maintain navigation channels and proper drainage
- Delineate water-stress areas for managing dry season demand
- Take necessary steps to protect the water quality and ensure water use efficiency
- Develop early warning and flood-proofing systems to manage natural disasters
- Designate flood risk zones and take appropriate measures to provide desired levels of protection for life and property
- Undertake survey and investigation of the problem of river bank erosion and develop and implement master plans for river training and erosion control works
- Give special importance to the conjunctive use of rain water, groundwater and surface water
- Develop water allocation rules/mechanism which indicates who will get water, for what purpose(s), how much, when, for how long, and under what circumstances. The priority for allocating of water during critical periods follows: domestic and municipal uses, non-consumptive uses (e.g. navigation, fisheries and wild-life), sustenance of the river regime, and other consumptive and non-consumptive uses such as irrigation, industry, environment, salinity management, and recreation
- Create enabling environment for women to play a key role in local community organizations for management of water resources
- Develop water resource projects, as far as possible as multipurpose projects.

## Strategies for Water Resources Development

The strategies for water resources development are as follows:

**Use of water for sustainable agriculture:** Water is a very essential input for increasing crop production and sustainable agricultural development. Therefore, a well-planned water use for irrigation is essential for a gradual increase of cropping intensity as well as yield. Irrigation efficiency will be ascertained and modern water management technologies will be promoted to enhance irrigation efficacy and water productivity through optimal use of available water resources. In addition, water reservoir/rainwater harvesting in rainfed/coastal/hilly areas will have to be encouraged, and small-scale water resources systems would be developed at local level taking care of environmental and social issues.

**Develop and improve embankments, barriers and water control structures:** Bangladesh has set up a national target of becoming a high-income country by 2041, for which lots of economic activities are ongoing and several others are in the pipeline. However, due to the climate change, extreme flood may occur for which the economic strongholds including major urban cities need higher level of protection. Therefore, construction of new embankments and other water control infrastructures as well as strengthening and/ or maintenance of the existing structures are needed at economic priority zones, major urban cities, etc. Moreover, building and maintenance of fish passes and fish friendly structures to ensure fish movement to facilitate seasonal migration of fish for breeding and grazing will be emphasized.

**Restoration, redesign and modification of embankments and structures:** There are lots of flood control, drainage and irrigation (FCDI) schemes in Bangladesh. But due to lack of operation and maintenance (O&M), most of these schemes are not fully functional. Many embankments and structures need to be restored, redesigned and modified. Restoration, redesigning and modification of embankments and other such FCDI structures should be undertaken to fully accommodate the prompt and timely drainage of the excess water from upstream catchments.

**Extension of the flood warning lead time:** The flood early warning system needs to be updated and the lead time needs to improve. The dissemination system will improve for delivering the warning to the local people with a higher lead time. Community based early warning services will be extended, including flood agents and networks for communication and action. A strong cooperation will be developed between institutions responsible for hydrology (BWDB), meteorology (BMD), modelling (institutes and centres), dissemination and early actions. Therefore, closer cooperation has to be ensured with neighboring countries. The BDP 2100 highlighted the following strategies for trans-boundary water management:

- Discharge and quality measuring stations need to be established and regularly monitored at different locations of the river
- Instead of attempting to agree on one treaty at a time, negotiation of multiple treaties would be a better option for Bangladesh
- In addition to sharing water of the Ganges and the Teesta river, water sharing treaty between Bangladesh and India needs to be developed for other six major trans-boundary rivers namely the Dharla, the Dudhkumar, the Manu, the Khowai, the Gumti and the Muhuri. Special attention should be given to dry season flows.
- Benefit-sharing “mutual gains” model has to be implemented that discourages unilateral actions and further encourages coordination between riparian countries

- Should there be a shortage on the availability of upstream flow, initiatives such as reservoir system to retain water to fulfill dry season water demands has to be taken
- Furthermore, knowledge building on hydro-diplomacy would be useful for the trans-boundary water negotiations.

**Basin-wide water resources development initiatives:** Regional cooperation is highly important for sharing of water resource of common rivers and for integrated river basin management. There are no basin wide organizations in existence for the South Asia region. Therefore, the following frameworks have been proposed in the BDP 2100 : (i) Ganges River Basin Organization comprising Bangladesh, India and Nepal; (ii) Brahmaputra River Basin Organization comprising Bangladesh, India, Bhutan and China; and (iii) Meghna / Barak River Basin Organization between Bangladesh and India.

**Ensuring safe water to sustainable drinking water and sanitation:** Sustainable use and availability of safe water for drinking and sanitation purpose will be ensured. Initiatives will be undertaken to encourage rainwater harvesting where feasible. Besides, increasing storage in existing water retention bodies should be promoted.

**Maintaining water quality for health and nutrition, live lihoods and ecosystems:** This involves both protection of environmentally valuable and sensitive areas and the prevention of pollution by enhanced treatment. Urban drinking water and sanitation authorities are key actors in implementing proper interventions to ensure quality of fresh waters.

**Increase drainage capacity and reduce flood risk at the coastal zone:** The drainage congestion in the coastal zone is a big issue. It happens due to less capacity of the river and sedimentation with the tidal effect. Thus, increasing the drainage capacity will reduce the flood risk. Measures will be undertaken to restore rural rivers/canals and livelihood improvement in coastal districts. The flood risk is very high in the coastal zone and it becomes disastrous when flooding coincides with tidal surges. Therefore, flood risk prevention strategies and proper preparedness will be implemented in a timely manner.

**Expansion of surface water irrigation:** Regional groundwater irrigation schemes have been developed in the north-western part of the country, which sufficiently contributed to increasing productivity. Excessive use of groundwater for irrigation has longer term ecological consequences. The BDP 2100 emphasizes on the development of surface water irrigation schemes. Augmentation of surface water for irrigation through development of water reservoirs recharges groundwater, and reduced use of groundwater. Key priority investment activities include:

- The development of small-scale surface irrigation in the southern part of the country requiring new infrastructure and capacity building;
- Partially reduce reliance on deep well irrigation in the northern part of the country, reduce costs and mitigate the risk of depleting groundwater;
- Rehabilitate dykes and embankments particularly affected by previous cyclones to protect vulnerable households and production base against sea intrusion in the extreme south;
- Improved drainage, saline intrusion control and flood management;
- Increasing river water flow towards the south, in particular involving Major River dredging effort.
- Initiative to create water reservoirs to retain water to fulfill dry seasonal water demands has to be taken.

- Steps have to be taken towards construction of Brahmaputra Barrage, 2nd Teesta Barrage and Padma Barrage.

Use water saving technology for improving efficiency of water and install facilities to reduce distribution losses. Activities include: reduce water losses in existing schemes through improved water management (capacity building of water management cooperatives); development of water saving techniques such as drip irrigation, buried pipe irrigation, 'fertigation'; alternate furrow irrigation or rehabilitation of existing schemes. Reduce impact of saline water intrusion in the south and enhance river water flow. The focused activities that emerged from the BDP 2100 consultations are: rehabilitation of polders and their management; dredging of rivers; enhanced surface water irrigation; and improved brackish water resource management practices.

**Reclaim new land in the coastal zone:** Extensive research will be conducted on morphological behavior to earn knowledge about the influence of land reclamation and to realise the potential of further development and artificial interventions for enhancing accretion process. Building cross dams at the strategic locations would be useful for accelerating land reclamation process for which potential cross dam projects would be undertaken with proper feasibility studies. Land reclaimed through accretion process need to be protected and developed with land zoning and other appropriate measures.

**Protect agriculture and vulnerable communities in haor and flash flood areas:** Pre-monsoon flash flood from the neighboring hilly region is a common phenomenon in haor areas. As a result, the numerous large, deep depressions are flooded, causing damages to the Boro crop immediate before the harvest. A number of Flood Control, Drainage & Irrigation (FCDI) projects have reduced damages from flash floods particularly in Surma-Baulai and Kushiara river systems. These existing FCDI projects should be maintained with developing integrated water control structures in response to the future climatic scenarios (rainfall intensity and peak discharges of the major rivers) developed by the Bangladesh Delta Plan 2100. Also, increasing the conveyance capacity of the flashy rivers through strategic and maintenance dredging, and re-excavation is needed. To protect the post-harvest crop from rotting in haor and flash flood areas, private and public initiatives and investment in intensive agriculture should focus on areas where much higher returns on investment are possible through homestead gardening and intensive livestock production. Mechanization needs to be promoted in the haor and flash flood area for quick land preparation, planting, weeding, harvesting, processing, drying etc. The raised platforms which are proposed to be built with dredged spoil may be utilized to increase cultivation of homestead vegetables, pulses, spices and fruits. This in turn will improve nutrition and increase household income.

**Updating policies, laws and plans:** Bangladesh has formulated good numbers of policies, plans and acts in the sectors related to water development and uses. Many of the important and essential related issues have been covered by and well written in these documents. The main weakness of most of these tools is inadequate implementation and application. Existing laws and regulations do not cover sufficiently in areas such as the rights, powers, and duties of individual users and the government. Governments should ensure strong division/district level agencies by supporting professional development, establishing management guidelines for shared aquifers, and providing monitoring standards for the available fresh water resource.

Practices, techniques and technologies can be improved for improved efficiency of water use to reduce wastage of water and ensure optimum economic and social benefits. Strong regulatory control mechanisms are urgently needed to enable proper management of the resource. Faced with the

difficulties in enforcing water abstraction limits and in view of the negative impacts of over-pumping of this critically valuable resource, implementation of the water policy is needed to move towards the introduction of new water management approaches. Water sector institutions must have a legal and regulatory framework under Water Act 2013. The Water Act 2013 currently operates through the use of a number of operating principles defined by the National Water Policy of 1999 and the National Water Resource Management document of 2001. The government approved the Bangladesh Water Rules 2018, which will contribute significantly toward improving Integrated Water Resources Management (IWRM) and achieving the Sustainable Development Goal (SDG). List of relevant policies, laws and plans are:

- Action Plan 2016-2021 Cabinet Division and General Economics Division of Planning Commission, Government of the People’s Republic of Bangladesh;
- Bangladesh Climate Change strategic Action Plan (BCCSAP) 2009.
- Bangladesh Delta Plan 2100 (2018),
- Bangladesh Water Development Board Act 2000
- Bangladesh Water Rules 2018;
- BWDB strategic action plan (2009- 2014),
- Coastal Development Strategy, 2006
- Disaster management policy and plan;
- Eighth Five Year Plan;
- Hoar Master Plan 2012
- Integrated coastal zone management plan, 2005
- Mapping of Ministries by Targets in the Implementation of SDGs Aligning with 7<sup>th</sup> Five Year Plan (2016-20);
- Master Plan for Agricultural Development in the Southern Region of Bangladesh 2013;
- National Action Plan of Ministries/Divisions by targets in the implementation of Sustainable Development Goals, UNDP Bangladesh, September 25, 2019;
- National Adaptation Plan 2022;
- National environment policy (1992);
- National Environmental Management Action Plan (NEMAP);
- National policy for safe water supply and sanitation (1996);
- National Policy on Adaptation (NAPA) on Climate Change;
- National Water Management Plan 2001;
- National Water Policy (1999);
- Seventh Five Year Plan;
- Sustainable Development Goals related to water resource management (SDG 6.5);
- Water Act 2013; and
- Water Resources Planning Act, 1992.

**Water management committees at different levels:** To fulfill the target and functioning the water resource sub-sector development the following committees have been formed at different levels:

- “The National Water Resource Parishad” headed by the honorable Prime Minister
- “Executive Committee” headed by the Minister, Ministry of Water Resource
- “District Integrated Water Resource Management Committee” in each district headed by the concerned Deputy Commissioner (DC)
- “Upazila Integrated Water Resource Management Committee” in each upazila headed by the concerned Upazila Nirbahi Officer (UNA)
- “Union Integrated Water Resource Management Committee” in each union headed by the concerned Union Parishad Chairman.

### 3.5.6 Institutions Coordination and Capacity of Water Resources Sub-sector

The three main ministries involved with water management as related to agriculture are the Ministry of Water Resources, Ministry of Agriculture and the Local Government Division dealing with Rural Development and Cooperatives. The large flood control and irrigation project and river management issues are dealt by the Water Ministry. The LGRD&C and MoA deal with minor irrigation and flood control schemes. BWDB, BADC, BMDA, LGED, DPHE, City Corporations are responsible for implementing water projects of the concerned Ministries. The Water Resources Planning Organization (WARPO) is an executive institution accountable for water resource planning and management in Bangladesh. The National River Conservation Commission (NRCC) established in 2014, is responsible for the prevention of illegal grabbing of river land, and conserving the river water and environment from pollution with all kinds of waste, The Bangladesh Inland Water Transport Authority (BIWTA) is another organization engaged in river conservation and developing, maintaining and operating inland river ports. Furthermore, different national agricultural research Institutes (BRRI, BARI, BINA etc.) are involved in developing water efficient technologies for crop production.

Appropriate organizations are required to facilitate the actions for sustainable development and management of water resources of Bangladesh. As Bangladesh Water Development Board has the mandate of investigating and monitoring the status of water all over the country and is working in this field for about six decades, field and laboratory facilities as well as appropriate man power of this organization should be strengthen for effective management plan of water resources to agricultural, rural and urban water supplies. In addition, strengthening other related organizations and experts would support to ensure sustainable long term use and governance of water resources.

### 3.5.7 Challenges of Water Resources Sub-sector

There are several challenges affecting development, management and proper utilization of the water resources which are summarised below:

**Flood Risk:** Bangladesh is one of the most flood prone countries in the world. About 1.32 million ha and 5.05 million ha of the total cropped area is severely and moderately flood prone (FAO Aquastat, 2011, in BDP2100), making Bangladesh the most flood prone country in the world. Abnormal flooding can submerge about 60% of the land area, damaging crops and property, disrupting economic activities and causing loss of life. North-west, North-central and South-west regions are more susceptible to river flooding whereas North-east and Eastern-Hilly Regions are vulnerable to flash floods (during



April-May). Rainfed flooding and water logging occur in many parts of the country but are mainly prevalent in the South-western part of the country. Coastal flood mostly occurs along the coastal zone of Bangladesh. Every year, flood damages agricultural crops, and causes huge economic loss for the country. After flood, food crisis cause hunger for many poor households.

**Availability of water in dry season:** Water availability in the dry season is a key issue for the agriculture sector. The total irrigated area in dry season is about 5.58 Mha (BADC, 2019-20). During this period (March/ April) most of the small rivers are dry and the groundwater table is lowered beyond the suction limit of STW and hand tubewell. Besides, in Bangladesh, several natural calamities occur throughout the years. Droughts primarily occur in pre-monsoon season (April-May) due to delayed onset of the monsoon rains and end of season droughts (October) are caused by early withdrawal of monsoon rainfall, affecting the 'Aman' rice crop. The South-west and North-west Hydrology regions of the country are most vulnerable to droughts. Droughts cause huge loss of crops every year. The availability of water in the dry season and high cost of irrigation are considered as major challenges for agricultural production.

**River management:** Most of the water related challenges are related to the mighty rivers. Reduction of dry season flows due to increasing upstream withdrawal is causing severe water shortage across the country. Only 15 percent of the total trans-boundary flow i.e. 148 billion cubic meter (BCM) is available during the dry season 8<sup>th</sup> Five Year Plan. Reduced stream flow is also accelerating salinity intrusion and environmental degradation. Restoration of major rivers and enhanced regional cooperation in the Ganges-Brahmaputra-Meghna basins will ensure availability of more flow in dry season. Increased dry season flow will positively affect the entire country.

**River bank erosion:** Bangladesh is a riverine country and the rivers carry huge water and sediment discharge during monsoon. In the dry season, the coastal rivers carry huge sediment with saline water during high tide from the Bay of Bengal. River bank erosion, sedimentation and salinity are the major devastating events of the south-west region of Bangladesh. River bank erosion mainly occurs due to displacement and transportation of non-cohesive bed material caused by excessive flow and non-resistant velocity resulting to shift the thalweg and widening the top width of the river. On average, some 6000 ha of river bank erosion occurs in the country on an annual basis, leading to the displacement of about 50000 people (BDP 2100). River bank erosion causes loss of land, displacement of human population and livestock, disruption of production, evacuation and loss of property.

**Coastal zone protection:** The coastal zone covers the South-west, South-central and South-east areas of Bangladesh, which, is often subjected to inundation by high tides, saline water intrusion, cyclonic storms and associated tidal surges. Due to sea level rise, the salinity frontier of the country will move upstream gradually over the years. Several areas in the coastal zone, especially Western part and Noakhali mainland suffer from extensive and permanent water logging. The problem of water-logging is also severe in the coastal polders, particularly in Satkhira, Jashore, Khulna, Bagerhat and Noakhali districts. Currently the polders 1-2,6-8, 34/2 and 36 under Satkhira, Khulna and Bagerhat districts are experiencing long standing water-logging (BDP 2100).

**Wetland conservation:** Wetlands play a crucial role in maintaining ecological balance, flood management and work as retention basins in the wet season. Wetlands contain very rich components of biodiversity and it also supports millions of people's livelihood. Wetlands, which are locally called haors, baors (oxbow lake), and beels (depressions), are disappearing due to population pressure, unplanned infrastructures that prevent wetlands from maintaining their ecological and hydrological

functions, etc. The total area of wetlands in Bangladesh is estimated to be 7 to 8 million ha. However, wetlands are reducing at an alarming rate and it is important to conserve and restore these wetlands.

**Climate change and its impacts on water resources:** The Government of Bangladesh has recognized climate change as an important issue and attempts are being made to incorporate potential response measures for reducing impacts of climate change into overall development planning process. It is being increasingly recognized that the adverse impacts of climate change in an already vulnerable country such as Bangladesh will put additional stress on overall development of the country. In recent years, the frequency of extreme climatic events, such as floods and cyclones has increased worldwide. Most of the studies have assessed impacts of climate change on water sector. Most damaging effects of climate change are floods, salinity intrusion, and droughts that are found to drastically affect crop productivity almost every year. Observation of salinity shows an increase of salinity at Khulna from 0.7 Parts Per thousand to 16.8 Parts Per thousand in the Rupsa river from 1962 to 2011 (BDP 2100). Climate change induced challenges are: (a) scarcity of fresh water due to less rain and higher evapo-transpiration in the dry season; (b) drainage congestion due to higher water levels in the confluence with the rise of sea level; (c) river bank erosion; (d) frequent floods and prolonged and widespread drought; (e) increased salinity in the coastal zone and (f) degradation of biodiversity.

Impacts of climate change on the country's water resources are assumed to affect the most in the coastal zone. Availability of fresh water will decline and natural hazards like cyclone, storm surges and coastal flooding will increase. The salinity level of groundwater along with the surface water will rise rapidly due to the sea level rise as a direct impact of climate change. The local communities and their livelihood would be greatly vulnerable due to climate change. The climate change policy, particularly adaptation thus becomes a part and parcel of the development policies of the country.

**Cyclonic storm:** The coastal area of Bangladesh and the Bay of Bengal are located at the tip of northern Indian Ocean, which has the shape of an inverted funnel. The area is frequently hit by severe cyclonic storms, generating long wave tidal surges which are aggravated because the Bay itself is quite shallow. Cyclones and storm surges are expected to become more intense with climate change. Coping with extreme climatic events like cyclone and storm surges is not new to the people of Bangladesh. Although the country is relatively well equipped particularly in managing the after effect of cyclones, the increased intensity of such disasters implies major constraints to the country's social and economic development. Increased intensity of extreme events severely affects infrastructure, human settlement, life and property almost every year. Besides crops, perennial trees and livestock are also damaged by cyclonic storm. The cyclone that hit in 1970 at greater Barishal caused nearly 300,000 deaths. But the one with almost the same severity in terms of wind speed hit in 2007 (the SIDR) took lives of nearly 3,406 people (BDP 2100). Unless proper adaptive measures are undertaken, in the coastal zone, the risks of cyclones is likely to be increased.

**Population growth:** Water demand for domestic purpose is estimated to increase by up to 50% by 2030 and 100% by 2050 considering the population growth (BDP 2100). Bangladesh will probably face the dominant environmental and possibly the most important development challenges in the coming days due to population growth. Fresh water will be polluted around the expanding urban and industrial areas. Therefore, high investments will be required to provide potable water to the expanding urban areas. With the growing population, sanitation will become a major problem both in the urban and rural areas.

**Upstream development (transboundary water issues):** Water resources management in Bangladesh will increasingly face challenges due to upstream river basin developments. Dry season flow of the trans-boundary rivers have significantly reduced due to infrastructural developments in upstream countries. According to the Ganges water sharing treaty Bangladesh is supposed to receive 35,000 cusec of water during dry season. Ganges Water Treaty 1996. The reduction of the Ganges flows has severely affected the fresh water supply to the people, agriculture, navigation, hydro-morphological dynamics, etc. in the South-western region of Bangladesh and also on the ecology of the Sundarbans.

**Institutional capacity, coordination and WRM:** Resource mobilization for operation and maintenance activities and its execution is critical and mainly depend on multidisciplinary participation, cooperation and partnership of the water related institutions. In Bangladesh more than 35 central government organizations, affiliated with some 13 ministries/divisions are working for water sector planning, development and management. The capacities of most of these organizations in terms of human resources, technical knowledge, budget, etc. are inadequate to undertake their mandated tasks efficiently. Operation and maintenance (O&M) work of most of the existing structural interventions are not duly performed because of shortage of resources. Prevailing institutional arrangements are inadequate to respond to the needs of Integrated Water Resources Management (IWRM) implementation.

**Sedimentation:** The sediments from the Ganges-Brahmaputra-Meghna systems discharges into the Bay of Bengal through the Lower Meghna mouth, turn clockwise, part of the sediments deposit in the ocean and the rest of the sediments re-enter into the western estuarine systems. During cyclonic events, this equilibrium breaks down and bulk amount of sediments re-enters into the system through the estuary mouths. Sedimentation, as expected, is the maximum in the unprotected regions of the coast. No sedimentation is observed inside polders (WARPO and IWFM 2020). A total of 139 coastal polders in the region largely determine the pattern of coastal floodplain sedimentation. The lands inside these polders are considered as 'protected' and do not allow any sediments to be deposited on the floodplain. The incoming sediment load (Calculated by Rahman et al, 2018) in the region from Ganges is 150 - 590 and from Brahmaputra 135 - 615 Million Ton/year. The known sediment management practices in the region are (1) Dredging (2) Tidal River Management TRM (3) Cross dam. Dredging is the most common sediment management practice in the south-west region. The sedimentation in the main river indeed increases the water-logging. Dredging in the main river improves the water-logging condition in the area which are within the drainage zone of the river. Outside the drainage zone, dredging impact is not visible.

**Water logging:** Water logging is a problem over large parts of the coast, especially in the southwest (Satkhira, Jessore, Khulna and Bagerhat) and south-east (Noakhali, Feni) coastal zones. The south-west region of Bangladesh is characterized by numerous morphologically active tidal rivers, which are the main drainage network for coastal polders and low lying beels. Tidal flow brings huge quantity of silt from the sea into the river systems of the coastal area. Before polderisation in early sixties and seventies, major parts of this incoming silt deposited naturally on the low-lying land (beels). On the other hand, there was significant amount of fresh water flow from the Ganges which helped to maintain a perennial tidal river in this part of Bangladesh. The continued fresh water flow from the Ganges helped to flush the incoming sediment with high tide from the sea and thus, the proper drainage capacity of these tidal creeks was maintained naturally. After polderisation and significant reduction of fresh water flow from the Ganges, these natural processes have been hindered significantly. The presence of coastal polders prevents the spreading of the natural tidal flows and restricts sedimentation on the low lying lands. This leads to large scale river bed sedimentation in the

peripheral rivers of polders. Construction of embankment along the bank of peripheral rivers caused decrease of drainage capacity or conveyance of the rivers. Also the reduction of dry season flow in the downstream of Ganges and its distributaries due to withdrawal of water upstream by operation of Farrakka barrage contributed to increased sedimentation in the distributaries tidal rivers. This continuous siltation process over the years resulted rise of river bed level and thereby reduction of the conveyance capacity of the peripheral rivers of the coastal polders significantly leading to large scale water logging problems inside the polders particularly in the Satkhira, Jessore, Khulna and Bagerhat districts. As a result, many polders are suffering from water logging and drainage congestion for quite long periods and that in turn caused large scale environmental, social and economic degradation. To solve this long-standing water-logging problem in the above area, the well-known Khulna-Jessore Drainage Rehabilitation Project (KJDRP) was implemented by Bangladesh Water Development Board during 1994-2002. Currently the polders 1-2,6-8, 34/2 and 36 under Satkhira, Khulna and Bagerhat districts are experiencing long standing water-logging (BDP 2100).

**Salinity intrusion:** River water salinity in coastal Bangladesh depends on the volume of fresh water discharges from the upstream river systems, the salinity of the Bay of Bengal near the coast, and the circulation pattern of the coastal waters induced by the ocean currents and the tidal propagation to the river systems. A reduction in freshwater inflows from the trans-boundary Ganges River, siltation of the tributaries of the Ganges, and siltation of other rivers following the construction of the polder system has resulted in a significant increase in river salinity in coastal Bangladesh during the dry season. Average salinity concentrations of the rivers in the coastal area are higher in the dry season than in the monsoon because of lack of freshwater flow from upstream. Salinity level generally increases almost linearly from October to late May with the gradual reduction in the freshwater flow from the upstream. Observation of salinity shows an increase of salinity at Khulna from 0.7 ppt to 16.8 ppt in the Rupsa River from 1962 to 2011 (BDP 2100).

The problem of river salinity is most severe in the south-west zone. The water resource system of the south-west zone has degraded considerably over time, primarily because of the reduction in freshwater inflows from the Ganges due to withdrawal of fresh water at Farakka. During the dry period the Gorai inflow is severely decreased, creating problems of downstream freshwater availability. Salinity intrusion reduces the freshwater area that results in decrease of agricultural production in many parts of the coastal zone, especially the Khulna region and the extreme south of the Patuakhali region, and locally in the Noakhali and Chittagong regions. Increase of salinity is damaging the freshwater fish habitat and has adverse impact on the Sundarban ecosystems.

**Skilled manpower:** The lack of skilled manpower has become a major obstacle in achieving development targets. The government must focus on creating skilled manpower to achieve various economic and development goals. The garment factories are running with a 15 to 20% skilled manpower shortage. There is a lack of necessary skills required in the industry although there is no shortage of highly educated youths in the country. Therefore, entrepreneurs have to depend on foreigners for various positions of management.

**Water pollution:** The intensive farming takes place with increased use of fertilizers and pesticides. Contamination of surface water bodies and groundwater aquifers by agricultural pollutants, industrial discharge, domestic pollution, and non-point source urban runoff exacerbate water quality problems. Therefore, the consequences of such pollution need to be analyzed. Effluent disposal from industries will be monitored by relevant government agencies to prevent water pollution.

### 3.5.8 How to Overcome the Challenges

For addressing the challenges of water resources sub-sector diverse actions would be taken for short term, medium term and long term basis starting from the launching of 8<sup>th</sup> five year plan (2021-2025). The following actions need to be taken for mitigate the challenges.

- **Flood risk:** Development and improvement of embankments and water control structures, construction of flood shelter, extension of the flood warning lead time.
- **Dry season water availability:** Ensuring conjunctive use of surface and groundwater, rainwater harvesting and conservation and increasing storage in existing water bodies.
- **River water management:** Restoration of major rivers and enhanced regional cooperation.
- **River bank erosion:** Several improved methods have been developed in many countries for prevention of bank erosion which is recommended for implementation.
- **Coastal zone protection:** Increasing the drainage capacity of coastal rivers, proper repair, maintenance and conservation of polders.
- **Wetland conservation:** Restore water bodies and improve connectivity between floodplains, wetlands and rivers.
- **Impacts of climate change:** Protect against degradation of natural water-bodies and adapting of climate change mitigation strategies.
- **Cyclonic storm:** Improved cyclone warnings, more cyclone shelters, awareness building, and highly developed disaster risk management capabilities.
- **Population growth:** Population growth should be minimum, so that the domestic demand for water is within the manageable level.
- **Upstream development (Transboundary issues):** Closer cooperation has to be ensured with neighbouring countries. Negotiation of multiple treaties would be a better option, knowledge building on hydro-diplomacy would be useful for the trans-boundary water negotiations.
- **Institutional capacity, coordination and WRM:** Field and laboratory facilities as well as appropriate man power of BWDB should be strengthened for effective management of water resources to agricultural, rural and urban water supplies. In addition, strengthening other related organizations and experts would support to ensure sustainable long term use and governance of water resources.

For addressing the Challenges actions plan & projects have been proposed (Table-41); (Annex-1).

### 3.5.9 Addressing the Cross-Cutting Issues between Institutions and Agencies

The cross-cutting issues related to the actions necessary to evolve and strengthening the institutional framework and to create an enabling environment conducive to efficient and effective management of the sector. Key aspects of institutional framework are:

- The government will endeavor to enter into agreements with co-riparian countries for sharing the waters of international rivers, data exchange, resource planning and long-term management of water resources under normal and emergency conditions of flood, drought and water pollution.
- The Water Resource Planning Organization (WARPO) is to take an apex role in national

planning and monitoring plan implementation; WARPO will also delineate the hydrological regions of the country.

- The Bangladesh Water Development Board (BWDB) will continue as manager of the water resource system and will be directly responsible for maintenance and development of the main and regional rivers. BWDB will implement all major surface water development projects and other FCDI projects with command area above 1000 hectares.
- The Local Government (LGED) will implement FCDI projects having a command area of 1000 hectares or less. LGED will manage and develop local systems interfacing between BWDB and the small-scale systems managed by communities and individuals.
- The Bangladesh Agricultural Development Corporation (BADC) will increase agricultural production in Bangladesh. The primary function of irrigation wing of BADC will be to provide irrigation facilities through utilization of surface and groundwater. Generally, BADC uses DTWs, STWs and LLPs for supplying irrigation.
- Barind Multipurpose Development Authority (BMDA) is an autonomous organization under the Ministry of Agriculture of Bangladesh. The main responsibility of BMDA will be to ensure irrigation water to the farmer along with various other development activities. As BMDA was established with the commitment of self financing that means all the O&M cost including the salary of all officers and staffs will be maintained from the income of the authority, so they developed smart card based pre-payment meter system for irrigation fee. This type of system is first time in Bangladesh in Agriculture Sector at BMDA. Disaster preparedness and relief operations will continue to be directed and coordinated by Disaster Management Bureau.
- The Agricultural Engineering Wing of DAE (Department of Agricultural Extension) is mainly responsible for efficient use of irrigation water and mechanization for crop production at field level. DAE is involved in dissemination of water efficient irrigation technologies, developed by NARS (National Agricultural Research Systems) institutions.

### 3.5.10 The Indicators of Water Resources Sub-sector

The main goal of water resource sub-sector is to ensure availability and sustainable management of water and sanitation for all. To achieve this goal, the relevant targets are universal and equitable access to safe and affordable water for drinking, sanitation and hygiene for all, improve water quality, sustainably increase water use efficiency, protect and restore water related ecosystems, expand international cooperation and strengthen participation of local communities in improving water and sanitation management. The main indicators for performance measurement of the sustainable development goals are given below:

- Achievement of equitable access to safe water for drinking, sanitation and hygiene for all.
- Improvement of water quality by reducing pollution and wastewater treatment.
- Enhancement of water use efficiency and reduction of fresh water scarcity.
- Implementation of integrated water resources management and improvement in trans-boundary cooperation.
- Enhancement in conservation of natural water bodies.
- Enhancement in international financial and technical support.
- Improvement of navigation facility.

- Reduction of flood risk and climatic hazards.
- Improvement of protection of river bank, agricultural land and vulnerable communities;
- Strengthen capacity of water resources management institutes.

### 5.5.11 Identificatoin of program for interventions & Target for 8FYP

The action plan on water sub-sector has been prepared with the expected impact of intervention to respond to the challenges of water resources management. The impacts of interventions are: (i) Rational management and wise-use of water resources of Bangladesh; (ii) Improvement of quality of life of Bangladeshi people by the equitable, safe and reliable access to water for production, health and hygiene; and (iii) Timely supply of adequate quantity of clean water for multipurpose use and preservation of the aquatic and water dependent ecosystems.

**Ensuring safe and sustainable drinking water supply and sanitation:** The demand for drinking water and sanitation will increase in future due to ever-increasing population. The rural areas of Bangladesh suffer from lack of quality drinking water. Surface water supplies are generally polluted and groundwater level is declining day by day due to over extraction and in many areas beyond the suction limit of shallow and hand tubewells. Lack of proper sanitation and drainage facilities, inadequate water supply, and insufficient health and hygiene education are the primary causes of diseases in the rural and the urban areas. Lack of access to safe water supply in the saline areas is a special hardship for women. Therefore, facilities need to be developed for availability of safe and affordable drinking water supplies through various means, including rainwater harvesting and conservation. Besides, increasing storage in existing water retention bodies should be promoted.

**Restoration of water bodies and connectivity:** Sedimentation and human interventions have made the rivers and khals congested for flowing water. Policies will be undertaken to restore water bodies and to improve connectivity between floodplains, wetlands and rivers;

**River management, excavation and smart dredging:** Excavation and smart dredging are needed for the management of the river system. In addition, maintenance dredging will be needed to clear out submerged chars developed through years of siltation and decreasing conveyance capacity of flow as well as obstruct navigation routes of major rivers. Navigation routes have to be kept running perennially through regular dredging;

**Research and innovation in water resources:** Bangladesh is still lagged behind in respect to developing water saving technology and promoting sustainable water management. Earlier attempts were mainly concentrated to the optimal utilization of water resources without considering of environmental degradation i.e depletion of groundwater level, arsenic contamination, water pollution, scarcity of drinking water to rural inhabitants etc. However, in recent years an impressive success has made as overall agricultural productivity has increased such as rice, fruits, vegetables, flower, pulses, spices, poultry, dairy and fish and almost bring self-sufficiency in food grain production.

**Development and improvement of embankments and water control structures:** Due to the climate change, extreme flood may occur for which the major urban cities need higher level of protection. Therefore, construction of new embankments and other water control infrastructures as well as strengthening and/or maintenance of the existing structures is needed at, major urban cities. Moreover, building and maintenance of fish passes and fish friendly structures to ensure fish movement to facilitate seasonal migration of fish for breeding and grazing will be emphasized.

**Protect agriculture and vulnerable communities in haor and flash flood areas:** Pre-monsoon flash flood from the neighboring hilly region is a common phenomenon in haor areas. As a result, the numerous large, deep depressions are flooded, causing damages to the Boro crop immediate before the harvest. Therefore, early maturing, high yielding short duration rice varieties should be used with timely transplanting. The existing FCDI projects should be maintained with developing integrated water control structures in response to the future climatic scenarios (rainfall intensity and peak discharges of the major rivers) developed by in the Bangladesh Delta Plan 2100. Also, increasing the conveyance capacity of the flashy rivers through strategic and maintenance dredging, and re-excavation is needed. Initiatives are needed to protect the post-harvest crop from rotting in haor and flash flood areas. Mechanization needs to be promoted in the haor and flash flood area for quick land preparation, planting, weeding, harvesting, processing, drying etc.

**Flood shelter:** Construction of flood shelter, and information and assistance centre to cope with enhanced recurrent floods in major floodplains.

**Extension of the flood warning lead time:** The dissemination of the flood early warning system will be improved for delivering the warning to the local people with a higher lead time. Community based early warning services will be extended. A strong cooperation will be developed among institutions responsible for hydrology (BWDB), meteorology (BMD), and modeling (institutes and centres).

**Protection of river bank from erosion:** In Bangladesh, over 2,400 km of river banks are threatened with erosion every year. Protecting against river bank erosion along the world's largest rivers is challenging. These mighty rivers are the most unpredictable and largest braided, sand-bed river. Many of the principles implemented successfully in other parts of the world failed in Bangladesh. To this end, Bangladesh embarked on intensive knowledge-based developments and piloted new technologies. After two decades, successful, sustainable, low-cost riverbank protection technology was developed, suitable for the challenging river conditions. It was necessary to accept that no construction is permanent in this morphologically dynamic environment. BWDB generally uses CC block + Geo-bag dumping at scour hole as a protective measure for river bank erosion but the results are not so encouraging. Recently, the Blue Gold Project has recommended a technique entitled "Semi-permeable spur/groyne from riverbank up to scour hole + sand-filled Geo-bag dumping at scour hole" as a preventive measure for bank erosion. But now -a-days, several improved methods have been developed in many countries for prevention of bank erosion which is recommended for implementation. Because, permanent solution of erosion of Padma, Ganga and Jamuna River is a vital issue.

**Expansion of surface water irrigation:** Groundwater level is declining day by day due to over extraction. Excessive use of groundwater for irrigation has longer term ecological consequences. Therefore, the following intervention may be taken:

- Develop of small-scale surface irrigation in the southern part of the country requiring new infrastructure and capacity building
- Rehabilitate dykes and embankments affected by previous cyclones to protect vulnerable households and production
- Reduce impact of saline water intrusion in the south and enhance river water flow. involving major river dredging effort
- Potential cross dam projects using small rivers would be undertaken with proper feasibility studies



- Use water saving technologies for improving efficiency of irrigation water and install facilities to reduce distribution losses.
- Development of hydro-power and recreational centre: (i) Mini-hydropower development schemes may be undertaken provided they are economically viable and environmentally safe; and (ii) Recreational activities at or around water bodies will be allowed provided it is not damaging to the environment.

**River basin management:** Regional cooperation is highly important for sharing of water resource of common rivers. Therefore, for integrated river basin management the following intervention have been proposed:

- Work with co-riparian countries to establish a system for exchange of information and data on relevant aspects of hydrology, morphology, water pollution, ecology, changing watershed characteristics, cyclone, drought, flood warning, etc.;
- Work with co-riparian countries for a joint assessment of all the international rivers flowing through their territories;
- Work jointly with co-riparian countries to harness, develop, and share the water resources of the international rivers to mitigate floods and augment flows of water during the dry season; and
- Work jointly with co-riparian countries for the prevention of chemical and biological pollution of the rivers flowing through these countries.

**Ensuring conjunctive use of surface and groundwater:** It is really difficult to govern water resources for sustainable use. The challenge is not solely one of groundwater management, but one of comprehensive water management. Effective means to optimize water resources are conjunctive use of groundwater and surface water and artificial recharge in overstressed aquifers. Therefore, the prevailing situation in most parts of Bangladesh is likely a push to exploit more water for food security in the face of a changing and more variable climate. The national expectation is improved water management to drive agricultural growth and poverty reduction. Further development of yet unexploited water sources is the most plausible option of satisfying increasing future water demand in Bangladesh. Exploiting underutilized rivers and streams, estimating aquifers' safe yields, recharging the aquifers by natural and artificial means, harvesting rain water, and utilizing wastewater are the possible scopes for this option.

**Increase drainage capacity and reduce flood risk at the coastal zone:** The drainage congestion in the coastal zone is a big issue. It happens due to less capacity of the river and sedimentation with the tidal effect. Thus, increasing the drainage capacity will reduce the flood risk. Measures will be undertaken to restore rural rivers/ canals and livelihood improvement in coastal districts. There are about 139 polders in Bangladesh. Polder- wise Management Committee is needed for proper repair, maintenance and conservation of polders.

**Rain water harvesting:** Every year Bangladesh is blessed with ample rain. The average annual rainfall in Bangladesh is about 2,200 mm, 75% it occurs between May and September. Therefore, rainwater harvesting is one of the feasible options of fresh water sources in the coastal areas and arsenic affected areas of Bangladesh. Groundwater has been reported to be contaminated by the Arsenic (As) since 1993, which was highly hazardous for human health. To overcome the As contaminated health hazards, rainwater harvesting was found to be one of the best remedial measures for the rural people

of Bangladesh. It was found from different studies that the stored water could be used for drinking, cooking and dishwashing of a family throughout the year. Thus, rainwater harvesting as an option can be adopted in order to facilitate availability of safe and affordable drinking water supplies and to preserve natural depressions and water bodies in major urban areas for recharge of underground aquifers.

**Public and private involvement:** The management of public water schemes, barring municipal schemes, with command area up to 5,000 ha will be gradually made over to local and community organizations and their O&M will be financed through local resources; ownership of FCD and FCDI projects with command area of 1,000 ha or less will gradually be transferred to the local governments, beginning with the ones that are being satisfactorily managed and operated by the beneficiary/community organizations; appropriate public and private institutions will provide information and training to the local community organizations for managing water resources efficiently; Enabling environment will be created for women to play a key role in local community organizations for management of water resources; and the government, where appropriate, will restructure its present institutions and design all future institutions for efficient implementation of the above policies.

**Public water investment:** The policy of the Government in this regard is to ensure that: (i) Water resource projects, as far as possible, are developed as multipurpose projects with an integrated multi-disciplinary approach from planning to implementation to monitoring; and interests of low-income water users, and that of women, are adequately protected in water resource management.

**Improve operation and maintenance:** The operation and maintenance of projects is a major problem due to lack of timely funding, for which many of the structures are becoming nonfunctional. The completed projects of water resources sector would be properly operated and maintained with the participation of stakeholders so that the targeted benefits of the projects are ensured. Necessary manpower and budget are needed for regular operation and maintenance of huge number of structures of BWDB.

**Enhancing groundwater recharge:** (i) Increasing groundwater-fed irrigation would enhance net recharge in areas where surface geology and soil properties are permeable and thereby favor recharge; (ii) Increase in groundwater recharge may be possible where actual (net) recharge is less than potential recharge; (iii) Artificial groundwater recharge will be encouraged to contribute to total groundwater use; (iv) Serious steps will be taken to use harvested rainwater to recharge aquifers. Community rainwater harvesting ponds may be introduced at the village level; and (v) As water availability during the monsoon is very high in Bangladesh, therefore, construction of cross dams on small rivers to retain flood water during the monsoon, draining rain water from nearby rooftops and connecting storm water drain lines to tanks and rivers can greatly improve the groundwater position with little effort and maintenance. The total annual withdrawal should not exceed the total annual recharge of ground water.

#### **Adapting of climate change mitigation strategies:**

- i. Natural water bodies such as beels, haors, and baors will be preserved for maintaining the aquatic environment and facilitating drainage. Integrated projects will be taken up in those water bodies for increasing fish production;
- ii. Natural environment will be Protected and preserved for sustainable development. Accordingly, water resource management actions will take care to avoid or minimize environmental damages;

- iii. Protect against contamination of surface water bodies and groundwater aquifers by agricultural pollutants, industrial discharge, domestic pollution, and other water quality problems;
- iv. Control other environmental problems such as excessive soil erosion and sedimentation, water logging and salinisation of agricultural land, groundwater depletion, watershed degradation and deforestation, reduction of biodiversity, wetland loss, saltwater intrusion, and coastal zone habitat loss;
- v. Therefore, all water management agencies will give full consideration to environmental protection, restoration and enhancement measures consistent with the National Environmental Management Action Plan (NEMAP) and the National Water Management Plan (NWMP);
- vi. Protection against degradation of natural water-bodies such as lakes, ponds, beels, khals, tanks, etc. affected by man-made interventions or other causes;
- vii. Take necessary steps to remove all existing unauthorized encroachments on rivers and watercourses and to check further encroachments that cause obstructions to water flows and create environmental hazards;
- viii. Location for establishment of new industries will be selected in consideration of fresh and safe water availability and effluent discharge possibilities;
- ix. Effluent disposal will be monitored by relevant Government agencies to prevent water pollution;
- x. Industrial polluters will be required under law to pay for the cleanup of water-body polluted by them;
- xi. Mainstreaming adaptation to climate change into policies and programmes in different sectors (focusing on disaster management, water, agriculture, health and industry); and
- xii. Promotion of research on drought, flood and saline tolerant varieties of crops to facilitate adaptation in future.

### 3.5.12 Action Plan Framework of Water Resources Development

The action plan of water resource sub-sector includes water management in all its dimensions such as flood control, water logging, river bank erosion, groundwater and surface water use, rain water harvesting, urban and rural water supply, water pollution, river dredging for inland water traffic, and preservation of environment. This plan of the government aims to provide direction to all agencies working with the water sector and institutions that relate to the water sector. The plan will also work as a guide for the development, maintenance, and delivery of water and water related services as well as the private users and developers of water resources.

#### Key action points of the sub-sector are:

- i. Increase use of water efficient irrigation technologies;
- ii. Improved crop technologies, conjunctive use of groundwater and surface water including rainwater harvesting and drainage water recycling will be encouraged and promoted;
- iii. Facilitate availability of safe and affordable drinking water supplies through various means including rainwater harvesting and conservation;

- iv. Develop and improve embankments and water control structures through redesign and modification of embankments and structures;
- v. Protect agriculture and vulnerable communities in haor and flash flood areas;
- vi. Strengthen early warning systems of natural hazards;
- vii. Continuing and strengthening river dredging for maintaining minimum stream-flows in designated rivers and streams for navigation;
- viii. Dredging and other suitable measures would be undertaken, wherever needed, to maintain navigational capability of designated waterways;
- ix. Construction of flood shelter, and information and assistance centre to cope with enhanced recurrent floods in major floodplains;
- x. Reduction of climate change hazards through coastal afforestation with community participation;
- xi. Harvesting rain water for providing drinking water, reduce salinity, improving surface water and groundwater position;
- xii. Enhancing surface and groundwater retention and utilization;
- xiii. Estimation of aquifer's safe yield and utilization;
- xiv. Monitoring groundwater recharge, surface and groundwater use and changes in water quality;
- xv. Strengthen climate change and adaptation information dissemination to vulnerable communities; and
- xvi. Review synthesis and analyze present bottlenecks on implementing cooperation between Bangladesh- India, including Ganges Water Treaty.

On the basis of above key action points the water resources action plan framework are shown in the following Table 41.

**Table 43: Action Plan for Addressing the Challenges of Water Resources Sub-sector**

Thematic Category/ Area	Strategic Goal of 8YFP	Action	Base line	Target	Implementaton period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA 1. Proper supply of water	1. Ensuring safe and sustainable drinking water supply and sanitation (P-328)	<p>1. Supply and distribution of quality Hand Tube Wells (No 6 pump), submersible pumps, DTWs to be ensured by DPHE, LGED, WASAs and other private agencies along with monitoring for safe and adequate supply of water for drinking and sanitation.</p> <p>2. Water availability to be increased by improving natural/ artificial recharging, rain water harvesting, purifying surface water for drinking, using submersible pumps in dry season water shortage areas etc.</p>	Annual = 3.6 km <sup>3</sup>	Annual = 3.70 km <sup>3</sup> 3.8 km <sup>3</sup>	a. Up to 2025  b. 2026-2030	141,000	6.1, 6.2 6.b	Specific water supply technologies in vulnerable areas (Ch-4, Art-7, P-368).	Clean water in sufficient quantities for multipurpose use.	DPHE, LGED, WASAs BADC	Scarcity of fresh water and fund. Political stability.
		<p>1. Timely supply and distribution of adequate amount of fresh water for irrigation to be ensured by BW/DB, BADC, BMDA and other water management institutions.</p> <p>2. Use of water saving technologies (AWD and others), sprinkler and drip irrigation for suitable crops for improving efficiency of irrigation water and install facilities (plastic pipe, buried pipe) to reduce distribution losses.</p> <p>3. Re-use of water for agriculture and other suitable purposes.</p>	Efficiency a. Major surface water project = 30% b. Minor irrigation = 50- 60% Coverage = 5.8 Mha	Efficiency a. Major surface water project =35% b. Minor irrigation 70%-75% Coverage = 8.0 Mha	a. Upto 2025  b. 2026-2030	38100	6.4, 6.a	Enhanced Irrigation development (Ch-3, Art-3-2, p-258)	Food security, improved standard of living.	BW/DB, WARPO, BADC, BMDA DAE, NARS institutes, LGED, DBHWD	Availability of water and fund.

Thematic Category/ Area	Strategic Goal of 8FYP	Action	Base line	Target	Implementation period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA 2. River water management	3-Development and improvement of embankments and water control structures (P-326)	1. Construction of new embankments and other water control infrastructures as well as strengthening and/ or maintenance of the existing structures in flood prone areas and at major urban cities.	a) Embankment = 16528 Km b) Hyd. Structure = 15762	a) New embankment = 10 km/yr b) Resectioning embankment = 300 km/yr c) Control structure = 40 Nos/yr and d) repair of structure = 55 Nos/yr	Beyond 8 <sup>th</sup> FYP 10 years.	1,15,000	6.5	Flood control and drainage scheme development (Ch-3, Art-3.1, P-254)	Proper control of Bangladesh's water resources.	BWDB, BIWTA, BADC, LCED, IWFM	Suitable site and manageable flood.
	4. River management, excavation and smart dredging (P-327)	1. Enhance river water flow to improve navigability through major river dredging in selected locations for reducing impact of saline water intrusion in the Southern Region. 2. Sediment Management and dredged material management after river dredging. 3. Potential use of dredged material obtained from river dredging.	River dredging = 1294 km Canal excavation = 4425 km	River dredging = 250 km/yr And Canal excavation = 300 km/yr	10 years. (To be continued)	110,000	6.5, 6.6	River improvement dredging (Ch-1, Art-7-6.5, P-77)	Improved navigability	BWDB, BIWTA	Suitable site and availability of water and timely fund release

Thematic Category/ Area	Strategic Goal of 8YFP	Action	Base line	Target	Implementaton period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA 3. Conjunctive use of groundwater, surface water, and rain water	5. Protection of river bank from erosion (P-325)	1. Prevention of bank erosion using existing techniques (CC block and Geo-bag) and several improved methods, developed in other countries.	Annual erosion = 6000 km Embankment protection = 1458 km	80 km/yr	Beyond 8 <sup>th</sup> FYP 10 years	52100	6.5	River erosion (Ch-3, Art-5-2.4, P-297)	Safety against natural calamities.	BWDB, BIWTA, RRI	Skilled personnel and improved technology
		2. Formulation of River Master Plan.									
	6. Ensuring conjunctive use of surface and groundwater (P-325)	1. Conduct research works for identifying type of aquifers in different regions of Bangladesh; 2. Estimating groundwater availability for use based on annual recharge of aquifers by natural and artificial means.	GW = 79% SW = 21%	GW=70% SW=30%	10 years.	1,467	6.3	Ground water resources (Ch-3, Art-2-5, P-242)	Food security, improved standard of living.	NARS BWDB, BMDA, BADC, LGED, NARS WARPO	Availability of ground water in dry season
7. Expansion of surface water irrigation (P-328)	1. Development of cross dams/ hydraulic elevator dam (HED) / rubber dam on small rivers to conserve water for irrigation with proper feasibility studies. Dredging can be performed to increase water holding capacity. 2. Development of surface water irrigation projects using LLP or submersible pumps. 3. Rehabilitation of dykes and embankments affected by previous cyclones/ floods to protect vulnerable households and production;	21%	30%	10 years.	1467	6.4	Surface water availability (Ch-3, Art 236, P-236)	Food security, improved standard of living.	BWDB, BMDA, BADC, LGED, DBHWD, WARPO	Suitable site for conservation and use	

Thematic Category/ Area	Strategic Goal of 8YFP	Action	Base line	Target	Implementation period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA4. Water resources management in unfavorable situation	8. Rain Water Harvesting (P-325)	Rain water harvesting using 15 cm levee around rice fields, constructing cross dams/rubber dams/HED on small rivers, using ponds, RW from roof-top for domestic use in saline areas.	60-80%	80-90%	Beyond 8 <sup>th</sup> FYP 5 – 10 years	1,590	6.b	Rain Water Harvesting (Ch-6, Art-7, P-529)	Food security, improved standard of living.	BMDA, BWDB, BADC, LGED, NARS	Availability of rain water and technology for use
	9. Increase drainage capacity and reduce flood risk at the coastal zone (P-328)	1. Dredging to be performed to increase the drainage capacity of coastal rivers/canals and to reduce the flood risk. 2. Conservation of fresh water in coastal and haor areas. 3. Tree plantation and maintenance of polders by BWDB to protect the coastal areas.	Dredged volume not found in literature.	250 km/yr.	5 -10 years	3,93,000	6.6	Coastal management (Ch-3 Art-7.3, P-68)	Sustainable economic growth, poverty alleviation.	BWDB, BADC, LGED, DDM.	Lack of organizational capacity and fund.
	10. Protect agriculture and vulnerable communities in haor and flash flood areas. (P-329)	1. Early maturing, high yielding short duration Boro rice varieties should be used with timely transplanting, 2. The existing FCDI projects should be maintained with developing integrated water control structures in response to the future climatic scenarios (rainfall intensity and peak discharges of the major rivers). Conveyance capacity of the flashy rivers to be increased through strategic and maintenance dredging. 3. Mechanization needs to be promoted for quick post-harvest agricultural operations.	Limited areas	Total cultivable land in connection with 141 haors is about 0.5 Mha.	10 -15 years	23,800	6.6	Specific water supply technologies in vulnerable areas (Ch-4, Art-7.4 P-371)	Food security and improved quality of life.	DBHWD, BWDB, BADC, LGED, BRRI, DAE, DDM	Managable flood and suitable site and technology



Thematic Category/ Area	Strategic Goal of 8YFP	Action	Base line	Target	Implementaton period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
TA5, Conservation of wetland and environment	11. Strategy for water resources in Chattogram Hill Tracts (CHT) (P-330)	<ol style="list-style-type: none"> <li>1. Protection of economic zones and towns from floods and storm surges;</li> <li>2. Develop cyclonic storm surge and tidal flood risk management practice;</li> <li>3. Fresh water supply to be ensured for drinking and sanitation;</li> <li>4. Hill soil erosion to be protected creating green belt</li> </ol>	Limited protection against cyclonic storm surge, less water supply and conservation	Protection from cyclonic storm surge, ensure water security and sanitation, soil and water conservation (100% area)	Beyond 8 <sup>th</sup> FYP 10 -15 years	18,300	6.6	Surface water resources (Ch-3, Art 2.4, P-229)	Quality of life improved	NARES BWDB, BADC, LGED, DDM	Availability of suitable site.
		<ol style="list-style-type: none"> <li>1. Necessary steps to be undertaken to remove all existing unauthorized encroachments on rivers and water courses and to check further encroachments that cause obstructions to water flows and create environmental hazards;</li> <li>2. A strong inter-connectivity among water bodies (Like river, haors, baors, beels, lake etc), flood plains and rivers to be established through removing the obstructions to improve connectivity.</li> <li>3. Re-excavation of wetlands may be needed.</li> <li>4. Eco-system based solution or nature based solution should be performed.</li> </ol>	Very limited initiatives.	7 – 8 Mha	10 -15 years.	4900	6.3, 6.6	Wetlands, water bodies and lakes. (Ch-3, Art-2.4.2, P-233)	Water pollution reduction and fish habitat improvement.	BWDB, BADC, LGED, CEGIS, IWM, DoF	Lack of specific measures for protection of wetland and environment from industrial pollution.
TA 6. Capacity building of water resource institutions.	13. Improve operation and maintenance (P-327)	<ol style="list-style-type: none"> <li>1. Necessary man-power and budget to be ensured for regular operation and maintenance of huge number of structures of BWDB and other water resource institutions.</li> </ol>	Inadequate allocation and limited training opportunity	Allocation of adequate O & M budget, training and education of personnel.	5 years.	17900	6.6	adaptation in disaster management and climate change (Ch-1, Art-8.2, p-86)	Institutional capacity building.	BWDB, BADC, LGED,	Lack of man-power and fund

Thematic Category/ Area	Strategic Goal of 8YFP	Action	Base line	Target	Implementaton period	Indicative budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Assumptions
							SDG's Target	BDP 2100 Measures			
	14. Extension of the flood warning lead time (P-327)	2. The dissemination of early warning system for flood and other natural hazards to be improved for delivering the warning to the local people with a higher lead time.	5 - 10 days lead time	15 days lead time	5 years	17900	6.6	Adaptation to disaster management and climate change (Ch-1, Art-8.2, P-86),	Reduction of flood risk.	BWDB, BMD, IWM	Availability of improved technology.
TA7. Trans-boundary water management	15. Strategy for trans-boundary water issue (P-330)	1. Work with co-riparian countries for a joint assessment of all the international rivers flowing through their territories;	a.) Less than 50% of dry season flow in Ganges.	a) 50% (35,000 cusec)	2 years 5 years	4700	6.5	International development (Ch-3, Art-3.6, P-278)	Improvement in proper share of trans-boundary water	BWDB, WARPO, JRC	Cooperation of neighboring countries.
		2. Closer cooperation has to be ensured with neighboring countries.	b) other international rivers are not yet assessed jointly.	b) At least other 6 major international rivers to be assessed jointly.							
TA8. Research and innovation	16. Improvement of agriculture	3. Discharge and quality measuring stations need to be established and regularly monitored at different locations of the river			5-10 years	4500.00	6.1 6.2 6.5	Enhanced Irrigation development (Ch-3, Art-3.2, p-258	Improved water management.	NARS Institutions	Availability of skill manpower and fund.
		4. Benefit-sharing "mutual gains" model has to be implemented that	Limited number of technologies disseminated in field level.	Large number of suitable technologies to be developed and disseminated in field level.							
		5. Knowledge building on hydro-diplomacy would be useful for the trans-boundary water negotiations.									
		1. Development of improved water management technologies.									
		2. Research should be conducted on effect of groundwater extraction on river water flow.									
		3. Research should be conducted to determine how much water is needed for navigation, fisheries, environmental flow and salinity management in coastal areas.									

a)Source: 8<sup>th</sup> FYP, P-326

**Table 44: Water Resources Sub-sector Monitoring & Evaluation Framework**

Thematic Category/ Thematic Area (TA)	Action	Indicator	Base		Target			Responsible agency	Assumptions
			Year	Status	2025	2030	2041		
TA1. Proper supply of water	1. Supply and distribution of quality Hand Tube Wells (No 6 pump), submersible pumps, DTWs to be ensured by DPHE, LGED, WASAs and other private agencies along with monitoring for safe and adequate supply of water for drinking and sanitation; and	Achievement of equitable access to safe water for drinking, sanitation and hygiene	2020	Annual = 3.6 km <sup>3</sup>	3.7 km <sup>3</sup>	3.8 km <sup>3</sup>	4.0 km <sup>3</sup>	DPHE, LGED, WASAs BADC	Scarcity of fresh water and fund. Political stability.
	2. Water availability to be increased by improving natural/artificial recharging, rain water harvesting, purifying surface water for drinking, using submersible pumps in dry season water shortage areas etc.	Enhancement of water use efficiency and reduction of fresh water scarcity	2020	Effi = 40%– 60% Cover = 5.6 Mha	Effi=65% Coverage=6.0 Mha	Effi=70% Coverage=6.5 Mha	Effi=75% Coverage=8.0Mha	BWDB, WARPO, BADC, BMDA DAE, NARS institutes, LGED, DBHWD	Availability of water and fund.
TA2. River water management	3. Timely supply and distribution of adequate amount of fresh water for irrigation to be ensured by BWDB, BADC, BMDA and other water management institutions.	Reduction of flood risk and climatic hazards	2020	Embankments =16528 Km Hydraulic Structure =15762	Additional Nos Embankment = 50 km. Additional Resectioning of Embankment = 1500 Km Additional Structure= 200 Nos. Additional Reconstruction of structure=275 Nos.	Additional Embankment = 100 km. per year Additional Structure = 3000 Km. Additional = 2000 Nos. Additional = 550 Nos.	-	BWDB, BIWTA, BADC, LGED, IWFM	Suitable site and manageable flood.
	4. Use of water saving technologies (AWD and others), sprinkler and drip irrigation for suitable crops for improving efficiency of irrigation water and install facilities (plastic pipe, buried pipe) to reduce distribution losses.								

Thematic Category/ Thematic Area (TA)	Action	Indicator	Base		Target			Responsible agency	Assumptions
			Year	Status	2025	2030	2041		
T13. Conjunctive use of groundwater, surface water, and rain water	2. Enhance river water flow to improve navigability through major river dredging in selected locations for reducing impact of saline water intrusion in the Southern Region.	Improvement of navigation facility	2020	a) River dredging =280 km b) Excav Canal = 4425 km	a) River dredging =1250 km b) Excav Canal= 8000 km	a) River dredging =2000 km b) Excav Canal= 10000 km	(To be continued)	BWDB, BIWTA	Suitable site and availability of water and timely fund release
	3. Prevention of bank erosion using existing techniques (CC block and Geo-bag) and several improved methods, developed in other countries.	Improvement of protection of river bank, agricultural land and vulnerable communities	2020	Annual erosion = 6000 ha	1500 ha / year	1500 ha / year	-	BWDB, BIWTA,	Skilled personnel and improved technology
	1. Conduct research works for identifying type of aquifers in different regions of Bangladesh. 2. Estimating groundwater availability for use based on annual recharge of aquifers by natural and artificial means.	Reduction in groundwater level depletion	2020	GW = 79% SW = 21%	GW=75% SW=25%	GW=65% SW=35%	GW=60% SW=40%	BWDB, BMDA, BADC, LGED, NARS	Availability of surface water in dry season
	3. Development of cross dams on small rivers to conserve water for irrigation with proper feasibility studies. 4. Development of surface water irrigation project in the southern part of the country using LLP or submersible pump. 5. Rehabilitation of dykes and embankments affected by previous cyclones/ floods to protect vulnerable households and production; 6. Rain water harvesting using 15 cm levee around rice fields, through re-excavation of canals, constructing cross dams/rubber dams on small rivers, RW from roof-top for domestic use in saline areas..	Enhancement in increasing surface water irrigation	2020	21%	25%	30%	-	BWDB, BMDA, BADC, LGED, DBHWD.	Suitable site for conservation of water and use.
		Enhancement of rain water harvesting	2020	60-80%	80-85%	85-90%	-	BWDB, BMDA, BADC, LGED, NARS	Availability of rain water and technology for use

Thematic Category/ Thematic Area (TA)	Action	Indicator	Base		Target			Responsible agency	Assumptions
			Year	Status	2025	2030	2041		
TA4. Water resources management in unfavorable situations	1. Dredging to be performed to increase the drainage capacity of coastal rivers/canals and to reduce the flood risk.	Improvement of coastal zone.	2020	560 km	Additional 500 km	Additional 500 km	-	BWDB, BADC, LGED	Lack of organizational capacity and fund.
	2. Early maturing, high yielding short duration Boro rice varieties should be used with timely transplanting.								
	3. The existing FCDI projects should be maintained with developing integrated water control structures in response to the future climatic scenarios (rainfall intensity and peak discharges of the major rivers). conveyance capacity of the flashy rivers to be increased through strategic and maintenance dredging.	Improvement of protection of agriculture in haor and flash flood area	2020	Limited areas	0.50 Mha	0.70 Mha	0.86 Mha	DBHWD, BWDB, BADC, LGED, BRRi, DAE	Managable flood and suitable site and technology
	4. Mechanization needs to be promoted for quick post-harvest agricultural operations.								
	5. Protecting economic zones and towns from floods and storm surges; developing cyclonic storm surge and tidal flood risk management; Ensuring drinking water security and sustainable sanitation; integrating erosion management in the hills by creating green belt	Improvement of water resource development in CHT	2020	Limited protection against cyclonic storm, less water supply and conservation	30% area	60% area	100% area	BWDB, BADC, LGED, NARS	Availability of suitable site

Thematic Category/ Thematic Area (TA)	Action	Indicator	Base		Target			Responsible agency	Assumptions
			Year	Status	2025	2030	2041		
TA5. Conservation of wetland and environment	<p>1. Necessary steps to be undertaken to remove all existing unauthorized encroachments on rivers and watercourses and to check further encroachments that cause obstructions to water flows and create environmental hazards;</p> <p>2. A strong net work between water bodies (Like haors, baors, beels etc), flood plains and rivers to be established through removing the obstructions to improve connectivity;</p> <p>3. Re-excavation of wetlands may be needed.</p>	Enhancement in conservation of natural water bodies	2020	Very limited area	2 – 3 Mha	5 – 6 Mha	7 – 8 Mha	BWDB, BADC, LGED, CEGIS IWM	Lack of specific measures for protection of wetland and environment from industrial pollution.
TA6. Capacity building of water resource institutions.	<p>1. Necessary man-power and budget to be ensured for regular operation and maintenance of huge number of structures of BWDB and other water resource institutions.</p> <p>2. The dissemination of early warning system for flood and other natural hazards to be improved for delivering the warning to the local people with a higher lead time.</p>	Enhancement in international financial and technical support	2020	Inadequate allocation and limited training opportunity.	Adequate allocation and capacity building of 40% personnel	Capacity building of 80% personnel	Capacity building of 100% personnel	BWDB, BADC, LGED, DBHWD DAE	Lack of man-power and fund
			2020	5 - 10 days lead time	15 days lead time	-	-	BWDB, BMD, IWM	Availability of improved technology.

Thematic Category/ Thematic Area (TA)	Action	Indicator	Base		Target			Responsible agency	Assumptions
			Year	Status	2025	2030	2041		
TA7. Trans-boundary water management	<p>1. Work with co-riparian countries for a joint assessment of all the international rivers flowing through their territories;</p> <p>2. Closer cooperation has to be ensured with neighbouring countries.</p> <p>3. Discharge and quality measuring stations need to be established and regularly monitored at different locations of the river.</p> <p>4. Benefit-sharing “mutual gains” model has to be implemented that discourages unilateral actions and further encourages coordination between riparian countries.</p> <p>5. Review synthesis and analyze present bottlenecks on implementing cooperation between Bangladesh-India, including Ganges Water Treaty.</p> <p>6. Knowledge building on hydro-diplomacy would be useful for the trans-boundary water negotiations.</p>	Implementation of integrated water resources management and improvement in trans-boundary cooperation	2020	Inadequate Less than 50% of dry season flow	At least 50% (35,000cusec)	-	-	BWDB, WARPO	Cooperation of neighboring countries.
TA8. Research & Innovation	Development of improved water management technologies.	Research and development	2020	-	-	-	-	BWDB, WARPO, IRC	Cooperation of neighboring countries.

### 3.5.13 The Way Forward

For proper implementation of the water resource sub-sector action plan the following recommendations may be considered in the future (Way forward for 9<sup>th</sup> FYP) water resources development activities:

- For proper implementation of the water resource sub-sector action plan the following recommendations may be considered in the future (Way forward for 9<sup>th</sup> FYP) water resources development activities:
- Water is a scarce and costly resource. Therefore, attempts should be made to utilize this costly water with minimum waste. Facilities need to be developed and ensured availability of safe and affordable drinking water supplies through various means, including rainwater harvesting and conserv
- Natural water bodies like haors, baors, beels, roadside borrow pits, etc. will, as far as possible, be preserved for maintaining the aquatic environment, facilitating drainage and fish production. Minimum stream-flows in designated rivers and streams will be maintained for navigation after diversion of water for drinking and municipal purposes. Dredging and other suitable measures would be undertaken, wherever needed, to maintain navigational capability of designated waterways;
- Potential cross dam projects using small rivers would be undertaken with proper feasibility studies;
- Necessary steps will be taken to remove all existing unauthorized encroachments on rivers and water courses and to check further encroachments that cause obstructions to water flows and create environmental hazards;
- The early warning systems for flood and other natural hazards will be improved for delivering the warning to the local people with a higher lead time;
- The currently practiced groundwater development and use policy need to be revised to make groundwater use more sustainable. Strategies such as artificial recharge to the aquifers and rain water harvesting along with water-saving technologies and integrated water resources management need to be adopted. Special attention needs to be given in areas where GWTs drop below the critical suction limit of suction-mode pumps. Alternate technology for pumping groundwater needs to be made available to provide household water;
- Initiatives are needed to protect the post-harvest crop from rotting in haor and flash flood areas. Mechanization needs to be promoted in the haor and flash flood area for quick land preparation, planting, weeding, harvesting, processing, drying etc;
- Review and analyze of existing multi-lateral treaties, agreements and other relevant documents between riparian states within the Ganges -Brahmaputra Basin are needed. Identify potential stakeholders and key informants. Review synthesis and analyze present bottlenecks on implementing cooperation between Bangladesh-India, including Ganges Water Treaty 1996; Teesta Agreement; Farraka, as well as other upstream interventions in both Ganges and Brahmaputra; and India-Bangladesh Joint Rivers Commission – meeting minutes/ collaborative documets/ publications. Initiative for further strengthening the common transboundary river basin management through harnessing potential mutual benefit sharing opportunities such as navigation routes, hydroelectricity generation, flood management etc. Jointly develop a regional vision and strategy for other co-partner's engagement in the Ganges-Brahmaputra river;



- Regular monitoring of groundwater storage and quality should be continued for the development and integrated management of water resource. Because of increasing demand of water and to reduce dependency on limited fresh groundwater resources, utilization of available surface water and conjunctive use should be stressed. Better operation and maintenance of tube wells, under an appropriate system acceptable to farmers, improving the management efficiency, crop diversification, increase in electrification of tubewells should be given high priority;
- Protect against contamination of surface water bodies and groundwater aquifers by agricultural pollutant, industrial discharge, domestic pollution and other water quality problems. Effluent disposal from industries will be monitored by relevant Government agencies to prevent water pollution. Industrial polluters will be required under law to pay for the cleanup of water body polluted by them.
- Zoning of groundwater aquifers, STW/DTW areas, saline encroachment areas, initiation and implementation of small-scale irrigation project, establishment of water resource information system, strengthen and upgrade the existing groundwater data centers may be considered as vital issues;
- To facilitate the actions for sustainable development and management of groundwater resources of Bangladesh, strengthening and capacity building of appropriate organizations is required;
- The prevailing situation in most parts of Bangladesh is likely a push to exploit more water for food security in the face of a changing and more variable climate. The national high expectation is improved water management to drive agricultural growth and poverty reduction, further development of yet unexploited water sources is the most plausible option of satisfying increasing future water demand in Bangladesh. Sinking new TWs in the potential areas may increase crop production. Exploiting underutilized rivers and streams, estimating aquifers' safe yields, recharging the aquifers by natural and artificial means, harvesting rain water, and utilizing wastewater are the possible scopes for this option;
- Strengthen the implementation and monitoring of water related projects. Make the best use of available water resources. Improve water cost-effectiveness and affordability. Improve urban drainage facility;
- It is important to collect a clearance certificate from WARPO for all sorts of water sector projects as per Bangladesh Water Act, which may play a significant role in scarce water management and ensure good water governance. Similar provision should be made for other organizations under Ministry of Water Resources;
- For sustainable development and management of water resources capacity building of appropriate organizations should be strengthen. Training should be conducted to enhance the knowledge and experience of water resources professionals, so that they are able to apply the knowledge in their own organizations during implementation of projects;
- Coordination of mathematical and physical modeling for hydro-morphological analysis of rivers is needed; and
- A dedicated organization is suggested to work on groundwater.

## Annex-1: List of Proposed Project of Water Resources Sub-sector with Indicative Budget and Implementation Period

Thematic Area (TA)	Name of Proposed Project	Period	Indicative Budget (Million Taka)
TA1: Proper supply of water	1.Piped water supply for drinking and sanitation in unfavorable areas.	2023-28	32,000
	2. Enhancement of agricultural productivity using improved water saving technologies and suitable water lifting devices.	2024-30	19,000
	3. Minor irrigation development project in North- west region of Bangladesh	2023-28	17,000
TA2: River water management	1. Dredging of Tista riverfor conservation and proper utilization of surface water	2023-27	240,000
	2. River bank protection in selected locations of southern part of Bangladesh	2023-25	3,300
	3. Prevention of bank erosion of Modhumoti river in south-western part of Bangladesh	2023-25	4,800
	4. Bank protection of Kushiara river in North-eastern region of the country	2023-25	4,600
	5. Prevention of river bank erosion in selected locations of Barishal region	2023-25	5,000
	6. Capital dredging of upper Meghna river	2023-29	3,60,000
	7. Prevention of bank erosion of Karnafuli river	2023-29	15,000
	8. Development of multipurpose disaster shelters in disaster prone areas	2023-30	390,000
TA3: Conjunctive use of groundwater , surface water, and rain water	1. Irrigation development project using surface water and rain water in hilly areas of Bangladesh	2023-27	4,900
	2. Development of cross dams/rubber dams on small rivers to conserve surface water for irriga- tion and to reduce pressure on groundwater.	2024-29	5,000
TA4: Water resources management in unfavorable situations	1. Integrated water resource management project to remove water logging in coastal areas of Bangladesh	2023-30	90,000
	2. Integrated water resource management project to remove water logging in Barindarea of Bangladesh	2023-24	4,000
	3. Construction of eco-friendly water reservoir for conservation of unused spring of rain water in hilly areas of Chattogram district	2023-27	22,000
	4. Pond digging project for conservation of rain water in selected districts of coastal areas.	2023-26	3,800

Thematic Area (TA)	Name of Proposed Project	Period	Indicative Budget (Million Taka)
	5. Improved water management in haor basins	2023-29	9,200
	6. In Irrigation development project in southern districts of Bangladesh	2023-28	51,000
TA5: Conservation of wetland and environment	1. Rapid removal of water logging in low-lying south-western part of Bangladesh	2023-27	4,500
	2. Re-excavation of silted wetlands and natural canals in selected locations for conservation of surface water	2024-27	106,000
	3. Sustainable restoration of connectivity of major wetlands	2023-30	28,900
TA6: Capacity building of water resource institutions	3. Improvement of delivering early warning system for flood and other natural hazards through developing expert man-power.	2023-26	3,400
	4. Enhancement in repair and maintenance of huge number of water control structures of BWDB	2023-28	5,500
TA7: Trans-boundary water management	1. Joint assessment of all the international rivers with neighboring countries.	2023-26	3,300
	2. Establishment of discharge measuring stations and strengthening regular monitoring	2023-27	2,200
TA8: Research and innovation	1. Expansion and modernization of monitoring network and tools for sustainable development , management and governance of groundwater in Bangladesh	2023-28	5,200
	2. . Estimating groundwater availability in different regions of Bangladesh	2023-28	5,000
	3. Increase agricultural production through improved water management in haor areas	2023-30	9,600





## Irrigation





## 3.6 Irrigation Sub-sector Action Plan

### 3.6.1 Introduction

Sustainable irrigation development is crucially important in Bangladesh agriculture as it is a key factor behind the self-sufficiency in food grains production and future food security. Development of irrigation systems and prioritization and implementation of adaptive measures under proper policy is crucial. Irrigation Sub-sector is to deal with issues related to adequate availability and improved management of irrigation water for optimum crop production over the year, wherever it is possible. Irrigation comes from major two sources, groundwater and surface water. Groundwater has covered 72.5% of total irrigated area and 27.5% of surface water is used for crop production (BADC 2022). Bangladesh receives annually about 7.5 meters of water over the country from surface flow and rainfall, which is enough for year-round use. But the distribution pattern of the huge water volume over the year makes a complex water environment in the country and causes flooding almost every year sometime during June to September and affects crop production due to water shortage during November to May. Under the too much and too little water environment the country faces problems in managing water resources for sustainable irrigation facilities.

Conservation of excess water received during rainy season and effective use of rainwater and irrigation and FCDI infrastructures developed so far can play important role in improving water availability in dry season. Comprehensive uses of irrigation and FCDI facilities developed so far are providing irrigation facilities to about 65% of cultivable land. However, irrigation efficiencies of irrigation facilities are low in most cases below 60% of their potential capacity and needs to be increased. Therefore, improved operation and management of Irrigation Sub-sector is required at local and national levels. Government and social interventions can solve the problem and irrigation efficiencies can be increased to 70% to 75%. GO-NGO partnership arrangement may take lead in this area immediately with supports from GOB and donors. Based on the literature review, discussions and interviews, major challenges and opportunities were identified and thematic area wise action points for the Irrigation Sub-sector Action Plan development has been proposed.

Major challenges were identified for irrigation sub-sector. For addressing the challenges of irrigation sub-sector, diverse actions have been proposed in the Action Plan Framework (Table 48).

### 3.6.2 Situation Analysis

Increased crop production and sustainable agricultural development of Bangladesh depend on unique dimension of water as a resource. Its variation on occurrence is a major constraint to water development for maximum contribution to the national economy. The country receives about 90% of the surface water resources during June to October through rainfall and river flows, most of which flows to the Bay of Bengal. With management alternatives, part of it can be retained in the rivers and distributor networks and can be effectively used for agricultural and non-agricultural purposes during the lean period, November to May. The country has plenty of groundwater, which is also of very good quality except in some part of the coastal area. Through conjunctive use of ground and surface water, about 76% of the cultivable area can be irrigated, of which as of 2021-22 about 66% is irrigated. Contribution of ground and surface water to 66% irrigated area achieved in 2021-22 are 72.5% and 27.5% respectively.

Agricultural practices in Bangladesh are controlled by hydrological cycle, therefore, farmers need protection and support against; (i) flood in wet season, (ii) irrigation in dry season, (iii) supplemental irrigation in wet season, (iv) saline water intrusion in coastal area, (v) arsenic contamination of groundwater for all over the country, (vi) drainage in wet and dry season, (vii) water related hazard (storm surge and cyclone) in coastal belt, and (viii) river erosion. In addition to these natural phenomena, there is man-made intervention.

Farmers are facing all the above constraints, but with supports from professionals and the government, producing enough food grains to make the country self sufficient. Unlike many other countries, Bangladesh is implementing Irrigation Water Management Strategy “to increase production per unit of land, unit of water and unit of time”, where most other countries are planning for “more crop with less drop”. (# 2: PPP). At present, groundwater irrigation is performed by DTW, STW, solar pumps, dug well and artesian well etc, where surface water irrigation is performed by LLP, Solar Pumps, Floating Pumps, Rubber Dams, Gravity Flow and Manual Methods. With potential use of irrigation facilities created so far and through conjunctive use of water resources about 76% of the cultivable area can be irrigated (MOA, 2020). But out of the present irrigated area of 5.69 Mha against net cultivated area of 8.12 Mha; irrigation coverage is 70%, Out of the irrigated area about 90% is covered by deep tubewells (DTW), shallow tubewells (STW), solar pumps manually operated irrigation facilities and low lift pumps (LLP).

Improved irrigation management and effective operation of flood control and drainage projects, agricultural production of the country can be increased substantially. The country can produce enough food grain for supporting the increasing population and also can export non-food grain crops especially fresh vegetables, flowers and fruits with improved processing, storage, packaging and transportation programs. To create enabling condition for the improvements, mistrust between, public, government and private business has to be removed. Stakeholders’ participation in management of available water resources should be ensured at all levels of project cycles that are planning, implementation, operation and management. Other constraints like, low productivity per unit of land and water, access to marketing and transportation, access to credit and frequent changing government policy should be resolved for sustainable development of agriculture in Bangladesh. Agricultural development should be linked with industrial development and export market for comprehensive and overall development of agricultural sector of the country.

Water use and distribution efficiencies of irrigation water is not satisfactory in Bangladesh and in most cases efficiency figures are below 60% and require immediate action to raise it to about 70% irrespective of mode of irrigation STW, DTW, LLP, manually operated pumps, and lift cum gravity irrigation systems. Farmers are now adopting and practicing AWD, lined canals, buried pipes, fita/hose pipes, drip, sprinkler and mulching for improving irrigation efficiency and reducing irrigation cost to some extent irrigation system loss is reduced by researchers working in the field of irrigation sub-sector. After developing means for improving performance of irrigation systems and the improved technologies will be demonstrated for improving irrigation and water use efficiencies by farmers and other beneficiaries (NGOs, pump owners, government agencies and extension personnel. However, these techniques have not reached to the farmers, who are end users of these technologies. It is recommended that there should be “Institutional Arrangement” for conducting a regular training program on Irrigation Water Management and Agricultural Mechanization”. BRRI and DAE may arrange a program like a former “Rice Production Training Program” and BRRI can be selected as home for this program. The program may be started immediately as part of the 8<sup>th</sup> FYP.



This North-west region is very important for increasing irrigation-based cropping over the year. Northwest region covers the area under present Rajshahi and Rangpur divisions and greater Kushtia and Jessore districts, which coincides with full of North-west and part of South West of the Hydrological Regions suggested by the Water Resources Planning Organization (WARPO, 2000). In the North-west and South-west hydrological region, irrigation activity for crop production is mostly done with groundwater due to scarcity of surface water. Most part of this area has low rainfall but fewer subjects to flood damages. However, this area which has net cultivable area (NCA) of about 2.94 Mha, has dependable on groundwater and can be brought under double/triple cropping with conjunctive use and improved management of water resources. This is the most potential area for agricultural development and may be subdivided into Barind tract, Atrai basin, Teesta Barrage Project, Barind Multipurpose Development Authority (BMDA), Ganges-Kobadak Project, Pabna Irrigation Project and the remaining area as plain land. The following section describes feature of Barind tract as it is unique from remaining part of Bangladesh.

Barind Tract is characterized typically as higher elevated which is 11-47 m above mean sea level, dome shaped undulated land mass. The annual rainfall is lower than the national average. Rain water does not conserve adequately, losses as runoff water which flows into the rivers, like, the Padma, Mohananda, Purnabhaba, Atrai and Barnai at the southern, western and eastern parts of the Barind area respectively. The area has the focus on strong agricultural development over last 30 years with increasing agricultural productivity.

High temperature in the summer with low humidity and rainfall have distinguished Barind tract of about 1.4 Mha from other parts of the country. Groundwater is a dependable source of irrigation in the area and can cover about 60% of the Barind tract but groundwater level goes below suction limit especially during the dry months. About 57% of cultivated area is irrigated area (BMDA 2021). Surface water conservation is possible in the rivers, low-lying areas including beels and ponds. This is also required for other areas of the country as out of 30 agro-ecological-regions (AEZ), only 13 have ample surface water for year round use (UNDP & FAO, 1988).

There are about 32,000 ponds in the Barind Multipurpose Development Authority (BMDA) project area and about 70,000 ponds in the entire Barind area (personal communication with BMDA). These ponds after re-excavation can be used for accumulating excess rainwater during the rainy season and can be subsequently used for supplemental irrigation, household uses and fish cultivation. Banks and the adjacent land area around the ponds can be used for afforestation and vegetable cultivation through participatory management with local poor people, which will further help in poverty reduction in addition to water conservation for agricultural and household uses.

BWDB at present is operating 14 gravity flow irrigation projects across the country those covers only 6.31% of total irrigated areas (BWDB Annual Report 2022). Most of the projects are very old and their efficiencies are poor compared to the expect action. But the irrigation cost per unit area is very low and affordable to farmers. But the recovery of this low irrigation service charge is very poor due to lack of participatory management. The projects should be retabulated to increase the irrigation coverage as well as efficiency along with strengthening the participatory water management.

Government introduced Integrated Minor Irrigation Policy 2017, Water Act 2013 & 2018, Groundwater Management Act 2018 and Delta Plan 2100. For sustainable surface and groundwater sources management, integrated water resources management approach to be adopted.

### 3.6.3 Present Status of Irrigation and Potential Area Coverage

According to last irrigation census done by BADC during 2021-22, total irrigated area in Bangladesh was 5.69 Mha, which is 70% of net cultivated area (8.12 Mha). Out of the total irrigated area, surface water irrigation covered 1.57 Mha which is 27.5% and groundwater irrigation covered 4.12 M ha which is 72.5%. In 2025, total irrigation coverage will be 6.55 Mha. Irrigation coverage will vary from 70-95% among seven zones/regions. With maximum development of available water resources, total irrigated area may be increased up to 7.45 Mha and irrigation coverage may vary from 95-97% among the regions (WARPO,2000).

#### Present Status of Irrigation Projects Implemented by Bangladesh Water Development Board (BWDB).

BWDB is implementing 52 surface water irrigation projects across the country where 4,04,512 hectares of crop lands are irrigated during all the crop seasons. It is about 6.31% of the total irrigated areas of the country. In these projects, the crop land are irrigated through irrigation channels by gravity flow from barrage or by pumping water from rivers. These projects are helping produce not only additional crops but also improving the livelihoods of the people by increasing business through developed communication systems, navigation, marketing facilities etc. The major irrigation projects are, Teesta Barrage Project, G.K Projects, Pabna Irrigation Projects, Barishal Irrigation Projects, Cumilla Irrigation Project, Meghna Dhanagadha Irrigation Project, Muhurri Irrigation Projects, Manu Irrigation Projects etc. But the irrigation efficiency /water use efficiencies and revenue collections of these projects are very poor due to poor management and as they are old. Now, they need proper rehabilitations and modernization to increase their efficiencies.

#### Irrigation coverage

**Table 45: Irrigation coverage**

Irrigation coverage by different irrigation appliances during 2021-22 is given below:

Irrigation appliance	Irrigation coverage
Deep Tube Wells	18,27 %
Shallow Tube Wells	52.95%
Low Lift Pumps	23.10%
Gravity Flow	6.31%
Solar Pumps	0.24%
Manual and Artesian Wells	0.13%
Traditional /Dug Wells	0.14%

Irrigated area covered by a single DTW, STW and LLP are found to be 30.63ha, 2.09 ha and 6.39 ha respectively.

Source: BADC 2021-22

### 3.6.4 Irrigation Demand

A lot of researches on determination of irrigation demand in Bangladesh according to zone basis were done by CSIRO, Australia in collaboration with Institute of Water Modelling (IWM) during last several years. Mainuddin et al.(2014) of CSIRO estimated the total irrigation demand in Bangladesh is about 33 cube kilo meters. The regional/zonal irrigation demand of the country throughout the crop seasons is;

- 11.4 cube km in North-West
- 8.3 cube km in North -Central
- 5.3 cube km in South -West
- 4,3 cube km in North-East
- 4.3 cube km in South -East

Local level actual ET, total and crop usable effective rainfall and irrigation requirement of major crops and cropping patterns are the key elements for different regions long term agricultural planning and water resources management. Irrigation water demand is projected to be increased up to 10% for 2030 and in average condition, it may go to 3% during dry season by 2050 (Kirby et,al. 2016). It will affect agricultural productivity when production of rice and wheat is predicted to decrease 8.8% and 3.2% respectively by 2050 (CRI,2017). Due to climate change drought occurrence is being increased which is affecting the crop yields as well as the national total production. Water use in Bangladesh is dominated by crop irrigation with estimated annual use varying from 25 to 33 kilo meter cube of which about 80% from groundwater. Domestic and industrial use is about 2.7 kilo meter cube per year which is projected to be increased about 4.1 kilometer cube by 2050.

### 3.6.5 Water Demand for Non Agriculture Sectors

The agriculture sector is by far the largest consumer in Bangladesh. But in setting priorities for allocating water for crop production during dry periods, the national water policy (1999) has given less importance on non agriculture sectors like, domestic/municipal use, navigation, fisheries, livestock, industrial uses, forest etc. Domestic demand: The domestic demand (2011) was 2.7 cubic kilo meter which is expected to increase to 4.1 and 5.4 cubic kilometer respectively by 2030 and 2050 by increasing population (CEGIS, 2014).

**Industrial demand:** The industrial demand was estimated to be 0.35 cubic kilometer in 2011 which is expected to be increased 400% by 2050.

**Fisheries demand:** The annual water demand for fish culture in Bangladesh was estimated to be 5.2 cubic kilometer in 2011 and it may be increased 7.8 cubic kilometer by 2050.

**Forest water demand:** In 2011, the forest cover was 12% of total area in Bangladesh, The forest water demand has been estimated to be 2.9 cubic kilo meter.

**Livestock water demand:** The annual livestock water demand was roughly estimated to be 1.6 cubic kilometer in 2011, which is expected to be increased 150%-200% with the increase of livestock population.

### 3.6.6 Monthly/Seasonal Water Availability (both surface and ground water)

Water availability situation over the years compels Bangladesh to address issues like irrigation, flood control and drainage which depends on the nature. For example, Bangladesh receives annually about 7.5 meters of water, out of which 5.5 meters from surface flow from the up streams and 2.0 meters from rainfall. About 90% of huge water volume is available during June to September in each year and the remaining 10% is received from October to May. With the water potential of the country, 76% of net cultivated area can be irrigated whereas only 70% of net cultivable area is under irrigation due to the poor efficiency and management of existing irrigation systems.

For the last 10-15 years, the upstream flow of the rivers has been drastically reduced during October to May. On the other hand most of the rivers or streams have been silted and their storage capacity have been decreased. Moreover the annual rainfall has been comparatively decreased and erratic which

affects the recharge of ground water aquifers. Most of our water bodies become dry up during winter/dry season. As a result, the surface water sources are very limited for dry season irrigation where 75-78% irrigation, domestic water supply and industrial use depend on ground water. Water availability in dry season (from mid February to mid May) is very scarce for providing irrigation to crops due to:

- Groundwater table goes below suction limit (More than 8.0 meters);
- Surface water sources like canals, smaller rivers/ streams and low lying watersheds such as, beels, hoars become dry;
- Arsenic concentration exceeds safe limit greater than 0.05 ppm;
- Soil salinity in coastal areas increases beyond crop tolerance greater than 4.0 mmhos/cm; and
- The irrigation and water resources systems as well as agriculture of Bangladesh are under the threat of climate change impacts for last decades.

### **3.6.7 Water Availability throughout the Seasons**

The annual average volume of rain falling on Bangladesh from 1985-2011 was 284 cubic kilometer of which 11-12% occurs during dry season (November to April) and the rest occurs during may to October. The annual average (1980-2011) inflows from the major combined rivers was 981 cubic kilometer but it is only 15% of total during dry season (November to April). The annual recharge to groundwater was estimated to be 28-65 cubic kilometer (CEGIS, 2014). Over the years, water availability situations in Bangladesh dictates that irrigation is very much essential for sustainable agriculture through increased crop production to feed the increased population.

### **3.6.8 Vision, Mission, Overall Objectives and Targets**

#### **a) Constitutional Obligation**

Efforts should be made to encourage involvement of small and marginal farmers and women in irrigation and water resource management. Availability of irrigation water for crop production and clean water for drinking and household purposes will be ensured by GOB under funding support. Agriculture sector is still supporting and engaging about 50% people in different aspects of agricultural activities. A major portion of employment in agricultural sector is women and youths. Beneficiary participation in earth works and operation and maintenance of irrigation infrastructures is essential under present GOB policy. Irrigation sub-sector is the major sub-sector and supports other sub-sectors under Agriculture Sector in employment generation.

#### **b) Vision and Mission**

##### **Vision**

The vision of irrigation sub-sector is to: Increase irrigation efficiency and crop water productivity of irrigation systems

##### **Mission**

The mission of irrigation sub-sector is to:

1. Emphasize on best use of irrigation infrastructures,
2. To restore the environment by decreasing groundwater abstraction.

## Objectives

Objectives of Irrigation development are to:

- Improve irrigation management and effective operation of FCDI projects for increasing agricultural production
- Increase crop production for feeding increasing population
- Export Non-grain crops especially fresh vegetables, fruits and flowers
- Increase income of farming community for livelihood improvement

## Output

- Irrigation infrastructures will be rehabilitated and modernized
- Surface water sources will be increased
- Increased capacity of water management personnel or groups in systems and water management
- More cultivable areas will be brought under irrigation with same water use
- Additional crop yields will be produced by increasing crop and water productivity

## Outcomes

The efficient and sustainable irrigation systems management will be developed which will help to increase additional crop production that will enhance the livelihood improvement of the farmers. Overall, the national gross production will be increased to feed the increased population of the country.

### 3.6.9 Policies for Irrigation Sub-Sector

The Government has a comprehensive water policy framework. The National Water Policy (1999) stated that larger schemes will be placed under private management or joint management by the implementing agency along with local government and community organizations. Despite a supportive policy in the irrigation sub-sector, the outcomes of investments to date have been mediocre. Second Command Area Development Project (CAD-II) prepared to enhance rural income by improving productivity of major irrigation systems. But the efficient performance of the irrigation systems was limited due to: (i) inadequacy of budget to support system O&M; (ii) lack of distribution between annual, periodic maintenance of the system; and (iii) poor cost recovery from the water management groups (WVG). The following key directives come from the National Water Policy: (i) Guidance for participatory water management (GPWM); and (ii) Irrigation services charge imposition, collection and usage regulation (2003). In general, the NWP is conducive to the sustainable rehabilitation and renewal of large-scale irrigation schemes.

Bangladesh government introduced National Water Policy (1999), Coastal Zone Management Act (2019), Bangladesh Water Act & Rules 2013 & 2018), Integrated Minor Irrigation Policy (2017) and Delta Plan 2100. Integrated Water Resources Management (IWRM) approach is to followed for sustainable surface and groundwater resources management. The Integrated Minor Irrigation Policy (2017) appears to be more efficient for cost-effective delivery of water to farmers for irrigation. The stated objectives included: (i) expansion of command areas; (ii) reducing costs; (iii) assign priority utilizing surface water for irrigation; (iv) expanding supplemental irrigation; and (v) ensuring optimal use of water resources.

According to Water Policy 2020, water resources management requires involvement of the public and private sectors, communities and individuals that benefits from the delivery of water related services. The management of public sector irrigation schemes barring municipal schemes with a command area up to 5000 hectares will be gradually handed over to the local and community organizations and their operations and maintenance will be done through local resources.

### 3.6.10 Strategies for Irrigation Sub-Sector

In the context of the changing global environment and socio-political and economic conditions of Bangladesh, agricultural development of the country and its sustainability deserve active government-private partnership. A comprehensive agricultural development action plan is required to face the challenges of feeding growing population. Appropriate marketing system development is also required to ensure price support to the growers at the same time price of the essential commodities should be within the purchasing power of low-income group of the society. First attempt will be to increase and stabilize production of selected essential commodities through maximum utilization of land, water and human resources of the country. In subsequent attempts, the country can plan for value addition to the products and for commercial agriculture, which have been started at limited scale but need expansion.

Cost of production of major crops is high in Bangladesh and power use in agriculture is low compared to even neighboring countries. Furthermore, whatever is produced, a bulk of it is lost after harvesting (post harvest losses). Therefore, efficient use of irrigation water, effective use of irrigation facilities, use of machine for agricultural operation and saving/minimizing post harvest losses are required to make agriculture cost effective in Bangladesh. In this study, possible contribution of water management for agricultural development has been discussed.

Water availability situation over the year compels Bangladesh to address issues like irrigation, flood control and drainage, which are contradictory in nature. For example, Bangladesh receives annually about 7.5 meters of water, 5.5 meters from surface flow and 2 meters from rainfall. About 90% of the huge water volume is available during June to September each year and remaining 10% is received during October to May. Therefore, water environment forces Bangladesh for irrigated agriculture supported by flood control measures and provision of drainage facilities. With the water potential of the country, about 76% of the cultivable area can be irrigated of which about 65% are under irrigation at present. Due to fluctuation in availability and lack of control over surface water, about 73% of the irrigated area use groundwater. Major constraints to face for irrigation, flood control and drainage systems development and operation are: lack of continuity in policy supports, withdrawal of surface water at upstream, lack of timely availability of fuel, oil and electricity for smooth operation of irrigation systems, funds and interest for maintenance of flood control, drainage and irrigation (FCDI) systems.

Water management is a critical issue in Bangladesh for about two to three months (mid February to May). During this period; Water table goes below suction limit (>8 meter); Arsenic concentration exceeds safe limit, >0.05 parts per million (ppm); Soil salinity in coastal area increases beyond crop tolerance level (>4 mmohs/cm or 4 dS/m); also Surface water sources especially smaller rivers, and low-lying areas (beels) become dry.

Therefore, comprehensive plans and implementation methods should be practised to address problems of irrigation sector for efficient water management related issues. Sustainable agricultural development and improved livelihood will be possible if land and water resources of the country are used judiciously. This will require taking advantages of improved technology available in the country or

adapted from abroad after adaptive trials. It has been observed over several years that both tube wells using ground water and large-scale canal irrigation systems in most parts of the country are operating at lower than 50% of their efficiency level. Experiences indicate that over all irrigation efficiency levels of tube wells and canal irrigation systems can easily be increased to 75% and 70% respectively. That means about 25% more area can be brought under irrigation with existing irrigation infrastructures. Therefore, performance improvement of existing irrigations systems can be one of the ways of making the systems cost effective. We could achieve a lot through improved water management by achieving the development potentials. Some of the improvement potentials could be achieved without additional investment at least for infrastructure development.

#### Hotspots Specific Strategies under Delta Plan 2100

- Coastal zone management
- Tidal river management
- Management of barind and dry prone areas
- Management of haor and flash floods area
- Chattogram hill tracts
- Management of river systems and estuaries
- Management in urban areas

#### **The following strategies may be undertaken into the action plan.**

**Infrastructure development:** For protecting lives and properties of the people, FCDI facilities are essential. During infrastructure development for providing FCDI facilities, construction of embankments and irrigation and drainage canals are required. Besides, new construction of FCDI structures, restoration, redesigning and modification programs for existing embankments and other FCDI structures should be undertaken to enhance irrigation and drainage. These infrastructures are mostly used for saving lives and properties and creating favorable environment for increasing agricultural production. Multiple uses of these facilities for afforestation and fish cultivation in addition to their primary uses of irrigation and drainage will make them more cost effective.

**Actions for proper and effective management of FCDI facilities or systems:** Irrigation personnel should be trained to use FCDI facilities and associated infrastructures for their best use. It will require active participation of the stakeholders and beneficiaries, which includes partnership among beneficiaries and government agencies. But responsibility of project implementation to be with implementing agencies. Participatory management and more specifically participatory water management in water sector projects are widely discussed now-a-days. Under present condition, government agencies are still the main player and beneficiaries are consulted for their opinion and expected assigned roles by the implementing agency or agencies. To be more specific, so far one of the agencies, which has been assigned responsibility for project implementation and operating funding arrangement for the development works become “captain” in the implementation team. Beneficiaries are expected to be good listeners and to follow directions of the captain. In real sense, beneficiaries should be the decision makers while agency personnel, researchers and NGOs engaged in development activities in the project area would work as advisors.

Other important deviations from common thinking is that, in most FCDI projects, activities related to management, operation and maintenance (MOM) of flood control, drainage and irrigation infrastructures although not addressed properly, get all the importance by the project management. Other components like, efficient use of water, crop production, fish, forest and livestock production are not getting due importance. Improvements of these aspects are left with the concerned line agencies and beneficiaries of the project area. However, multiple and integrated use of the FCDI projects and integrated water resources management (IWRM) should be the priority areas for irrigation sub-sector projects.

Few examples are cited in this respect to emphasis and elaborate difference of the concept from the existing operational procedures. Guidelines for Participatory Water Management (GPWM) in Bangladesh states that “Participation is an important voluntary process in which local stakeholders influence policy formulation, alternative plans/designs, investment choices and management decisions affecting their communities and establish the sense of ownership”. The GPWM indicates that “Give the local stakeholders a decisive voice at all stages of water management”. The co-management concept validated through a case study supports decision - making power than the decisive voice.

The GPWM also supports participation of local stakeholders to “prepare production plans on agriculture, fishery, forestry and livestock development and environmental management plan based on the feasibility study” by the implementing agencies. In real life, the implementing agencies, BWDB and LGED are not doing these as existing government mandates entitles Department of Agricultural Extension (DAE), Forest Department (FD), Department of Fisheries (DOF) and Livestock Department (LOD) to prepare their plan of action for the country including water sector project areas.

Co-management and participatory management support that more participation in decision-making and consultation by agency personnel in water sector projects will not bring much benefit to the stakeholders. For increasing agricultural production, which is required for improved livelihood of stakeholders and for effective land and water resources in irrigation projects, stakeholders should have authority of decision—making for management of all infrastructures. Proposals agreed upon by the stakeholders should be implemented to achieve maximum benefit from the investment made in implementing irrigation projects and building infrastructure.

Action plans should be developed to emphasize on how water environment of the country can be managed to make positive influence on health, food availability and intake of nutrients and mitigate negative impact on these issues. Few examples of such action plan are:

Surface water use conservation of excess water received during rainy season and effective use of rainwater and infrastructure developed so far can play important role in improving water availability in dry season, if comprehensive use of the facilities are ensured. Improved management at local and national levels through government and social interventions can solve the problem. Irrigation or water resources development of the country should be different for different agro-ecological regions of Bangladesh. The national development plan should be to maximize utilization of rainfall, surface and ground water through conjunctive use of these resources. Comprehensive studies should be undertaken at the upazila level involving stakeholders, government and non-government organizations (NGOs) working with agriculture, soil and water based development programs for developing and implementing local level production plan. Several studies indicate that improvements are possible for increasing annual crop production, increasing irrigation/water use efficiency and improving livelihood of farmers.



Irrigation in Bangladesh at present is not cost effective. Over the years, number of deep and shallow tube wells and LLPs has increased, but area coverage per unit of these facilities has not increased rather decreased. This issue may be reviewed by practicing professionals and means for improvement should be developed. It is required to increase irrigation efficiency, increase service area of irrigation units, and minimize water distribution loss by adopting location specific appropriate techniques.

Low water demanding crops during dry season may be cultivated for minimizing irrigation cost during dry season in highly permeable area. Low water demanding crops like wheat, pulses, spices and oil seeds may be cultivated in place of high-water demanding crops like Boro (rice) if the economic return and farmers demands permit. Research findings proved this hypothesis effective through several research outputs. Appropriate changes in legal framework and investment atmosphere should be made to encourage private sector investment in major irrigation projects. Canal digging or renovation for water conveyance and storage. Use of canals, small/ narrow rivers for water conservation during monsoon and use for irrigation season should be priority program for Govt. agencies in association with NGO's, Water Users Organization (WUO) and Water Users Association (WUA). They should be involved in operation, maintenance and management (MOM) of large FCDI projects so that water users develop ownership for irrigation and FCDI projects, which needs public-private partnership (PPP).

### **3.6.11 Institutional Coordination and Capacity of Irrigation Sub-sector**

Intervention, including the role of government agencies in developing the Agriculture sector: Land area especially cultivable area and water resources, which include rain, surface, and groundwater of each zones of the country should be carefully estimated. Land area of each zone should be further estimated in relation to flooding conditions (Fo to F4 types of land). Potential crops for the zones and its specific localities to be selected reviewing farming system research data from the research institutes and Agriculture Extension department. Production maximization packages to be developed with assistance of the farmers and extension agents. Government agencies provide advisory services for input supports and market information. Government should play facilitating roles for maximizing development of agricultural production, which includes crop, fishery, forestry and livestock, through technical support and integrated use of water and land resources. The strategy should be to increase production per unit of land, unit of water and unit of time. The country does not have choice for horizontal expansion of agricultural land; rather it is reducing annually at the rate of 0.70% per year. Therefore, all possible efforts to be made for best use of resources including trained manpower for increasing production through vertical expansion of cultivable land and efficient use of irrigation facilities and other resources.

Partnership among GO and NGOs: Partnership with other government institutions, private sectors, development partners, local government bodies and non-government organizations are required for overall development of irrigation and water resources. There should be multiple uses of water bodies in rivers, canals and existing ponds. Water resources can be used for primary use for irrigation and household uses and for fish cultivation. River and canal banks should be used for plantation or afforestation vegetable and fodder cultivation. Farmers and landless persons of the adjacent areas may form partnership and use river and canal banks and water bodies, which is permissible under "Water Act". In return, the proposed beneficiaries should be responsible for routine operation and management (O&M) of infrastructures. However, major repair and O&M to be done by government agencies. NGOs in consultation with relevant government departments will assist formation of beneficiary groups and train them for utilization of resources in operation and maintenance of land

and water resources and infrastructures. Operating procedures will be such that minor O&M will be done by beneficiaries and major repairs should be done by government department/agencies.

### 3.6.12 Major Challenges for Irrigation Sub-sector

Conservation of excess water received during rainy season and effective use of rainwater and infrastructure developed so far can play important role in improving water availability in dry season if comprehensive use of the facilities is ensured. Low cost treatment facility of arsenic contaminated ground water is available in Bangladesh. Therefore, improved management of water resources at local and national levels through government and social interventions can solve the problem and can ensure clean water for all. GO-NGO partnership arrangement may take lead in this area immediately with supports from GOB and donors. Water availability in dry season (from Mid February to May) for providing irrigation to crops is very difficult due to: (i) Ground Water Table goes below suction limit (> 8 meter); (ii) Arsenic concentration exceeds safe limit, >0.05 ppm; (iii) Soil salinity in coastal area increases beyond crop tolerance level (> 4 mmohs/cm or 4 dS/m); and (iv) Surface water sources especially canals, smaller rivers/streams and low lying areas (beels, watersheds) becomes dry.

At present, the hilly region is becoming a very potential region for horticultural crop production specially for fruits. But shortage of irrigation water for crops as well as for drinking purpose is the main problem. So, building of irrigation infrastructures for solving the problem is also the great challenge. In addition to agricultural use, water has domestic, industrial, recreational and environmental use. Therefore, with efficient management of irrigation water in the critical period, irrigated crops can be saved and optimum yield can be achieved. Climate change situation has added another dimension to water availability problem during mid-February to end of April. Bangladesh is a very insignificant contributor to the causes for global climate change, but is probably the worst sufferer due to its global position. Therefore, water management for enhancing crop production under climate change situation requires additional attention for better use of land and water resources of the country. Over the years, water availability situations in Bangladesh dictates that irrigation is essential for sustainable development of agriculture through increased production and crop diversification. Bangladesh will have to increase crop production especially during dry season (November to March/April) for feeding her increasing population. Agricultural production during remaining part of the year is not ensured as this period of the year is more subjected to storms, cyclones drought and floods. Moreover, this period is mostly the rainy season but there is frequent short duration of droughts which reduces the crop yield to some extent. But farmers are very reluctant to use supplemental irrigation for arranging irrigation systems as well as for higher fuel price. Furthermore, there is limited scope of crop diversification during monsoon as only rice, jute and very few other crops can survive under too much water environment. Aman, the wet season rice was the major crop in Bangladesh up to recent past, which has been replaced by irrigated Boro rice and other different winter crops grown during from November/December to May/June.

#### The challenges for irrigation sub-sector are:

**Infrastructure development:** For protecting lives and properties of the people, FCDI facilities are essential. BWDB has created FCDI facilities for potential requirement of 5.76 Mha. During infrastructure development for providing FCDI facilities, BWDB has constructed embankments in the coastal and non-coastal areas. BWDB has also created water bodies through construction of irrigation canals and drainage channels, barrages and river closures. These infrastructures are mostly used for saving lives and properties and creating favorable environment for increasing agricultural production. Multiple

uses of these facilities like afforestation, fodder and fish cultivation in addition to their primary uses will make them more cost effective.

**Groundwater recharge status and dependability:** As of Minor Irrigation Survey Report of January 2021 (BADC, MOA, 2021), groundwater covers 73% of the irrigated area in Bangladesh of which about 54% is irrigated with shallow tubewells. In North-western region of the country, the agricultural development due to irrigation development has been done remarkably during last 30 years, faces groundwater table declination significantly over the years specially in Barind areas. Over exploitation of groundwater for irrigation is not the reason but also other factors are related for this declination like changing land use pattern, up-streams rivers regulation, changing cropping patterns, reduction in wetland areas, comparatively low rainfall and low flows in upstream rivers in the dry season (CSIRO, 2021). Fortunately, whatever volume of groundwater is pumped during dry season is almost near fully recharged during wet season if there is adequate rainfall except in Dhaka and Gazipur city area and few locations around Dhaka city. The groundwater withdrawal rate mostly for household water supply and industrial use is higher than recharge rate in Dhaka and Gazipur city areas. So, there is very sharp decrease in groundwater table for the last 15-20 years in these two cities. But in the recent years, the annual rainfall in Bangladesh is comparatively lower than the previous years. Recharge deficit and recharge rejection significantly in intensive ground water irrigation areas decreased from 1995-2004 to 2005-2016 (CSIRO, 2018).

**Ground water quality issue:** The country depends on intensive withdrawal of ground water for crop irrigation, industrial use, fish culture and household purposes during the summer months. Quality deterioration of groundwater during the recent years due to arsenic contamination has aggravated safe water availability for drinking and irrigation purposes for all over the country. In Bangladesh, about 85 million of people is facing a threat due to different intensities of arsenic contaminations in drinking water as well as in food crops to some extent (Arsenic Contamination in Bangladesh -2006). However, the extent of contamination varies from area to area and entire area of a district is not affected. Groundwater quality degrades in two ways: Firstly, due to geo-chemical reactions in the aquifers and soils and secondly, when irrigation is supplied to the crop fields from polluted canals or drainages. Groundwater quality also depends on the nature of recharging aquifers from precipitation, surface and subsurface water and through hydro-geological chemical process (Keesari et al, 2016a and Das et al, 2017)

Monthly monitoring of arsenic concentration in groundwater in several locations showed that arsenic concentration is not constant throughout the year. It was observed that arsenic concentration started to increase from January and it continued up to May/June. At the beginning of the dry season (December/January) arsenic concentration in the study tubewells was <0.05 ppm, concentration gradually increased to >0.05 ppm by the end of dry season (May/June) but was reduced again to <0.05 ppm after the rainy season. However, extent of fluctuation of arsenic level varies from place to place even within short distance. Initial findings indicate that crop production (rice, wheat and most other grain crops and several popular vegetables) is not affected by irrigating with arsenic contaminated water where contamination of arsenic level is below 0.05 ppm. This level of contamination is within permissible level (quality wise), which is good news for the country. Only Aroids used as vegetable in Bangladesh is reported to be affected to some extent by arsenic. There is accumulation of arsenic in grains of rice and wheat and in the edible parts of vegetables but the levels are much below the critical levels.

**Minimizing the groundwater irrigation cost per unit area:** BADC (2020-21) reported that nearly 74% DTW and STW,s are run by diesel and 26% are run by electricity. Due to the sharp increase the price of fuel, the per unit irrigation cost for the farmers has been tremendously increased. It has been observed over several years that both the tube wells using groundwater and large-scale canal irrigation systems in Bangladesh are operating at about 50% or less than their efficiency level. Over the years, shallow tube wells were operated at 50% of their rated capacity and irrigated about 1.5 -2.6 ha against potential of about five ha. Deep tube wells were operated and covered on average 25 ha against rated capacity of 40 ha. All the systems, shallow and deep tube wells, low lift pumps and canal irrigations irrigated about 5.63 million ha during 2019-2020 irrigation season. It can also be observed from that even the highest irrigation coverage in last eleven years per DTW (32.29 ha), STW (2.34 ha) and LLP (6.73 ha) are 81%, 47% and 24% respectively comparing with expected irrigation coverage for DTW (40 ha), STW (5 ha) and LLP 28 (ha). Experiences indicate that over all irrigation efficiency levels of tube wells and canal irrigation systems can easily be at 75% and 70% respectively. That means, about 25% more area can be brought under irrigation with existing irrigation facilities by increasing efficiency of the systems. Irrigable area of Bangladesh could be covered with the facilities already created. Therefore, performance improvement of existing irrigation systems can be one of the ways of making the systems cost effective.

**Table 46: Status of irrigation coverage per unit of equipment during last ten years 2009-10 to 2019-20**

Season/Year	Area Irrigated in last 11 (Eleven Years (000 ha))			Average Coverage per Equipment (ha) for Reporting Period		
	DTW	STW	LLP	DTW	STW	LLP
2009-2010	773	3337	964	23.5	2.34	6.42
2010-2011	719	3505	1010	21.36	2.26	5.82
2011-2012	759	3418	1084	22.23	2.28	6.12
2012-2013	934	3242	1034	26.45	2.13	6.07
2013-2014	877	3279	1084	24.33	2.10	6.33
2014-2015	962	3235	1107	26.30	2.08	6.62
2015-2016	1194	2955	1165	32.29	2.08	6.72
2016-2017	1063	3079	1188	28.60	2.20	6.73
2017-2018	1073	2982	1221	2.8.57	2.19	6.72
2018-2019	1076	2994	1247	28.59	2.21	6.67
2019-2020	1084	3001	1270	29.30	2.15	6.35
Expected	Coverage-	-	40	5	-	28

Source: Minor Irrigation Survey Report, Ministry of Agriculture (MOA), January 2021

Experiences 2022 indicate that overall irrigation efficiency levels of tubewells and canal irrigation systems can easily beat 75% and 70% respectively. That means another 25% area could be brought under irrigation with existing irrigation facilities by increasing efficiency of the systems. Irrigable area of Bangladesh could be covered with the facilities already created by increasing irrigation efficiency. Therefore, performance improvement of existing irrigation systems can be one of the ways of making the systems cost effective.

**Ground water use in coastal area:** Most of the lands in coastal areas remains fallow during the dry season (November to April/May). It was believed by even the professionals that ground water in the entire coastal area is saline and may not be suitable for irrigation. Therefore, analysis of groundwater

for determining its salinity level and possible use for irrigation during the dry season is required. Experience of working in Khulna and Satkhira area opened opportunities of using groundwater for crop production and drinking purposes. Over exploitation of groundwater resources may result in salt water intrusion that may trigger severe repercussion on ecological balances, environmental degradation and the economy of saline areas. However, sustainability of groundwater use in the area will deserve intensive investigation as saline water intrusion may cause havoc. Conjunctive use of water will provide additional development alternatives. In several locations of Barishal Region where water is not saline and can be used for irrigation. There is so many potentials of conjunctive use of medium saline and fresh water for irrigating mustard, potato, maize, wheat, vegetables etc during dry season in coastal areas (IWM Division Research Report, BARI, 2018-20 and Faisal et al, 2018, BARI.

**Reduce operation cost:** As reported by BADC 2021-22, 74% of the irrigation pump units are diesel operated and 26% are electricity operated in Bangladesh. If these pumps could be electricity driven, significant saving in operating cost can be achieved. The command areas per unit tube wells is lower than its potential. That is why the operational cost in our minor irrigation systems is higher. Solar pumps can reduce irrigation cost but its initial investment is so high that our farmers cannot afford. Availability of electricity in the remote villages will also promote industrial growth at least of minor industries and will facilitate development in the rural areas.

**Reduce the conveyance loss as well as increase water use efficiency for minor irrigation systems:** At present, 78-80% of minor irrigation systems are operated by private basis and the rest is operated by BMDA and others. BADC (2020-21) reported that the conveyance loss of minor irrigation system (Except BMDA operated Tube well systems) varies 45-60%! There may be debate on this information because at present farmers of many areas are using polythene hose pipes/ plastic pipes for conveying irrigation water for rice and upland crops irrigation instead of earthen irrigation channels. BADC also has installed Buried pipe systems under many DTW schemes. So, the conveyance loss has been reduced to some extent. It is not possible to install buried pipe systems under each STW scheme due to huge investment. Secondly, some of the STW irrigation schemes are temporarily or shifting due to individual farmers decision. In this regard, govt. investment, policy formation and implementation, training and awareness build up can be the effective measures for reducing conveyance loss and increasing water use efficiencies.

**Change water use pattern especially for rice cultivation:** In Bangladesh, irrigated agriculture means mostly irrigated rice cultivation. Diversification of crops under irrigated conditions may make agriculture more profitable and may also reduce pressure on irrigation facilities as well as on groundwater abstraction. Moreover, water requirements for non-rice crops are much less than irrigated rice cultivation. Crop diversifications are becoming popular but market instability still sometimes discourages farmers to cultivate non-rice crops.

Development of marketing systems for non-rice crops requires administrative supports from the government for facilitating market chain development for domestic and export markets. Irrigation management for rice cultivation should be revisited as alternate wetting and drying (AWD) of rice field which can bring about 25% additional areas under cultivation without significant yield reduction with same amount of water delivery against traditional irrigation (continuous standing water). This will make irrigation systems cost effective. However, motivation of pump owners is a precondition for expansion of AWD. In Bangladesh, pump owners used to have contractual arrangement with farmers (owner or rental) for delivering irrigation water for acre/hectare not by volume of water or number of irrigations required for growing period of crop. Therefore, benefit of water saved by adopting AWD goes to the

favor of pump owner not of the farmers. Not only AWD for rice, other improved water management technologies for non-rice crops cannot be transferred to farmers due to this faulty arrangement of selling irrigation water by the tube well owners/pump operators. If Government can ensure the irrigation water selling by volume or time basis throughout the country, the irrigation cost as well as crop production cost per unit area can be minimized. Simultaneously, the groundwater abstraction may be reduced. As a result, AWD for rice and other improved water saving technologies for non rice crops could be promoted among the farmers. Government agencies and NGO representatives should make an arrangement to compromise solution among farmers and pump owners.

**Transfer of improved irrigation and water management technologies at the field level:** The Scientists of BARI, BRRI and BINA has innovated a lot of improved irrigation and water management (Irrigation water saving) technologies those are already tested and validated at the farmers' level. The most promising technologies are: i) Alternating wetting and drying for rice irrigation ii) Alternate furrow irrigation (For row crops like, maize, potatoes, tomato, cabbage, cauliflower, flowers etc) iii) Drip irrigation/Fertigation (for high value horticultural crops like, tomato, capsicum, brinjal, watermelon, guava, ber including all fruits) iv) Sprinkler irrigation (for spices crops like onion, garlic, suitable for before flowering stage of wheat, maize, oilseed crops etc) v) Conjunctive use of fresh and saline water irrigation for coastal areas (For maize, wheat, potato, sunflower etc). These technologies save 25-45% of irrigation water for crop production along with the yield increase of 22-30% for crops. But these technologies are not transferred at the field level satisfactorily due to the technical know how of field level agricultural staffs/workers and farmers and due to selling of irrigation water as crop seasonal basis.

**Conjunctive use of ground and surface water:** Irrigation or water resources development of the country should be different for different agro-ecological regions of Bangladesh. The national development plan should be to maximize utilization of rainfall, surface and ground water through conjunctive use of these resources. Comprehensive studies should be undertaken at upazila level involving stakeholders, government and non-government organizations (NGOs) working with agriculture, soil and water-based development programs for developing and implementing local level production plan. It is assumed that this is similar to one of the priority issues considered by farmers managed irrigation systems (FMIS) approach in Nepal. Water use priority should be to utilize rain water to the extent possible for crop production. If seasonal crop water requirement cannot be met with rain water (which is reality in Bangladesh), supplement with surface water from nearest river, canal or pond. If rain and surface water can not meet demand of crops, then use groundwater, so that crop does not suffer from shortage of water or soil moisture and result to crop yield below optimum production level. Bangladesh Government is trying to increase surface water flow by renovating existing water bodies those are going to be silted up through the related government agencies. Many projects are going on for redigging the canals, rivers, lakes throughout the country. Although, it is not sufficient according to needs but it needs huge investment. BMDA, LGED and BADC are also implementing some projects for the development of surface water irrigation to reduce ground water abstraction.

**Development of irrigation facilities/infrastructures in hilly areas:** Among the hilly areas of Bangladesh, Chittagong Hill Tracts is the most prominent for agricultural production, which is located in the Southern- Eastern part of the country and covers 13, 184 square km of which 92% is high land, 2% medium high land, 1% medium low land and 5% of homesteads and water bodies (BBS, 2020) .The irrigated area is only 26.5% (BBS) where it is almost 70% in the plain land. The annual rainfall ranges 3300-4700 mm (BMD, 2021). Water is more than abundant in the monsoon (May – September) but it

is very scarce during dry season (October- April). During the dry season, small water, bodies between two hills e.g Chara's (Creeks) are the main source of water which serves as a main source of irrigation for farming practices. LGED constructed few Rubber Dams for storing monsoon water in few areas. Shifting cultivation, plantation of horticultural crops, agroforestry and mixed fruit orchard are practiced on the hill slopes and on the top of the hills. During the last 15-20 years, thousands of fruit orchards like, orange, malta, mango, papaya, guava etc have been established in the three hill districts. But the agricultural productivity of these orchards is not upto the mark due to the scarcity of irrigation water/ systems during dry season. The development of irrigation systems for the hill tops/slopes from chara is very expensive which is a big challenge for hill agriculture. The integrated water shade management through rainwater harvesting techniques, different soil conservation techniques for irrigation from existing rivers and charas is indispensable for both agricultural and rural development for improvement of livelihoods of hilly people to achieve MDG,s

**Development of irrigation facilities/infrastructures in haor areas:** Haor is naturally depressed areas in North-Eastern part of the country which covers 19,998 square kilometers with accommodation of nearly 20 million people. Most of these areas go under deep water during pre-monsoon and monsoon seasons due to overflow of flashy rivers and heavy rainfall. There are 373 small and large haors in Bangladesh situated in the districts of Brahmanbaria, Kishoreganj, Netrakona, Sunamgonj, Habigonj, Maulivibazar and Sylhet These 373 haors cover an area of 85,900 hectares which is about 43% of total area of haor districts. The haor is mainly mono-cropped area during dry season which is Boro rice. This Boro rice is mostly irrigated and partly rainfed/partly irrigated. Still, a lot of areas is out of cultivation due to lack of irrigation facilities. Bangladesh government has established "Bangladesh haor and Wetland Development Board (BHWDB) in 2000. The mandate of BHWDB is to co-ordinate the activities of different sectors in haor areas and formulate the projects relating the development of haors and wetlands of the country. Accordingly, BHWDB developed a masterplan in 2012 for the developments of haors and wetlands with the technical support of CEGIS . Excess rainfall in .the upstream hilly areas and subsequently runoff, sedimentation in the rivers, deforestation & hillcuts, landslides, improper drainage facilities, unplanned roads, water management and flood control structures as well as the effect of climatic variability are the main reasons for the devastation caused by flash floods. So, development of irrigation systems and water resources in haor areas is a great challenge.

**Water conservation and opportunities for its multiple uses:** Bangladesh receives annually about 7,95,000 cubic meter of water through surface flow and about 2 meter (BMD, 2000) from rainfall. Rain water and part of surface flow during later part of monsoon can be stored in low-lying area, smaller rivers, irrigation and drainage canals and ponds for subsequent use during at least early part of the dry season. Bangladesh has river areas of 12,790 square km (WARPO, 2000) of which about 1,890 square km have width between 25 to 100 meter. These narrow rivers can be converted to temporary water reservoirs (seasonal ponds during November to May) with rubber dam or any other suitable water conservation structures and will provide additional water body of about 1,89,000 ha. Water conservation in the narrow rivers and irrigation and drainage canals especially during the lean period (November to May) will provide opportunities for storing water over additional area of about 1,92,000 (1,89,000 + 2,000 + 800) ha. With about one meter depth, these water bodies can be used for fish cultivation in addition to their normal use. Water conservation structures on the rivers and irrigation and drainage canals will also help in conserving water in the adjacent low lying areas (beels). This will further assist in increasing total water storage capacity of the country. These water bodies, which are not existing, at least in planned way can contribute to groundwater recharge, development of additional irrigation facilities during the dry season and will also contribute to better environment.

Community based fisheries management system can be introduced in the seasonal ponds following the Common Property Resource Management Procedure of the country. Fisheries experts confirmed that these seasonal ponds could be brought under profitable fish cultivation program through stakeholder participation and on average, 2.0 to 3.0 tons of fish can be harvested in per hectare of water body. There has been modest beginning of implementing such approach but further expansion is recommended. Moreover, water stored in the seasonal ponds/riverbeds will be a continuous source for groundwater recharge, which subsequently can be used for irrigation using deep and shallow tube wells without severe lowering of groundwater table. Success of this approach may be replicated in other areas of the country, which will contribute to its overall development potential.

**Use of solar irrigation systems:** Increased use of renewable energy will reduce dependency on imported fuel resulting in foreign exchange saving. Solar irrigation is eco-friendly, saves fuel / energy by using renewable energy. It has low maintenance cost, needs less technical know how, reduces irrigation cost per unit area. There is a great prospect of getting solar energy in summer countries like Bangladesh. Due to the sharp increase of fuel and energy for irrigation, the irrigation cost per unit area as well as the crop production cost has been increased sharply. In this case, solar irrigation can be a profitable option for irrigated crop production. But the initial investment for installation of solar irrigation systems is very high and it is also weather dependent. Farmers can not afford this huge investment. The technical, social and institutional barriers to the adoption of renewable energy technologies to overcome.

### 3.6.13 How to Overcome the Challenges

For overcoming the challenges the following actions will have to be taken:

- **Infrastructure development:** Government should give more emphasis to develop new irrigation system to bring more areas under irrigation especially in coastal haor and hilly areas gradually during coming days and to modernize the existing ones.
- **Groundwater table declination and increase of aquifer recharge:** Ensuring conjunctive use of surface and groundwater for irrigation, rainwater harvesting and conservation of harvested rainwater/ increasing water storage in existing surface water bodies by some innovations will reduce declination of groundwater table and will help increase of aquifer recharge.
- **Groundwater quality issue:** The water quality of surface water as well as groundwater sources should be restored/maintained fresh by imposing rules and regulations for mandatory installation of Effluent Treatment Plant (ETP) in all industries and factories with frequent monitoring by government authority
- **Minimizing groundwater irrigation cost per unit area:** The government should fix up an unified and judicial water surcharge for different crop irrigation under different energy operated irrigation systems throughout the country. The diesel operated engines for DTW, STW and LLP,s should be replaced gradually by electric motor or solar systems.
- **Groundwater use in coastal areas:** Ground water investigation study should be done intensively by concerned government agencies in coastal areas for find out the suitable fresh water aquifer for groundwater abstraction in irrigation as well as in drinking purpose.
- **Reduce operational cost:** The government gives some subsidy in fuel/electricity and solar pumps which can reduce operational cost.
- **Increase of water use efficiency:** The installation of buried pipe systems under all DTWs



schemes should be done in phasewise and farmers should be motivated to use polythene hose pipes for water conveyance in STW schemes can increase water use efficiency. Promotion of drip irrigation and sprinkler irrigation systems for horticultural, spices and oil crops should be done.

- **Change water use pattern for rice cultivation:** Farmers should be motivated to adopt crop diversification programs by mass demonstrations on cultivation of low watering crops countrywide. AWD practise in rice irrigation can be increased by imposing irrigation water price in volumetric basis.
- **Transfer of improved irrigation and water management technologies at the field level:** Massive demonstration programs on improved water saving technologies for different crop cultivation developed by different NARS institutes should be executed at farmers level of different areas of the country by DAE, BARI, BRRI and BINA. The Agricultural Engineering Wing of DAE should be strengthened so that at least one agricultural engineer can be posted in each upzila agriculture office to conduct these programs properly. Imposing of irrigation surcharge by volumetric basis will definitely accelerate the adoption of these technologies by the farmers.
- **Conjunctive use of surface and groundwater:** Surface water irrigation should be increased along with groundwater irrigation by increasing surface water sources/ storages and by the development of new surface water irrigation systems.
- **Development of irrigation systems in haor and hilly Areas:** The irrigation facilities/ infrastructures should be developed as well as by increasing surface water sources in haor and hilly areas so that more areas can be brought under irrigation during dry season to increase crop productivity in these areas. Water conservation and storage in surface water bodies should be increased not only for irrigation but also for fish culture and duck rearing.
- **Use of solar irrigation:** Use of solar irrigation systems should be increased gradually in coastal, haor and hilly areas with some sorts of government subsidy where electricity facilities are very limited.

#### 3.6.14 Climate Change

Global climate change will certainly affect Bangladesh and the country is already facing its consequences. Though Bangladesh is a very insignificant contributor to the causes for global climate change, but it is probably the worst sufferer due to its global position.

The affects of climate change may further increase as climate change will result to: (1) Changing rainfall pattern; (2) Increased temperature; (3) Increased evaporation; (4) Increased evapo-transpiration; (5) Increased soil and water salinity; (6) Sea level rise; (7) Increased flood (magnitude and occurrence); and (8) Increased intensity of storms, cyclones, any other natural hazards.

Increased temperature, increased evaporation and changing of rainfall pattern will directly influence and result to increase crop water requirement. Increased soil and water salinity will increase management cost and addition of non-saline water for maintaining tolerable environment for crop production. Higher monsoon rainfall and increased flood will damage standing crops and infrastructures. Increased number of storms and cyclones will affect lives and properties of people, especially coastal area people. Intensity of damage will depend on magnitude of storms and cyclones. The dry season of the country is getting longer due to climate change.

Irrigation water demand is projected to increase up to 1.0% for 2030 and in average condition it may go to 3% during dry season for 2050 (Kirby et al., 2016). It affects agricultural productivity when production of rice and wheat is predicted to decrease by 8.8% and 3.2% respectively by 2050 (CRI, 2017). Due to climate change drought occurrence is being increased, which is affecting the yield of the crops as well as the total crop production. Every year about 1.5 -2.35 million hectares of land are affected by different intensities of drought. Sudden flooding is a common phenomenon in Bangladesh due to climate change, which is more harmful than regular floods. About 1400 sq.km in south eastern and 400 sq.km in the north eastern areas faces flash floods frequently, which damages agricultural production as well as other resources. Sustainable groundwater irrigation remains crucial due to high installation, operation and maintenance costs in sustaining agricultural growth to meet the food security of country's population (Mainuddin et al., 2014)

Fortunate scenario is that professionals of Bangladesh have developed mitigation measures in consultation with farmers and increasing annual production under year round use of irrigation facilities, improved water management and mitigation of climate change scenario. In place of rice-, non-rice cropping pattern, many farmers are practicing rice-non-rice-rice and receiving better annual net return than from two rice crops in a year. Therefore, comprehensive plans and implementation methods should be practiced to address these issues. Sustainable agricultural development and improved livelihood will only be possible if land and water resources of the country are used judiciously taking advantages of improved technology available in the country or adapted from abroad after adaptive trials.

**Irrigation development:** As of June 2020, the country provided irrigation facilities for about 5.6 million hectare (Mha) which is about 65% of the cultivable areas of 8.6 Mha. The country has also created flood control and drainage (FCD) facilities for about 6.5 Mha, against potential FCD areas of 5.76 Mha. This may be due to revised requirement for protecting from river erosion. Efforts should be made to bring the entire FCD areas, under irrigation and more than two, preferably three crops should be grown (cropping intensity may be 250% or more) in the areas with FCDI facilities. Where flood regimes permit, all irrigated areas should be brought under three crops per year (two rice and a non-rice crops) and a minimum production of 15 tons/ha per year may be targeted, which has already been demonstrated by researchers (Ghani and others, 2014 BARC Report). Irrigation development in Bangladesh can be classified into dry season irrigation and supplemental irrigation (which has become essential for wet season crop production due to climate change scenario). Recent studies revealed that due to effects of climate change, optimum yield of most non-rice crops cannot be obtained without one to three irrigations over the growing season.

**Dry season irrigation:** With the liberalization of minor irrigation equipment supply, there has been a tremendous increase in irrigated area, leading to increased production of food-grains. Irrigated area has increased from 1.5 million ha in 1981/82 to 5.6 million ha in 2019 (MOA, 2020). Most of the increase occurred since after liberalization of government policy in the late 1980's.

**Table 47: Trends in Irrigated Area during 2009-10 to 2019-20**

Divice-wise Irrigated Area (thousand ha)							
Season/Year	STW	DTW	LLP	Traditional	Major Canal	Total%	Increase over last year
2009-2010	3337	773	965	40	85	5200	1.42
2010-2011	3505	719	1010	04	19	5264	1.23
2011-2012	3418	759	1084	28	20	5322	1.10
2012-2013	3242	934	1036	28	98	5373	0.95
2013-2014	3279	877	1083	28	101	5403	0.56
2014-2015	3235	962	1107	20	96	5448	0.83
2015-2016	2955	1194	1165	18	129	5490	0.77
2016-2017	3079	1063	1188	15	155	5527	0.63
2017-2018	2982	1073	1221	13	242	5557	0.54
2018-2019	2994	1076	1247	8	239	5587	0.54
2019-2020	3001	1084	1270	7	242	5628	0.73

Source: Minor Irrigation Survey Report, Ministry of Agriculture (MOA), January 2021

From 2012-2013 to 2019-2020, increase in irrigation area per year is less than one percent and needs to increase for supporting increasing population. (Table 47).

Over 90% of this area is irrigated by means of privately owned minor irrigation equipment (low-lift pumps and shallow and deep tubewells). Out of the 5.6 Mha irrigated areas, about 73 % is irrigated with groundwater, which are annually recharged during each monsoon season if adequate rainfall occurs and can be safely tapped without risk of “mining”, except in Dhaka and Gazipur area. However, recent concern of “Arsenic Problem” has compelled the country to take very careful step in developing irrigation using groundwater.

For dry season irrigation, in some areas and in years of low rainfall during the prior monsoon, water table falls below suction limit toward the end of the season. Farmers have learned to deal with this problem by digging pits to install the engine down for shallow tubewells to pump water. The permanent or temporary channels would reduce conveyance losses (as compared to the current earthen channels) and might reduce the need to dig pits to reach water table. Improved layout of canal structures and formation of larger irrigation groups would also improve pump utilization and water use efficiency. However, the larger the group, the greater the problem of social organization, so the above issues of water use inefficiency may reflect the social realities of the area rather than lack of technical know-how.

Bangladesh is divided into 30 agro-ecological zones (AEZ) based on soil and land type, climate water availability situation both from surface and ground water (Table 33). The classification indicates about status of water availability, “adequate or inadequate” (UNDP and FAO, 1988) ground or surface water or combination of both for year round irrigated crop production. Agriculture Extension and Irrigation professionals can assist farmers to identify and select potential areas for irrigated cropping pattern for the specified AEZ or combination of irrigated and non-irrigated areas (Annex-1).

Extent of  $F_0$  and  $F_{01}$  types of agricultural land in the country also varies from 65% to 70%. Professional judgments support that these lands can be converted to over 250% cropping intensity with efficient use of irrigation facilities. Remaining areas under  $F_{02}$ ,  $F_{03}$  and  $F_{04}$  types may be targeted to cultivate other crops depending on local preference. Irrigation coverage in all 64 districts varies from 3.3% (Borguna) to 98% (Kushtia) of cultivated area during dry season of 2018-2019 (Table 42), which needs to be increased to acceptable level (which should be 60% to 70%).

Department of Agriculture Extension (DAE) and Bangladesh Agricultural Development Corporation (BADC) conducted a survey to identify areas for rice (Boro) and non-rice cultivation during dry season and how much area for this can use surface water for irrigation. Areas which will be under standing water of one meter or above in January should be used for water storage for irrigation and fish culture. This was a good approach and may be used. However, the low lying areas if earmarked water body during part of dry season, may also serve as source of recharge and water levels of the areas, which will remain within suction limit. It will also help to some extent in reducing the effect of climate change and maintaining better environment.

**Supplementary irrigation:** Irrigation is practiced mainly for Boro (winter) rice and other non-rice crops during rabi/winter seasons leaving irrigation equipment almost idle for the rest of the year. Supplemental irrigation is applied for rainfed crops like, Transplanted Aman and Aus rice, other non-rice crops in addition to rainfall. For most of the parts of the country and in most of the years, this may be appropriate considering cost and benefit of supplemental irrigation. However, in years of low rainfall, supplemental irrigation at the grain filling stage of transplanted Aman could prevent as much as 59% loss of yield (Islam, Rahman and Ghani 1991). Since the irrigation equipment is available, it is somewhat of a mystery at present, why supplemental irrigation is generally not used throughout the country in years of drought. One theory is that, it is a matter of lack of understanding by the farmers and conveyance channels. Farmers had a tendency to wait and hope for “rain tomorrow” and incurred yield loss. The situation is different now and farmers and pump owners keep irrigation systems (equipment and distribution system) ready for year-round use for optimum yield of all crops selected in annual cropping patterns. . Supplemental irrigation is beneficial at any stage of rice but most profitable at transplanting and flowering (Roy et al., 2010). He also found that the increased yields of T. Aman due to supplemental irrigation over rainfed were 2.2, 6.7 11.1 and 13.3% just after transplanting, till panicle initiation, till flowering and till ripening respectively.

Some people have suggested construction of permanent channels, which would be available for use in the rainy season in years of drought and would also improve water use efficiency in the dry seasons. However, such permanent channels would remove land from production, and make a portion of the land available for crop production in most rainy seasons. A second alternative would be to use removable plastic pipes, which could be connected quickly in years of drought and removed thereafter to allow crop production in years of normal rainfall. Such pipes could also be used in the dry season to improve water distribution and water use efficiencies. However, the problem is more one of the cultural practices than physical works. Water has traditionally been sold in Bangladesh in return for a percentage of the crop. In some areas of Bangladesh, where private pump owners have begun to charge instead per hour or per day of water utilization, the use of supplemental irrigation is reported to have increased significantly.

It is not known in practice whether the benefits of permanent or temporary channels, in terms of improved yields in drought years and improved water use efficiency in the dry season, would be sufficient to justify the costs (both investment costs and, for permanent structures, the reduced production area for rainy season cultivation). It is also not known what changes in irrigation practices would be acceptable to farmers or what the real constraints are? Therefore, studies are suggested to undertake experiment, to work with groups of farmers in particular areas, as experiment with improved conveyance systems selected and designed in a participatory manner, and to measure the costs and benefits. Since the economic viability of the proposed investments has not been demonstrated, farmers would not be asked to pay for at this stage. Thus, these experiments would not demonstrate willingness of farmers to bear investment cost, which would need to be established before any large scale implementation could be considered. But the trials would provide information on costs and benefits, social constraints and farmer preferences, which would be useful in deciding which approaches (if any) are worthy of further consideration. They would also provide useful information on methods and guidelines for formation of effective farmer groups for improved management of irrigation infrastructures and on appropriate measures for dealing with equity issues in irrigation area.

**Surface versus ground water irrigation:** Most of the groundwater-based irrigation through tubewells and part of surface irrigation through LLPs are operated and managed by the private sector, which covers about 90% of the present irrigated area. The remaining 10% of the irrigated area is covered by public agencies, Bangladesh Water Development Board (BWDB, Barind Multi-purpose Development Authority (BMDA) and the Local Government and Engineering Department (LGED) but mostly by BWDB using surface water through lift cum gravity irrigation systems. This type of irrigation at present covers about 0.4 Mha (BWDB, 2020) against facilities created by BWDB for about 1.3 Mha, which indicates utilization level of about 30%. Unfortunately, most of the irrigation facilities in Bangladesh are operating at about 60% of their rated capacities. This confirms that irrigation facilities created in Bangladesh with scarce resources are utilized much below their rated capacities, irrespective of private or public operations (Ghani, 1996).

**Conjunctive use of water:** Irrigation or water resources development of the country should be different for different agro-ecological zones (AEZ) of Bangladesh. The national development plan should be to maximize utilization of rainfall, surface and ground water or conjunctive use of these resources. Ground and surface water availability status are presented in (section 3.6.5) which can be used for developing water utilization and crop production plan for the country. Water management for increasing crop production is more important in Bangladesh than increasing irrigation efficiency. The development strategy will be to increase production per unit of land, unit of water and unit of time. Comprehensive studies should be undertaken at upazila level involving stakeholders, government and non-government organizations (NGOs) working in agriculture sector. Bangladesh Agricultural Development Corporation (BADC) should put emphasis on surface water irrigation through lift pumps in coastal areas where sweet or fresh water available. Soil and water-based development programs for developing and implementing upazila production plan under irrigation. BMDA is also now implementing a large project on surface water irrigation lifted from the Padma River in Rajshahi and Chapai Nawabganj Districts.

**Crop diversification:** BARI, BRRRI and other NARS Institutes should carryout Technological demonstrations on on-farm water management for low water demanding short duration crops along with crop demonstration programs over the country (3 to 5 acres in each thana/upazila). Demonstrations of improved technologies for crop production should be done by Department of Agriculture Extension along with the participation of farmers and NGOs. Farmer's training and field days on improved technologies should be arranged frequently for the adoption of these improved technologies. Upazila based annual crop production plan considering farmers' needs and profitability, soil types and water availability should be developed and implemented. Training will also be provided to improve capability of upazila level staff of the Department of Agriculture Extension (DAE). Emphasis should also be given on training programs on on-farm water management, pump operators and mechanics, for farmers (including training of women in seed processing, compost making, and homestead gardens improvements). This will help in increasing crop production and soil health management under irrigated condition. Seed supply for improved crop varieties and equipment should be ensured to farmers by BADC.

**Flood control, drainage, irrigation and embankment facilities:** Up to June 2019, BWDB has created facilities for flood control, drainage and irrigation (FCDI) for about 6.5 Mha with coastal embankment of 5788 km and with non-coastal embankments of 10,565 km (BWDB, 2020). Since its beginning, BWDB implemented 130 irrigation and drainage projects and created facilities for irrigating 1.64 Mha. BWDB has also implemented 139 polders in coastal area for saving crops, infrastructures, houses and lives of human beings and domestic animals. During construction of these facilities, BWDB has also created irrigation and drainage canals and borrow pits, which can be used for fish cultivation and duck rearing. The embankment slopes and toes and foreshore areas can be effectively used for afforestation, vegetable and fodder cultivation. Effective program in coordination with Livestock, Fisheries DAE and Forest Departments will help in increasing overall food production and income of the coastal people without foregoing primary objectives of the FCDI projects. Landless people of the area or project affected persons (those who were affected during project implementation) can be rehabilitated on

the country side toe of the embankments. In return, may be entrusted with routine maintenance of the sections of the embankments and will be provided share of the income accrued from income generated through participatory management program. The rehabilitated persons and people of the protected areas can be encouraged to undertake livestock rearing program since fodder cultivation can be practiced on the embankment slopes and toes. Now-a-days, fodder is also a cash crop.

Bangladesh has constructed about 5,788 km of coastal embankment with average outer slope of 1:5 and countryside slope of 1:3. With average embankment height of 5 meter, estimated embankment surface area of both side slopes will be about 23,152 ha. Considering average 1,500 number of trees/ha, about 34.73 million trees can be grown on coastal embankment slopes. Side slopes for non-coastal embankments are 1.2 on both sides and average height of embankment is 3.0 meter, and will have surface area of 12,678 ha. This area can be used for planting 19.02 million trees in non-coastal embankment slope areas. Therefore, all the embankments (coastal 5,788 km and non-coastal 10,565 km) can support tree population of about 53.74 million (34.73 +19.02) trees which will produce significant amount of fruits and timbers and will make substantial contribution to the development of the country. Maintenance of trees and embankments will provide job opportunities to the poor and landless people. Green vegetation and trees on the embankment slopes and toes will also contribute to improved environment.

Government of Bangladesh (GOB) has recommended plantation on 500 meter wide foreshore area along coastal embankment of 5788 km. This will result in foreshore area of about 289,400 ha and with above assumption (1,500 trees in one ha) about 434.1 million trees can be planted. This will provide adequate, protection of coastal embankments, sea shore, good environments and income generating activities for coastal people. However, it will require good cooperation among government agencies like, BWDB, LGED, Forest Department, Department of Fisheries, Department of Livestock, selected NGOs and local beneficiaries who will be involved in taking care of embankments and sea shore.

Bangladesh is blessed with excellent quality of irrigation water, which is in abundance for the year-round use. However, distribution pattern of surface water availability over the years makes a complex condition for profitable use of water for agricultural production. The country receives about 90% of the surface water resources during June to October through rainfall and river flows, most of which flows to the Bay of Bengal. With management alternatives, part of it can be retained in the rivers and distributor networks and can be effectively used for agricultural (crop and fish production) and non-agricultural purposes during the lean period from November to May. The country has a plenty of ground water which is also of very good quality except in some parts of the coastal areas. Through conjunctive use of ground and surface water, about 76% of the cultivable area can be irrigated of which as of 2018-19 about 65% is irrigated (MOA, 2020). Out of the present irrigated area of 65% (5.6 Mha out of net cultivated area of 8.6 Mha), about 90% of irrigated areas was covered by deep tubewells (DTW), shallow tubewells (STW), manually operated irrigation facilities and low lift pumps (LLP). Out of 65% irrigated area, about 77% was irrigated with ground water and 23% was irrigated with surface water.

Through irrigation management and effective operation of flood control and drainage projects, agricultural production of the country can be increased substantially. The country can produce enough food grains for supporting the increasing population and also can export non-food grain crops especially potato, fresh vegetables and fruits with improved processing, storage, packaging and transportation. To create enabling condition for the improvements, mistrust between, public, government and private business has to be removed. Stakeholders' participation in management of available water resources should be ensured at all levels of project cycles that are planning, implementation, operation and management. Other constraints like, low productivity per unit of land and water, access to marketing and transportation, access to credit and frequent changing government policy should be resolved for sustainable development of agriculture in Bangladesh. Agricultural development should be linked to industrial development and export oriented market for comprehensive and overall development of agricultural sector of the country. Water quality and pumping cost have become matter of major concern of using groundwater and requires effective management for making irrigation systems

cost-effective. Shallow and deep tubewells are covering about 77 percent of the irrigated areas about running at below 50 percent efficiencies, respectively of their potential capacities, therefore, it needs improvement. Efficiency levels of other irrigation facilities are similar. Irrigation water management strategy of Bangladesh will be to increase production at per unit of land, unit of water and unit of time. Vertical expansion of agricultural/cultivable land is required to support increasing population since horizontal expansion not possible. Improved irrigation management is required for increasing cropping intensity, crop diversification and annual production per unit of cultivated land.

### 3.6.15 Addressing the Cross-cutting Issues

Major cross-cutting issues will include mainstreaming, community empowerment, sustainability, equity, inclusion, and social accountability. This will give the community a sense of ownership that will support the long-term sustainability of the schemes or projects in crop, forestry, livestock, fisheries, water resource and irrigation sub-sectors. Management of land and water resources of the country will affect use of the limited natural resources such as land, water and production environment. The consultants have suggested to use resources among the subsectors under agriculture for optimum utilization of limited resources for maximizing annual outputs. There may be competitive use of water resources for irrigation, crop production, fish cultivation and navigation. Cross cutting issues will require most viable, sustainable, environment friendly use of the resource for most benefit to more people and more areas of the country. A multi-sectoral approach is required to raise the profile of agriculture development opportunity for rural poor and especially for women. Through various programs and portfolios under selected sub-sectors, continue to emphasize the need to create opportunities for youths to engage in agricultural activities. Strategies towards effective engagement of youth in agriculture will focus on contributing to appropriate national policies that are aimed at empowering youths to be innovative and create opportunities through enhancing their entrepreneurial skills. It will also aim to create interest of people in agriculture through career development opportunities and attachment training schemes in collaboration with academic institutions and other formal and informal capacity development initiatives.

### 3.6.16 The Indicators for Sustainable Development Goals

Improvement of livelihood through food and nutrition security, poverty reduction and mitigation of climate change. Indicators for the achievement of the goal is given below:

- Increase per capita income from agricultural sector by 20%
- Increase food production
- Increase purchasing capacity of farmers and other work forces
- Adopt mitigation measures for climate change

### 3.6.17 Prioritizing the Programme for Interventions by Ministry/Division

The following three priority areas are identified and provided below:

- Comprehensive area development over the country through efficient management of water and land resources.
- Indicator of achievement: Increase irrigated area from 65% to 75% of net cultivated area by 2025
- Increase of Irrigated crop production, cropping intensity and annual production per hectare

#### Indicator of achievement:

- Increased cropping intensity from 216% to 290% by end of 8<sup>th</sup> FYP
- Yield/ha/year increased from 10 to 12 tons

### 3.6.18 Estimation of Resource Allocation/Requirement

Water conservation and management strategy of Bangladesh should be based on water availability conditions and improvement potential of different regions of the country. Integrated management of flood control, drainage and irrigation (FCDI) infrastructures should be addressed on priority basis. The country may be divided into five irrigation and FCDI areas depending on water availability, land capability, subject to annual flooding and agricultural practices. These are: Northwest, Coastal area, Central Flood plain, Haor area and Hilly area. The specific areas considered under different zones in this SAPA study are; (i) Northwest which includes area under present Rajshahi and Rangpur divisions (including Barind tract) and greater Kushtia and Jessore districts; (ii) Coastal area (which is earmarked); (iii) Central flood plain which includes most part of central flood plain and remaining area of coastal belt where saline water inundation is rare; (iv) Haor: Low lying areas of Sylhet Division and districts of Netrakona, Kishoregonj and Brahmanbaria; and (v) Hilly area of Chittagong, Sylhet and Chittagong Hill Tract. Development options through integrated land and water resources of these crop production zones and FCDI infrastructure to be explored and implementation strategies will be suggested, which may make significant contribution to the overall agricultural development of the country.

Professional experiences indicate that if crop water requirements can be met, household water supply may not be a problem, as agriculture is the major user of water resources. This plan will provide framework for identification of public and private partnership policy initiatives and projects for public and private initiatives in the sectors. The SDGs also require it for all over the country. Budget allocation for Agriculture Sector is quite reasonable in 8<sup>th</sup> FYP (Table 44 below) compared to 7<sup>th</sup> FYP. However, gap in utilization of allocated budget and expenditure for Agriculture (Crops), Fisheries and Water Resources varies are 25.20%, 4.95% and 6.54%, respectively (Table-45). Therefore, capacity for fund utilization needs significant improvement in Agriculture Sub-sectors and concerned Ministries for achieving targets fixed in the 8<sup>th</sup> FYP.

**Table 48: Ministry-wise ADP Allocation in 8<sup>th</sup> FYP (FY21 to FY25) under Agriculture Sector**

(Taka in Billion)

Sector	FY 21		FY 22		FY 23		FY 24		FY 25	
	Current prices	Constant Price	Current prices	Constant Price	Current prices	Constant Price	Current prices	Constant Price	Current prices	Constant Price
Ministry of Agriculture	41.2	41.2	46.1	43.8	47.9	43.2	49.7	42.8	59.6	49.0
Ministry of Fisheries	9.0	9.0	11.1	10.6	12.8	11.6	15.0	12.9	18.0	14.8
Ministry of Water Resources	108.6	108.6	156.9	149.0	228.7	206.6	276.2	237.8	346.4	284.6
Ministry of Environment Forest	4.8	4.8	7.3	6.8	8.6	7.7	10.1	8.6	11.9	9.6
Total	163.6	163.6	221.4	210.2	298.0	269.1	351.0	302.1	435.9	358.0

Source: 8<sup>th</sup> FYP

### 3.6.19 Theory of Change

The Expected outcome of the sub sector action plan is mentioned in the Table 10 including, responsibility, finance, target, assumption, locations, alignment with SDG and BDP 2100, since SDG and BDP has overarching role. However an inclusive theory of change is prepared which contained vision, mission, objectives/ outcome, outputs, strategies and interventions are stated below in Fig-13.



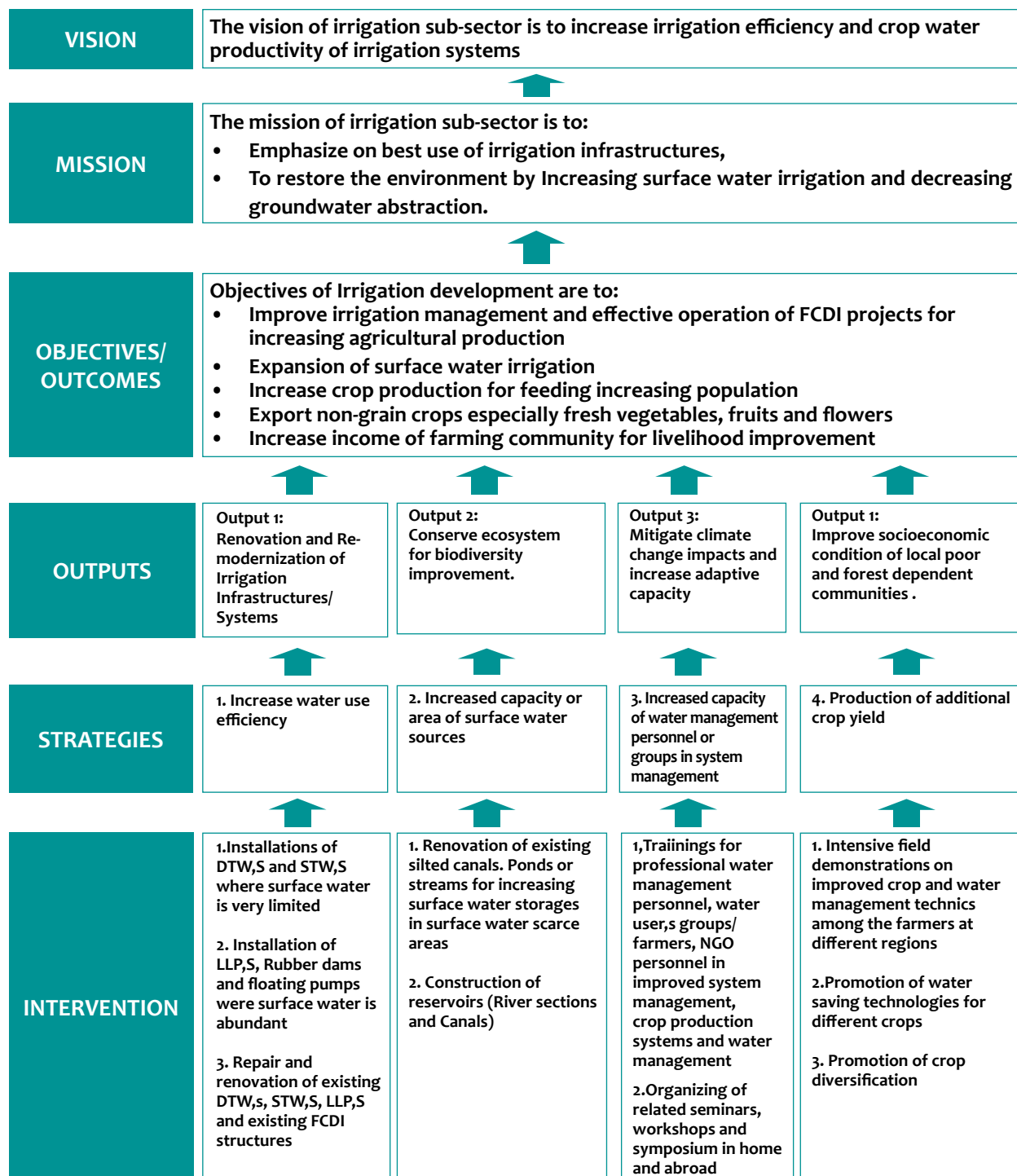


Fig. 16: Theory of Change

### 3.6.20 Irrigation Sub-sector Action Plan Framework and Investment Plan

Irrigation sub-sector action plan has been prepared reviewing relevant policy and planning documents in addition to several water use and management related documents. KII, Consultative Meeting, and Group Discussion were also conducted with Senior Officials of Departments and institutions dealing with water and incorporated feedback in the irrigation action plan. The Irrigation Management

Improvement Investment program has also been developed to improve the sustainability and profitability of irrigation systems following the modality of a multi-tranche financing facility (MFF). The use of MFF is appropriately given as a large amount of investments required for improving irrigation management of medium and large schemes.

Agricultural practices in Bangladesh are controlled by hydrological cycle, therefore, farmers need protection and efficient support against/for; (i) Flood in wet season (ii) Irrigation in dry season (iii) Supplemental irrigation in wet season (iv) Saline water intrusion in coastal area (v) Arsenic contamination of groundwater for some parts of the country (vi) Drainage in wet and dry seasons in some areas (vii) Water related hazards (storm surge, hail storm and cyclone) in coastal belt and (viii) River bank erosion. In addition to these natural phenomena, there is man-made interventions such as, inefficient as well as over- use of irrigation water. Higher costs of agricultural inputs are also a big constraint to the farmers for overall crop production.

Agriculture sector is to face all the above constraints for its development. Constraints and consequences of the above constraints and mitigation are managed and actions are taken by relevant agencies and ministries. Therefore, inter-ministerial coordination and inter-agency cooperation are essential for expected development of Agriculture Sector of Bangladesh. Food Ministry and Safe Food authority should also work with agriculture sector as partner organizations.

Farmers are facing all the above constraints, but with supports from professionals and the government, they are trying to produce enough food grains to make the country self-sufficient. Unlike, many other countries, Bangladesh is implementing Irrigation Water Management Strategy to increase food production to meet increasing food requirements in response to increasing population. Long-term success of Agricultural Sector will also require developing actions to face perspectives of Bangladesh Delta Plan 2100.

For addressing challenges of irrigation sub-sectors diverse actions would be taken for short, medium and long term basis starting from the launching of 8<sup>th</sup> Five Year Plan (2020-2025). The following Action plan (Table-46) along with target, implementation period, indicative budget, responsible agency is given. In three major thematic areas 16 action plans have been proposed for irrigation sub-sector action plan development.

**Table 49: Irrigation Sub-sector Action Plan Framework**

Thematic Category	Thematic Area	Activities/Actions	Baseline	Target	Duration (Implementation Period)	Indicative Budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Remarks
							SDG's Target	BDP 2100 Measures			
TC 1. Consumptive use of ground water, surface water and rain water	TA 1. Expansion of surface water irrigation	1. Timely supply and distribution of adequate amount of fresh water for irrigation to be ensured by BWDB, BADC, BMIDA and other water management institutions.			Medium (FY 2023-24 to 2027-28)	15000	SDG6	FR3; FW1; FW2; Strategies under Agriculture, Food Security.		BWDB, BMIDA, LGED	Detailed feasibility study needed
		2a. Development of cross games/ hydraulic elevator game (HEAD)/ rubber dam on small rivers to conserve water for irrigation with proper feasibility 2b. Development of surface water irrigation projects using LLP or submersible pumps.	21%	30%	10 years	1467	6.4	Surface water availability (Ch-3, Art 236, P-236)		BWDB, BMIDA, BADC, LGED, DBHWD, WARPO	Suitable site for conservation and use
	TA 2. Use of water for sustainable agriculture	1. Rehabilitation of existing surface water irrigation project particularly Muhuri, Manu, Bihola, Barisal, Chandpur, Meghna-Dhonagoda, Teesta, G.K. 2. Use of water saving technologies (AWD and others), sprinkler and drip irrigation for suitable crops for improving efficiency of irrigation water and install facilities (plastic pipe, buried pipe) to reduce 3. Expansion of Small-scale Irrigation Technology and Increase Surface Water use for Irrigation	Major irri. Efficiency= 30% Surface water irri, Coverage= 27.5% Minor irri. Efficiency= 50-60% Ground water irri. Cov.=72.5%	Major irri. Efficiency= 50% Surface water irr. Coverage= 35% Minor irri. Efficiency= 75% Ground water irri. Cov.= 65%	a. Upto 2025 b. 2026-2030	38100	6.4, 6.a	Enhanced Irrigation Development (Ch-3, Art-3-2, P-258)	Food security Improved standard living	BWDB, BMIDA, BADC, BMIDA	Availability of water and fund.

Thematic Category	Thematic Area	Activities/Actions	Baseline	Target	Duration (Implementation Period)	Indicative Budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Remarks
							SDG's Target	BDP 2100 Measures			
TC3. Resource Development and Management	TA3. Development of Surface Water Resources	1. Canal rehabilitation (For increasing water storage) These will facilitate water conservation for supplemental irrigation of Aman and irrigation of non- rice crops. Location: AEZ 1,2,3,4,5,7 and 8) and covers major part of Rajshahi, Rangpur, Khulna and Mymensingh Divisions. Average canals linking other canals and smaller rivers and irrigation and drainage canals.	-	50 Km in selected each dist.	FY 2023-2030	1,764				BWDB, BADC, BMDA	Professional Coordination (PC) is required
		2. Rehabilitation of ponds in Barind area Location: AEZ 25, 26 and 27	-	10 ponds in each upazila under Rajshahi, Naogaon, Chapai Nawabganj, Dinajpur, Jaypurhat districts	FY 2023-2030					BMDA	BMDA management to engage implementation. Team
		3. Rehab, of ponds and canals and digging of ponds for water conservation during rainy season Location: AEZ 11,12, 13, 19	-	Numbers and volume of works to be decided at Agricultural Regions of DAE	FY 2023-2030	24,700				BMDA, BADC and BWDB	PC is required
		4. Construction of Rubber Dam 62 meter wide Location: AEZ 28,29	-	8 districts	FY 2023-2030	-				LGED & BADC	PC is required
		5. Reservoir (River section and canals) Location: AEZ 25, 27, 29	-	5,000 (5km) long	FY 2023-2030	280				BWDB, BADC and BMDA	PC is required

Thematic Category	Thematic Area	Activities/Actions	Baseline	Target	Duration (Implementation Period)	Indicative Budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Remarks	
							SDG's Target	BDP 2100 Measures				
TC3. Resource Development and Management	TA4. Infrastructure Management and Irrigation development	1. Repair of DTWs to keep existing DTWs running until developing new source of irrigation Location: AEZ numbers, 25, 26, 27, 28	-	3,700 Nos	3,700 Nos	11,100				BADC and BMDA	PC is required	
		2. Repair of STWs to keep existing STWs running until developing new source of irrigation by linking smaller rivers and drainage systems Location: AEZ numbers, 19, 22, 25, 27, 28, 30,	-	1,40,000 Nos.	FY 2023-2030	280					BMDA, BADC, private sector and users	Users to be active
		3. Repair of 1 cfs LLPs to keep existing 1 cfs LLPs running until developing new source of irrigation Location: AEZ, 27, 28	-	10,000 Nos.	FY 2023-2030	2,000					BMDA, BADC and private sector	PUsers to be active
		4. Repair of 2 cfs LLPs to keep existing 2 cfs running until developing new source of irrigation Location: AEZ 25, 27	-	10,000 Nos	FY 2023-2030	1,750					BADC, BMDA And private sector	PC is required
		5. Install DTWs where surface water can not cover irrigable area Location: AEZ 25, 27	-	2,000 Nos.	FY 2023-2030	6,000					BADC & BMDA	Users to be active
		6. Install STWs where surface water can not cover irrigable area Location: AEZ numbers 25, 27, 28	1,00,000 Nos.	10,000 Nos.	FY 2023-2030	2,000					BMDA, Users, BADC, private sector	Users to be active
TC4. Utilization of Surface Water Resources	TA5. Increase of irrigation efficiency	1. Enhancement of irrigation efficiency through buried pipeline in greater Rangpur district Location: Greater Rangpur district	-	3,700 Nos	FY 2024-2028	2,056				BADC and BMDA	PC is required	
	TA6. Development of surface water irrigation facilities	1. Installation of Low lift Pumps ( 2.0 and 1.5 cusec capacity at Haor and Coastal and Haor areas Location: AEZ 13, 18, 20, 21, 22	-	500 Nos.	FY 2025-2030	-				BADC, BWDB, And LGED	PUsers to be active	

Thematic Category	Thematic Area	Activities/Actions	Baseline	Target	Duration (Implementation Period)	Indicative Budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Remarks
							SDG's Target	BDP 2100 Measures			
TC4. Utilization of Surface Water Resources	TA6. Development of surface water irrigation facilities	2. Supply of Padma and Mahananda river water for irrigation extension in Barind area by double lifting system Location: AEZ 11, 12, 25, 27	-	10,000 Nos.	FY 2024-2030	9,980				BMDA	PUsers to be active
		3. Installation of Floating Pumps Location: AEZ numbers 7, 8,9, 19, 20	-	10,000 Nos	FY 2023-2030	30				BADC & LGED	PC is required
		4. Construction of Semi pukka earthen Dams across the small reivers and charas in the Hilly areas Location: AEZ 28, 29	-	300 Nos.	FY 2025-2030	300				BADC LGED BARI & CHTDB	-
		5. Installation of Duble lifting pumps to pump out charas and rsmall reservoir water to the hill top or slope Location: AEZ 28, 29	-	300 Nos.	FY 2025-2030	300				BADC, LGED & CHTDB	-
		6. Renovation of gravity flow irrigation projects under BWDB Location: Existing BWDB projects areas of Bangladesh	-	12 Nos.	FY 2025-2040	300				BWDB	-
TC5. Utilization of Renewable Energy	TA7. Irrigation Development in Unfavorable Ecosystem like coastal, Hill and Haor areas	1. Installation of solar pumps (1.5, 1.0 and 1.25 cusec) Location: AEZ 13,18, 20,21, 28, 29, 25, 27	-	100 Nos	FY 2025-2035	2,056				BADC, LGED and BMDA	-
		2. Operation of irrigation equipment using solar energy Location: AEZ 13, 18, 20,21, 22	-	500 Nos.	FY 2025-2030	44,152				BADC, BW/DB, LGED	PUsers to be active
	TA8. Increase of Irrigated Areas	1. Integrated agriculture development project in Char areas of Rangpur district Location: AEZ numbers 7, 8,9, 19, 20	-	10,000 Nos	FY 2024-2029	4,213				BMDA	PC is required

Thematic Category	Thematic Area	Activities/Actions	Baseline	Target	Duration (Implementation Period)	Indicative Budget (Million BDT)	Aligned to		Expected outcome	Responsible agency	Remarks
							SDG's Target	BDP 2100 Measures			
TC6. Technological Development and Transfer	TA10. Transfer of Existing water saving technologies at the field level	1. Innovation of Irrigation & Water Management/ Water Saving Technologies Location: All over the country	-	50 Nos.	FY 2025-2035	300				BARI, BRRI, BINA	-
		1. Intensive demonstrations of innovated water management technologies at farmers, level Training for farmers, UAO, SAAO, NGO personnel Location: All over the country	-	25000 Nos.	FY 2025-2035	300					BARI BRRI BINA DAE BMIDA BADC
TC7. Capacity Development	TA11. Participatory Management and Capacity Development	1. Professional Training (staff and Officers) For: Dept. and Institutes handling irrigation and water mgt. and Agril. Mechanization	-	Staff Trainers for 4 yrs.	FY 2023-2030	72 14.4				DAE, BRRI and BARI	PC is required
		2. Seminar, workshop (Home 5/ year, abroad 2/year) For: National Institutes and beneficiaries	-	2 nos. in project period; home 3 groups of 5 in abroad	FY 2024-2030	20 5.1					BRRI, DAE and BARI
TC8. Resource Augmentation	TA12. Resource Development	1. Explore sweet water in coastal area) Location: Coastal Area	-	19 coastal districts	FY 2023-2030	1900				BWDB, BADC, BRRI, BARI and DPHE	PC is required

**Table 50: Monitoring & Evaluation Framework for Irrigation Sub-sector**

Thematic Area	Activities/Actions	Indicator	Base		Target			Responsible agency	Remarks
			Year	Status	2025	2030	2041		
Irrigation TA 1. Expansion of surface water	1. Timely supply and distribution of adequate amount of fresh water for irrigation to be ensured by BWDB, BADC, BMDA and other water management institutions.	Surface water used for irrigation	2006	6.62 Km <sup>3</sup>	7.25 Km <sup>3</sup>	9.50 Km <sup>3</sup>	12 Km <sup>3</sup>	BWDB, BMDA, BADC, LGED	
	2a. Development of cross games/ hydraulic elevator game (HEAD)/ rubber dam on small rivers to conserve water for irrigation with proper feasibility								
TA 1. Expansion of surface water	2b. Development of surface water irrigation projects using LLP or submersible pumps.								
	1. Rehabilitation of existing surface water irrigation project particularly Muhuri, Manu, Bholu, Barisal, Chandpur, Meghna-Dhonagoda, Teesta, GK. 2. Use of water saving technologies (AWD and others), sprinkler and drip irrigation for suitable crops for improving efficiency of irrigation water and install facilities (plastic pipe, buried pipe) to reduce distribution losses	a. Efficiency: Major Irrigation Minor Irrigation b. Coverage: Surface water irri, Ground Water Irri.	2006	30%	35%	40%	50%	BWDB, BMDA, BADC, LGED, BARC	
			2006	50-60%	65%	70%	75%		
			2022	27.5%	30%	65%	40%		
2022			72.5%	70%	85%	60%			
TA 2. Use of water for sustainable agriculture	1. Canal rehabilitation (For increasing water storage) These will facilitate water conservation for supplemental irrigation of Aman and irrigation of non- rice crops.	Increase of water storage for irrigation.	2020	-	20 km	30 km	-	BWDB, BADC and BMDA	Availability of water and fund.



Thematic Area	Activities/Actions	Indicator	Base		Target			Responsible agency	Remarks
			Year	Status	2025	2030	2041		
TA3. Development of Surface Water Resources	2. Rehabilitation, of ponds in Barindarea	Ponds are rehabilitated	2020	-	4 pond in each upazila under Rajshahi, Naogaon, Chapai Nawabganj, Dinajpur, Jaypurhat districts	6 ponds in each upazila under Rajshahi, Naogaon, Chapai Nawabganj, Dinajpur, Jaypurhat districts	-	BMDA	Availability of suitable site and fund.
	3. Rehab, of ponds and canals and digging of ponds for water conservation during rainy season	Enhancement of water storage capacity of ponds and canals.	2020	-	Numbers and volume of works to be decided at Agricultural Regions of DAE	Numbers and volume of works to be decided at Agricultural Regions of DAE	-	BMDA, ADC and BWDB	Availability of suitable site and fund.
	4. Rubber Dam 62 meter wide	Rubber dam installed.	2020	-	4 (1/dist)	4 (1/dist)	-	LGED and BADC	Availability of suitable site and fund.
	5. Reservoir (River section and canals)	Increased volume of water stored in reservoir	2020	-	2,000 m (2 km) long	3,000 m (3 km) long	-	BADC and BMDA	Availability of fund and expert man-power
	TA4. Infrastructure Management and Irrigation development	1. Repair of DTWs to keep existing DTWs running until developing new source of irrigation	All DTWs are in operation.	2020	-	1,700 Nos	2,000 Nos	-	BADC and BMDA
2. Repair of STWs to keep existing STWs running until developing new source of irrigation by linking smaller rivers and drainage systems		All STWs are in operation.	2020	-	40,000 Nos.	100,000 Nos.	-	BMDA, BADC, private sector and users	Availability of fund and expert man-power
3. Repair of 1 cfs LLPs to keep existing 1 cfs LLPs running until developing new source of irrigation		All LLPs are in operation.	2020	-	3,000 Nos.	7,000 Nos.	-	BMDA, BADC and private sector	Availability of fund and expert man-power
4. Repair of 2 cfs LLPs to keep existing 2 cfs running until developing new source of irrigation		All LLPs are in operation.	2020	-	3,000 Nos.	7,000 Nos.	-	BADC, BMDA And private sector	Availability of suitable site and fund.

Thematic Area	Activities/Actions	Indicator	Base		Target			Responsible agency	Remarks
			Year	Status	2025	2030	2041		
TA4. Infrastructure Management and Irrigation development	5. Install DTWs where surface water can not cover irrigable area	New DTWs installed in water shortage areas	2020	-	600 Nos.	1,400 Nos.	-	BMDA and BADC	Availability of suitable site and fund.
	6. Install STWs where surface water can not cover irrigable area	New STWs installed in water shortage areas	2020	-	40,000 Nos.	60,000 Nos.	-	BADC, BMDA and private users	Availability of suitable site and fund.
TA5. Increase of irrigation efficiency	1. Enhancement of irrigation efficiency through buried pipeline in greater Rangpur district	Enhancement of water use efficiency	2020	-	60%	70%	-	BADC, BMDA, BWDB, DAE and private users	Suitable site.
TA6. Development of surface water irrigation facilities	1. Installation of Low lift Pumps ( 2.0 and 1.5 cusec capacity at Haor and Coastal areas	Increase of surface water irrigation in haor and coastal areas.	2020	-	200 Nos	300 Nos	-	BADC and BMDA	Suitable site
	2. Supply of Padma and Mahananda river water for irrigation extension in Barind area by double lifting system	Increase of surface water supply through double lifting system.	2020	-	40,000 Nos.	100,000 Nos.	-	BMDA	Availability of surface water in dry season
	3. Installation of Floating Pumps	Floating pumps are in operation	2020	-	10 Nos.	20 Nos.	-	BADC and LGED	Suitable site
	4. Construction of Semi pukka earthen Dams across the small rivers and charas in the Hilly areas	Increased water availability in hilly areas by making cross dams.	2020	-	100 Nos.	200 Nos.	-	BADC LGED BARI & CHTDB	Suitable site
	5. Installation of Double lifting pumps to pump out charas and small reservoir water to the hill top or slope	Increased water availability on hill tops by double lifting system.	2020	-	100 Nos.	200 Nos.	-	BADC, LGED & CHTDB	BMDA and BADC
	6. Install STWs where surface water can not cover irrigable area	Improved repair and maintenance of gravity flow projects of BWDB.	2020	-	2 Nos.	5 Nos.	5 Nos.	BWDB	Timely release of fund and organizational capacity

Thematic Area	Activities/Actions	Indicator	Base		Target			Responsible agency	Remarks
			Year	Status	2025	2030	2041		
T7. Irrigation Development in Unfavorable Ecosystem like coastal, Hill and Haor areas	1. Installation of solar pumps (1.5, 1.0 and 1.25 cusec)	Solar pump irrigation increased in unfavorable areas	2020	-	20 Nos.	40 Nos.	40 Nos.	BADC, LGED and BMDA	Suitable site and availability of fund
	2. Operation of irrigation equipment using solar energy	Solar pumps irrigation are in operation	2020	-	-	-	-	BADC, LGED and BMDA	Suitable site and availability of fund
T8. Increase of Irrigated Areas	Integrated agriculture development project in Char areas of Rangpur district	Enhancement of irrigated areas.	2020	-	-	-	-	BMDA	Suitable site and water availability
T9. Optimization of Irrigation Water Resources	Innovation of Irrigation & Water Management/ Water Saving Technologies	Development of water saving technologies.	2020	-	5 Nos.	20 Nos.	25 Nos.	BARI, BRRI & BINA	Lack of expert professionals
T10. Transfer of Existing water saving technologies at the field level	Intensive Demonstrations of innovated water management technologies at farmers, level Training for farmers, UAO, SAAO, NGO personnel	Improved water management.	2020	-	5 Nos.	20 Nos.	25 Nos.	BARI BRRI BINA DAE BMDA BADC	Availability of improved technology.

Thematic Area	Activities/Actions	Indicator	Base		Target			Responsible agency	Remarks
			Year	Status	2025	2030	2041		
TA11. Participatory Management and Capacity Development	1. IProfessional Training (staff and Officers)	Skill man-power developed	2020	-	-	Staff Trainers for 4 yrs.	-	DAE, BRRRI and BARI	Organizational cooperation
TA12. Resource Development	Explore sweet water in coastal area	Increase of fresh water availability in coastal area.	2020	-	For 5 coastal districts	For 14 coastal districts	-	BWDB, BADC, BRRRI, BARI and DPHE	Availability of suitable site and expert professionals.

### 3.6.21 The Way Forward

The following recommendations along with other relevant factors can accelerate comprehensive agricultural development of Bangladesh.

- Utilization strategy of irrigation facilities should aim in protection of the resource to allow its long-term use.
- Improvement should be made in major and minor drainage schemes all over the country to conserve monsoon flows and rainwater in all the channels and low pockets and be utilized for supplemental irrigation during later part of the monsoon and in the winter season.
- Government subsidy on solar powered drip irrigation systems for high value horticultural crops to large and medium farmers.
- An effective media campaign should be launched to inform and educate farmers on benefits of irrigation for increasing agricultural productivity and output. Cost and benefit of various irrigation equipment, engines, advantages and disadvantages of different modes of payments for irrigation may be undertaken.
- Rural credit should be made available on reasonable terms and conditions throughout the country, preferably through NGOs and private sector participation, to encourage purchase, renting, and support services of irrigation equipment. Efforts should be made to encourage involvement of small and landless farmers and women in irrigation activities.
- Given the economies of scale and poor quality of imported engines, there may be huge potentials for local manufacturers of irrigation equipment. To encourage this to happen government to remove some anomalies in the structure of current import restrictions that make raw materials for engine manufacturers so expensive that the locally made engines would be more expensive than imported ones.
- Enhance country wide groundwater monitoring including water quality and water table fluctuation and provide information and remedial actions if quality deterioration is observed. As the groundwater development potential is a matter for national interest, it should be reviewed time to time.
- Policy should be ascertained about the roles and assignments of various ministries and agencies involved in groundwater planning and management. Supervise the data improvement operation closely to ensure a platform on which the monitoring agencies can operate sensibly.
- Strengthen cooperation among agricultural research and extension systems in order to develop new technologies related to crop varieties, integrated farming systems, improved agronomic, agro-processing technologies, water management and for diffusion of proven technologies.
- Formulate integrated land use policy conducive to optimum use of irrigation facilities and water resources for agricultural development.
- Promote water conservation for irrigation and other uses such as enhance conveyance capacity of water courses through de-siltation and introduce cultural fisheries in the completed FCDI projects.

- Accelerate mass communication for year-round use of irrigation facilities especially for supplemental irrigation during aman season.
- Enhance training programs for efficient use of irrigation facilities and advocate for command area development of existing FCD/I facilities.
- Introduce and emphasize on cultivation of pulses or green manure crops in the cropping patterns for improving soil health and increasing water-holding capacity of soil to hold more water in the root zone.
- Introduce comprehensive block demonstration on water management, land use and new crops for production maximization in all upazilas.
- Irrigation or water resources development of the country should be different for different agro-ecological zones (AEZ) and Agricultural Regions of DAE. The national development plan should be to maximize use of rainfall, surface water and groundwater through conjunctive adoption of these resources.
- Water productivity and BCR analysis under a study indicated that inclusion of non-rice crops in the cropping pattern especially after aman harvest will make production cycle more profitable and reduce pressure on water resources. This may be adopted as a mitigation measure for affects of climate change.
- Climate change scenario at present is indicating abnormal behaviour of the climatic parameters. Rainfall and evapotranspiration are most likely to be affected more and influence water management in the coming years.
- However, the level of change is very negligible at present and the abnormal conditions resulting due to change is manageable through adoption of appropriate cropping schedule and water management technologies.
- Carrying out of comprehensive block demonstrative on water management, land use in all upazillas.

## Annex-1: List of Proposed Projects and Indicative Budget and Implementation Period

Name of Proposed Project	Implementing period and indicative Budget (Million Taka)		
	2024	2025	2030
1. Development of surface water resources by rehabilitation of canals and ponds in different areas of Bangladesh	2,500	3000	3000
2. Construction of Rubber Dams for increasing surface water storage	120	150	300
3. Construction of water storage reservoirs for dry season irrigation	300	500	500
4. Rehabilitation of existing DDTW,s, STW,s and LLP,s for increasing Efficiency and irrigated areas	2200	2500	3000
5. Installation of new DTW,s and STW,s for increasing irrigated areas	6500	7200	8000
6. Enhancement of irrigation efficiency through burried pipe lines In Rangpur Division	5000	5500	6000
7. Installation of LLP solar pumps in haor and coastal areas	350	400	500
8. Supply of Padma and Mohananda river water for irrigation in Barind area by double lifting systems	500	550	600
9. Installation of floating pumps by increasing surface water irrigation	900	950	1000
10. Construction of semi pucca earthen dams across the Small River and charas in the hilly areas & installation of double lifting systems	600	700	900
11. Installation of solar pumps in haor, coastal and hilly areas	2500	3000	4000
12. Integrated Agricultural Development project in char areas Of Northern Bangladesh	2500	3000	4000
13. Development of improved irrigation and water saving Technologies for crop production	400	500	600
14. Transfer of irrigation & Water management Technology is at Farmers' level	4000	5000	6000
15. Participatory management and capacity development	4500	5000	6000

## Annex-2: Agro-ecological zones-wise surface and ground water availability in Bangladesh

SI No	Zone	Water Availability
01	Old Himalayan Piedmont Plain	Limited surface water Ample groundwater
02	Active Tista Floodplain	No dependable surface water Ample groundwater
03	Tista Meander Floodplain	Limited surface water Ample groundwater
04	Koratoya-Bangali Floodplain	Limited surface water Ample groundwater except in some locations
05	Lower Atrai Basin	Limited surface water Ample groundwater
06	Lower Purnabhaha Floodplain	Limited surface water Uncertain groundwater
07	Active Brahmaputra and Jamuna Floodplain	Limited surface water Uncertain groundwater
08	Young Brahmaputra and Jamuna Floodplain	Ample surface and groundwater
09	Old Brahmaputra Floodplain	Available surface water (exploited) Ample groundwater
10	Active Ganges Floodplain	Limited surface water Ample groundwater
11	High Ganges River Floodplain	Limited surface water Ample groundwater
12	Low Ganges River Floodplain	Limited surface and groundwater Groundwater is not available in some places
13	Ganges Tidal Floodplain	Ample surface water Ample groundwater
14	Gopalganj-Khulna Beels	Adequate surface water but saline within 500 meter. Adequate groundwater but saline nears surface and good below 300 meter.
15	Atrai Beel	Ample surface and groundwater with some limitation of groundwater in certain areas.
16	Middle Meghna River Floodplain	Ample surface and groundwater
17	Lower Meghna Floodplain	Ample surface and groundwater
18	Young Meghna Estuarine Floodplain	Ample surface water but little salinity in dry season. Groundwater is good below 300 meter.
19	Old Meghna Estuarine floodplain	Ample surface and groundwater but saline in some areas
20	Eastern Surma-Kushiyara Floodplain	Surface and groundwater are available but not enough for the entire area
21	Sylhet Basin	Ample surface water Limited groundwater
22	Northern and Eastern Piedmont plains	Surface and groundwater are limited
23	Chittagong Coastal Plain	Limited surface and groundwater
24	St. Martin's Coral Island	Surface water is saline No mention about groundwater
25	Level Barind Tract	Limited surface water Good groundwater



SI No	Zone	Water Availability
26	High Barind Tract	Limited surface water Groundwater is poor but need detail investigation
27	North Eastern Barind Tract	Limited surface water but groundwater is good.
28	Madhupur Tract	Limited surface water but Ample groundwater
29	Northern and Eastern Hills	Limited surface water, Groundwater is also limited, but need detail surveying.
30	Akhaura Terrace	Limited surface water Groundwater is good but need detail survey whether it is enough for the entire area.

Source: Land Resources Appraisal of Bangladesh for Agricultural Development, Report 2, Agro-Ecological Regions of Bangladesh, UNDP & FAO, Rome, 1988

### Annex-3: List of agricultural regions and districts with total cultivable and irrigated areas as of June 2019

SI No	Region	District	Total Area (ha)	Cultivable Area (ha)	Irrigated Area ((ha)	Irrigated Area (%)
1	Dhaka	Dhaka	146360	94238	40952	43.5
2		Munshiganj	100430	60191	19095	31.7
3		Narayanganj	68440	51321	23630	46.0
4		Manikganj	138370	93253	50054	53.7
5		Narsingdi	115010	82926	49356	59.5
6		Gazipur	180640	101475	50142	49.4
7		Tangail	341430	220085	136150	61.9
8	Mymensingh	Mymensingh	439460	302438	260695	86.2
9		Jalalpur	211520	146915	115565	78.7
10		Sherpur	136470	99114	71277	71.9
11		Netrokona	279430	190562	149450	78.4
12		Kishorganj	268860	173307	118338	68.3
13	Barishal	Barisal	278450	175434	80031	45.6
14		Jhalokathi	70680	51588	12093	23.4
15		Pirojpur	127780	80464	20074	24.9
16		Patuakhali	322130	85917	14833	17.3
17		Borguna	183130	103212	3451	3.3
18		Bhola	340350	162090	39421	24.3
19	Faridpur	Faridpur	202590	133050	33545	25.2
20		Rajbari	109230	71969	35235	49.0
21		Madaripur	112570	76024	29291	38.5
22		Gopalganj	146870	101438	60070	59.2
23		Shariatpur	117410	80835	20937	25.9
24	Khulna	Khulna	439440	147170	100891	68.6
25		Shatkhira	381730	139371	80361	57.7
26		Bagerhat	395910	128810	76746	59.6
27		Jessore	260690	190468	131046	68.8
28		Norail	69800	72341	38791	53.6
29	Kushtia	Kushtia	160880	104124	101623	97.6
30		Meherpur	75160	60954	54140	88.8
31		Magura	103910	73472	44983	61.2
32		Chuadanga	117410	86354	53679	62.2
33		Jhenaidah	196480	138935	119356	85.9

SI No	Region	District	Total Area (ha)	Cultivable Area (ha)	Irrigated Area ((ha)	Irrigated Area (%)
34	Rajshahi	Rajshahi	242540	195996	64924	33.1
35		Natore	190020	148871	94913	63.8
36		Naogaon	343560	281475	259638	92.4
37		Nawabganj	170250	126627	108704	85.8
38	Bogra	Bogra	289870	224700	201131	89.5
39		Pabna	237610	184905	159432	86.2
40		Sirajganj	240210	183220	143920	78.6
41		Joypurhat	10240	81250	64976	80.0
42	Rangpur	Rangpur	240060	209025	190484	91.1
43		Kurigram	224500	142443	120273	84.4
44		Lalmonirhat	124740	101034	67231	66.5
45		Gaibandha	211480	153608	115109	75.0
46	Dinajpur	Dinajpur	344430	288348	272845	95.0
47		Panchagar	104016	112799	77207	68.4
48		Thakurgaon	178170	151841	125959	83.0
49		Nilphamari	154660	83645	74049	88.5
50	Chattagram	Chattagram	528290	174701	77320	44.3
51		Cox's Bazar	249190	90900	57019	62.7
52		Feni	99040	69903	35748	51.1
53		Laxmipur	144040	109390	37361	34.2
54		Noakhali	368590	145353	35748	24.6
55	Rangamati	Rangamati	611610	124655	21689	17.4
56		Bandarban	447900	140457	15838	11.3
57		Khagrachori	274920	32454	18111	55.8
58	Comiia	Comilla	314630	227821	151213	66.4
59		Chandpur	164530	100996	61888	61.3
60		B.Barua	188120	142276	108951	76.8
61	Sylhet	Sylhet	345210	173372	71983	41.5
62		Habiganj	263660	199398	115265	57.8
63		Moulbibazar	279940	118798	74990	63.1
64		Sunamganj	374720	179662	164257	91.4

Source: Minor Irrigation Survey Report, Ministry of Agriculture (MOA), January 2021.

Note: It is not possible to comply with the comments as Agricultural Regions will not match with Hydrological Regions.



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