PROJECT PERFORMANCE ASSESSMENT REPORT

BANGLADESH

Integrated Agricultural Productivity Project

Report No. 182298
SEPTEMBER 1, 2023

IEG
Independent Evaluation Group

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Integrated Agricultural Productivity Project (TF-10378)

September 1, 2023

Finance, Private Sector, Infrastructure, and Sustainable Development

Independent Evaluation Group

Abbreviations

BADC	Bangladesh Agricultural Development Corporation
DIME	Development Impact Evaluation
FFS	farmer field school
GAFSP	Global Agriculture and Food Security Program
HYV	high-yielding variety
IAPP	Integrated Agricultural Productivity Project
IEG	Independent Evaluation Group
PPAR	Project Performance Assessment Report
WUG	water user group

All dollar amounts are US dollars unless otherwise indicated.

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This report was prepared by Samjhana Thapa, who assessed the project in July 2022. G. M. Monirul Alam assisted as an in-country consultant. The report was peer-reviewed by Abel Lufafa and panel reviewed by J. W. van Holst Pellekaan. Jean-Jacques Ahouansou provided administrative support.

Note: IEG = Independent Evaluation Group; PPAR = Project Performance Assessment Report.

Contents

Figure

Appendixes

Data

This is a Project Performance Assessment Report by the Independent Evaluation Group (IEG) of the World Bank Group on the Bangladesh Integrated Agricultural Productivity Project (P123457).

This lending instrument and the methodology for this evaluation are discussed in appendix C.

This report presents its findings based on a review of the World Bank's project documentation, other relevant materials, and interviews with a range of different stakeholders associated with the program, including government officials, implementing agencies, World Bank staff, other development partners, and civil society. Two impact evaluations—one from the World Bank and the other administered by an external agency—were also reviewed. An IEG mission visited project sites in Bangladesh (Barisal, Patuakhali, Rangpur, and Lalmonirhat districts) from June 27 to July 8, 2022, and from July 30 to August 1, 2022. A questionnaire was also distributed to collect information from the district and upazila (subdistrict) agricultural extension staff of relevant districts. IEG gratefully acknowledges the support of the World Bank office in Bangladesh, particularly for the guidance received from Samina Yasmin, senior agriculture specialist, and for the logistical assistance provided by Md Abul Fayez Khan, program assistant, before and during the mission.

Following standard IEG procedure, copies of the draft Project Performance Assessment Report were shared with relevant government officials for their review and comment.

Integrated Agricultural Productivity Project (P123457)

Basic Data

Country	Bangladesh	World Bank financing commitment	US$46.31 million
Global Practice	Agriculture and Food	Actual project cost	US$63.81 million
Project name	Bangladesh Integrated Agricultural Productivity Project	Expected project total cost	US$63.81 million
Project ID	P123457	Actual amount disbursed	US$46.23 million
Financing instrument	Specific investment loan	Environmental assessment category	B
Financing source	Global Agriculture and Food Security Program		

Dates

Event	Original Date	Actual Date
Approval	August 12, 2011	August 12, 2011
Effectiveness	September 15, 2011	September 15, 2011
Restructuring	July 30, 2015	July 30, 2015
Mid-Term Review	April 15, 2014	May 21, 2014
Closing	September 30, 2016	December 31, 2016

Key Staff Responsible

Management	Appraisal	Completion
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Summary

Background and Description

In response to the government of Bangladesh's strong commitment to a sustainable and diversified agriculture sector, the World Bank has been supporting the government to enhance agriculture productivity with investments in agriculture research, extension services, and technological development. With a grant from the Global Agriculture and Food Security Program, the Bangladesh Integrated Agricultural Productivity Project (IAPP) was financed to address the technology needs of marginal and small-scale farmers living in agroecologically constrained areas in the north and south of the country. The project targeted these areas given that they face significant environmental stress. Some of the districts in the north are more prone to seasonal droughts, cold snaps, and flash flood submergence, whereas the districts in the south that are closer to the coastal region face varying levels of salinity and tidal submergence.

The project aimed to address low productivity, limited crop diversification, and irrigation inefficiencies. The interventions supported by the project were for technology generation, adaptation, and adoption, promoting location-specific technologies and dissemination processes designed by coordinating with the decentralized extension services. The project put emphasis on community mobilization by working with existing (or forming new) farmer groups that would ultimately promote greater technology adoption by farmers.

The project development objective of IAPP, which remained the same during implementation, was "to enhance the productivity of agriculture (crops, livestock, and fisheries) in pilot areas" (World Bank 2017b, 1).

Results

This Project Performance Assessment Report assessed the project to have achieved its project development objective in enhancing productivity (that is, yields for rice, fish, and milk) in pilot areas. Adoption of high-yielding variety seed, improved agronomic practices and technologies, and access to irrigation by the farmers led to increased yields for all varieties of crops, including rice. For example, for the boro (winter) rice variety, yields in the project areas increased to 6,300 kilograms per hectare compared with a baseline of 5,450 kilograms per hectare. Over the project period, the crop productivity of 152,000 farmers increased. On fisheries, farmers have successfully adopted new technologies and production practices. This led to an increase in fish yields from a baseline of 2,700 kilograms per hectare to 5,420 kilograms per hectare. At project end,

48,177 farmers increased their fish productivity. In addition, the yield for milk increased to 2.86 liters from a baseline of 1.6 liters, reaching 50,652 farmers.

Project Design

The project design played an important role for IAPP to have successfully achieved its results. Although the project has been closed for several years, IAPP's design features were widely appreciated by stakeholders interviewed by the Independent Evaluation Group.

The project appropriately addressed key constraints faced by farmers to enhance their productivity, through improved generation, adaptation, and availability of seed and production practices for crops and fisheries that were combined with investments in irrigation. This led to changes in farmers' behaviors from using traditional, low-yielding varieties before the project to adopting high-yielding variety seed and agronomic practices.

An important feature of the project design was the participatory and demand-driven technology adoption model based on farmer group approaches (for example, farmer field schools). In the crop sector, the decentralized structure of extension services worked well, consisting of a network of extension staff of the Department of Agricultural Extension and other local agencies, which were supported through district- and community-level staffing that engaged farmers on technology dissemination and adoption. Emphasis was given to community mobilization, and the phased process of dissemination and adoption that brought ownership of the project activities resulted in higher adoption rates of the technologies and practices by the farmers.

The project's supply-side approach, with an absence of activities to ensure market access, was a missed opportunity in the project's design, considering that high commercialization of farm production exists in Bangladesh. Finally, the project's design did not include activities to enhance increased participation of the private sector in the seed market.

Nevertheless, the strength of the project design was the technology generation and adoption mechanisms and production practices that were disseminated through a participatory and demand-driven approach. The key gap in project design was the absence of activities on market access.

Implementation and Sustainability

During project implementation, the Project Management Unit's strong capacity was instrumental in project planning, monitoring, and facilitating collaboration among

implementing agencies. The activities of the various agencies were coordinated well, with relevant bodies at the national, regional, and district levels periodically meeting for project planning, implementation, and coordination. This led to improved links between research and extension services that resulted in faster and more efficient dissemination of technologies. Technical assistance and capacity-building activities geared toward local extension workers and farmer organizations were instrumental in improving technology dissemination and adoption. Further, the technologies generated and disseminated were suitable for the districts that were facing different environmental challenges (for example, drought, flooding, and salinity).

Although this Project Performance Assessment Report concludes that the project was successful in achieving its development objective of enhancing agricultural productivity (that is, yields for rice and fish), some of the factors that contributed to the achievement of project outcomes have been inconsistently pursued (which may impair the sustainability of increased productivity in the longer term). For example, since project closure, financial resources to sustain the links among institutions responsible for research and extension have been limited. Although there is evidence of better information flows between these institutions, the technology generation and adoption mechanisms that were promoted by the project were not formally continued. Similarly, only a few of the local institutions (for example, farmer field schools and seed villages) that were established by the project remain functional.

In summary, this Project Performance Assessment Report rates the overall outcome of the project to be satisfactory based on high relevance of design, substantial overall efficacy, and high efficiency. However, the sustainability of this outcome is at risk. The Independent Evaluation Group's final project ratings are described in appendix A. The evaluation methodology and evidence sources are described in appendix C.

Lessons

This assessment draws the following lessons:

- A design based on participatory demand-driven technology research and adoption programs with strong community mobilization efforts attracts strong buy-in from farmers, but sustainability of the design requires continued monitoring and technical support.
- Improved links between research and extension and farmers require strong governance and oversight structures to be in place. This was evident in the expost review of this project, which found that sustainability is threatened by a lack of public financing of these links to ensure the utility of the outcomes as public goods.

- Monitoring and evaluation systems need to be built, not only to separately assess the impact of single project interventions but also to track multiple interventions, such as the joint effects of irrigation and improved seed technologies on yield increases of the type achieved in this project.

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1. Background, Context, and Design

1.1 Bangladesh has made remarkable progress in the past 50 years since its independence, but the country still faces considerable challenges. From being one of the poorest countries in the world, affected by frequent natural disasters and famines, Bangladesh rose to become a lower-middle-income country in 2016 (World Bank 2021c). Since 2000, the country's GDP growth has averaged close to 6 percent annually. The country's growth from exports of ready-made garments created jobs and income that, together with remittances, led to substantial reductions of poverty and improved food security. The national poverty rate fell from 48.9 percent to 24.3 percent between 2000 and 2016, whereas extreme poverty declined from 34.3 percent to 12.9 percent (World Bank 2021a). The COVID-19 pandemic interrupted growth, but the country navigated the economic impact relatively well (World Bank 2022a). Despite these positive trends, the country's vulnerability to climate change,[1] in addition to natural calamities such as floods and droughts, continues to pose serious risks to poverty reduction and growth. Disparities still exist, particularly in the country's northwest and south, in relation to access to education, health care, and other basic services.

1.2 The agriculture sector plays an important role in the economy and has addressed challenges related to poverty and the country's vulnerability to natural calamities. Most people living in rural areas are engaged in agriculture, which has been a powerful driver of poverty reduction, accounting for 69 percent of poverty reduction from 2005 to 2010 and 27 percent from 2010 to 2016 (World Bank 2022a). The sector's contribution to GDP has been declining, but agriculture still employs 38 percent of the population (World Bank 2022a). During 2000–10, the sector performed well, sustaining an average growth rate of 5 percent as a result of productivity growth and experiencing yield increases for most of its crops. However, this growth has now slowed, mainly because of a recent decline in total factor productivity, along with a decline in the growth of inputs since the 1990s (Genoni et al. 2021). During the 1990s, the sector implemented some important policies, such as the liberalization of agricultural inputs markets, seed sector reforms, and others, which contributed not only to food security and the reduction of poverty but also to total export earnings.

1.3 Despite these advances, the agricultural sector faces several constraints to producing diversified food supplies to the domestic market through increased productivity and better management of natural resources. In Bangladesh, many farmers continue to use traditional, low-yielding crop varieties and breeding stock, along with outdated crop and livestock management practices, and there is low availability of good-quality seed and improved breeds of livestock and fish at the farm level. There has been progress on the development of new technologies, but there continues to be

insufficient relevant technologies suitable for the environmental constraints of the country. Current agricultural extension services are inadequate; therefore, there are challenges regarding the dissemination and adoption of new technologies by farmers. Further, despite the wide coverage of irrigation, agricultural water management is weak. Finally, farmers are not always linked to markets, and there is a relatively constrained role for the private sector (World Bank 2021c).

Objective, Financing, and Design

1.4 **Background.** The World Bank has been an important partner supporting the government of Bangladesh in addressing its key priorities in agriculture—improving productivity and achieving food security, enhancing nutrition through diversified food, and building resilience to climate impacts. The World Bank's agriculture lending portfolio for Bangladesh amounted to nearly $2 billion in 2022, and it is among the top five countries in terms of the share of the World Bank's portfolio allocated to the agriculture sector. The World Bank has, therefore, responded well to the government's priorities by preparing several sectoral analytical products and committing to a comprehensive lending program that consists of continued investments in technology generation and adoption, livestock and dairy, climate-smart agriculture and water management, food storage facilities, entrepreneurship, and livelihood programs. A comprehensive Program-for-Results operation is in the pipeline that aims to focus on the following thematic areas: (i) sustainable food and nutrition security, (ii) increasing income and livelihood opportunities for farmers, and (iii) modernization of agricultural research, education, and extension.

1.5 Agricultural research, extension, and technology development has been one of the key areas of World Bank assistance to enhance agricultural productivity in the country. The World Bank has invested for some time in supporting the national research and technology system through a series of adaptable program loans. The phased approach (I and II) of the adaptable program loan program focused on institutional development of key agricultural research, technology, and extension institutions, along with interventions that would operationalize institutional reforms through support to demand-driven and participatory research and extension services in the first phase (National Agricultural Technology Project I). The second-phase project (National Agricultural Technology Project II) is currently under implementation, which began toward the end of the Bangladesh Integrated Agricultural Productivity Project (IAPP). The IAPP was financed by a grant from the Global Agriculture and Food Security Program (GAFSP) to address the technology needs (for example, higher drought, flood, or cold tolerance, higher yield, shorter duration to maturity, and improved breed stock) of marginal and small farmers living in specific agroecologically constrained areas of the country. This project (the focus of this Project Performance Assessment Report [PPAR])

aimed to address low productivity, limited crop diversification, and irrigation inefficiency. The interventions supported by the project on technology development and adaptation promoting location-specific technologies and dissemination processes were designed to be coordinated with the decentralized extension services. The project placed emphasis on community mobilization and involvement and working with existing (or forming new) farmer groups that would ultimately promote greater technology adoption by farmers.

1.6 **Objective.** The project development objective of IAPP, which did not change during implementation, was "to enhance the productivity of agriculture (crops, livestock, and fisheries) in pilot areas" (World Bank 2017b, 1).

1.7 The project was primarily aimed at small-scale and marginal farmers. The project covered the following eight districts of the country: Rangpur, Kurigram, Nilphamari, and Lalmonirhat in the north and Barisal, Patuakhali, Barguna, and Jhalokati in the south. The project targeted these areas because they faced significant environmental stress (seasonal droughts, cold snaps, and flash flood submergence in the north; varying levels of salinity and tidal submergence in the south). Thus, about the start of the project, poverty rates in the northwest and southern regions were higher than the national average. All four targeted districts in the north suffered acute seasonal deprivation and famine-like conditions—a phenomenon locally known as monga (World Bank 2017b).

1.8 **Financing.** The project was approved on August 12, 2011, and closed on December 31, 2016 (compared with the original closing date of September 30, 2016). The project was financed through a grant of $46.31 million from the GAFSP and cofinancing of $17.5 million from the government of Bangladesh. The project underwent one level 2 restructuring in July 2015, which revised the results framework to add missing baseline values. There were no other changes made during the project's implementation.

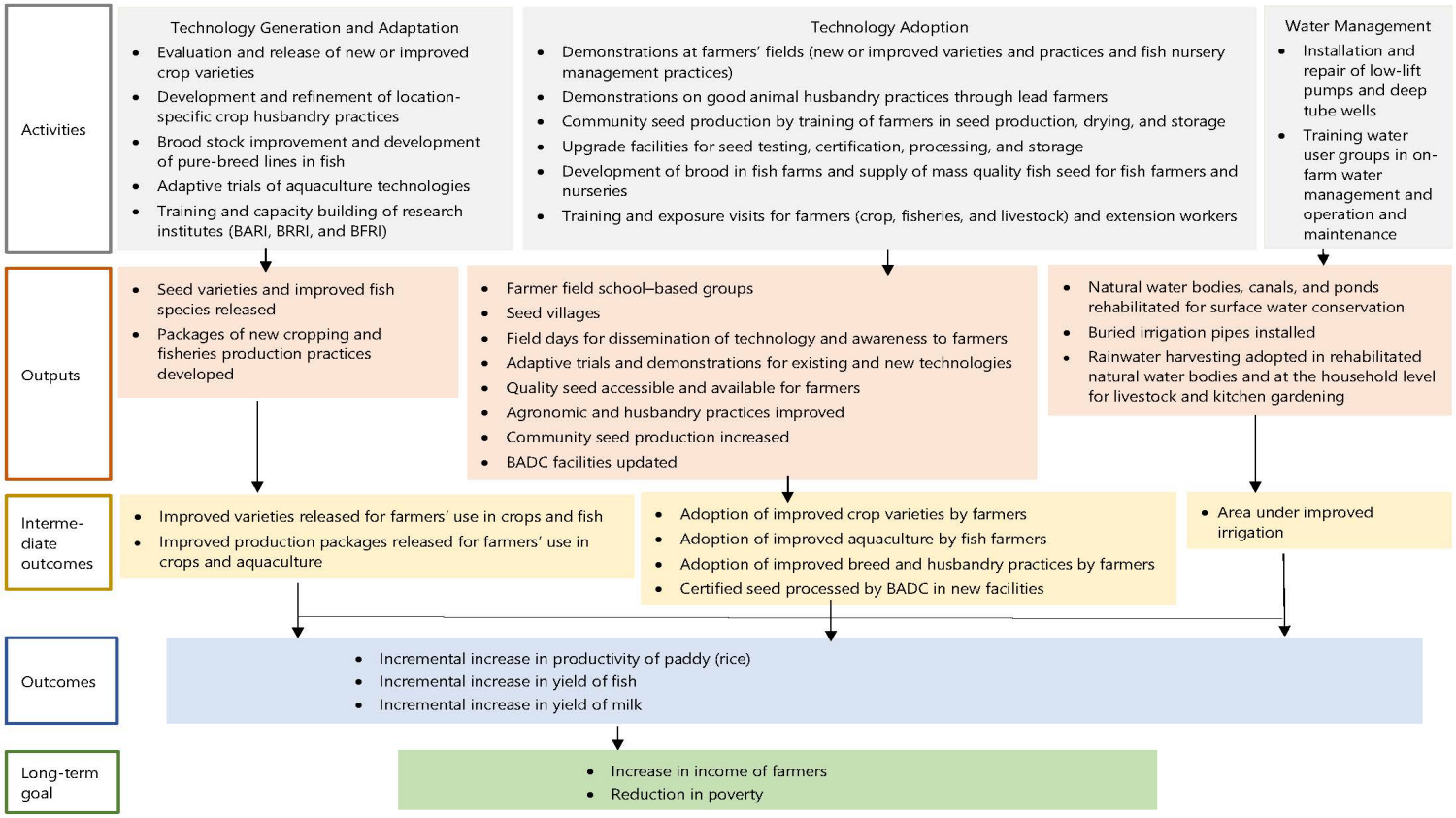
1.9 **Design.** The project included four major components (see appendix A for details). Component 1 focused on technology generation and adaptation by releasing high-yielding varieties (HYVs) of seed and production-intensifying technologies to crop, fish, and livestock farmers. Component 2 aimed to enhance technology adoption by working with farmers in the project areas to adopt improved seed and agricultural production technologies and management practices for crops, livestock (milk), and fish production to increase their productivity and promote production intensification and diversification. Component 3 financed interventions on water management and irrigation to improve water usage efficiency, expand the irrigated agricultural land area for enhanced cropping intensity and patterns, and reduce irrigation-related risks in crop production. Component 4 supported project management activities related to project

planning, coordination, compliance with fiduciary and safeguard standards, and monitoring.

1.10 Eight different agencies implemented the project. Three agencies (the Bangladesh Rice Research Institute, the Bangladesh Agricultural Research Institute, and the Bangladesh Fisheries Research Institute) focused on technology generation and adaptation (component 1). The Department of Agricultural Extension, the Department of Fisheries, and the Department of Livestock Services were responsible for technology adoption and dissemination through extension (component 2). The Bangladesh Agricultural Development Corporation (BADC) implemented the water and minor irrigation activities (component 3), including processing and distribution of certified seed (component 2),[2] whereas the Seed Certification Agency was responsible for seed certification of newly produced seed by BADC and the farmers.[3]

1.11 **Theory of change and result indicators.** Neither the Project Appraisal Document nor the Implementation Completion and Results Report Review constructed a theory of change because it was not required at that time; therefore, we prepared a new theory of change for this PPAR (figure 1.1). The project design is based on the premise that new and adapted technologies developed by research institutions disseminated through community and demand-driven extension services would lead to increased adoption and eventually higher yields. Rehabilitated irrigation systems were expected to lead to more intensive or diversified agricultural production. The project components and activities were aligned to meet these objectives. The result indicators presented in the Project Appraisal Document are included in appendix A.

Figure 1.1. Theory of Change



Source: Independent Evaluation Group field mission.
Note: BADC = Bangladesh Agricultural Development Corporation; BARI = Bangladesh Agricultural Research Institute; BFRI = Bangladesh Fisheries Research Institute; BRRI = Bangladesh Rice Research Institute; FFS = Farmer Field School; O&M = operation and maintenance; WUG = water user group.

2. What Worked, What Didn't Work, and Why?

2.1 During project implementation, the World Bank's Development Impact Evaluation (DIME) team was engaged and led the impact evaluation of the project. There was an additional impact assessment—a third-party evaluation (BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016) commissioned by the project and prepared by a consulting firm based in Dhaka. These evaluations were comprehensive and assessed the project to have achieved its objective of enhancing agricultural productivity. This PPAR builds on these evaluations to emphasize the factors behind the successful achievement of the project and to assess whether the project's achievements have been sustained.

2.2 This project covered several crops (for example, rice, wheat, and maize), pulses and oilseeds, and fisheries and livestock; however, in this PPAR, we focus our assessment only on the extent to which the productivity of rice was increased (as representative of achievements in the crop subsector and investments in irrigation) and productivity increases in fish production.

Results

2.3 Adoption of HYVs of seed, improved agronomic practices and technologies, and access to irrigation have been critical for enhancing agricultural productivity. Rice is the main staple crop of Bangladesh. Rice production accounts for 77 percent of the country's gross cultivated area and is produced in three seasons: aman (monsoon), boro (winter), and aus (spring). Experience from many developing countries demonstrates that HYVs of seed are a critical input for sustained agricultural productivity (Ahmed, Islam, and Mujeri 2021). Research in Bangladesh has shown that farms that have switched from local to HYVs have experienced a 35 percent higher yield and a 76 percent higher profit than nonadopting farmers (Rahman and Connor 2022). Along with agricultural inputs, irrigation is known to increase agricultural productivity, with irrigated land found to be twice as productive compared with nearby rain-fed land (FAO 2011). In Bangladesh, irrigation has proved to be one of the most critical factors for increased agricultural productivity. As a result of irrigation, rice production has tripled in the country since the early 1970s (Gatzweiler and von Braun 2016).

2.4 Use of HYVs of seed increased among farmers. During project implementation, five varieties of rice, including salinity-, drought-, and flood-tolerant types relevant to the districts, were released (see table D.1). By project end, 152,000 farmers (against the target of 140,000) were using HYVs of seed for all crops. Against a baseline of 9 percent of farmers who used HYVs, 62 percent of farmers were using HYVs at project closing.

Conversely, although 82 percent of farmers were using local varieties of seed at baseline, there was a drastic reduction (93 percent) in farmers using local varieties at project closing (see table D.2;[4] BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016). Further, there was a positive impact on the adoption of the rice varieties in the regular treatment group compared with the control group—farmers who were provided seeds by IAPP ("adoption farmers") were 19 percentage points more likely to adopt them (World Bank 2016b).[5] The interviews that the assessment mission of the Independent Evaluation Group (IEG) conducted with a small, purposively selected group of farmers in the four districts and the questionnaires completed by the district officials found that farmers continued to use HYVs of seed after the project closed, including newer varieties generated by the research institutes. Some of the location-specific seed varieties (with saline, drought, or flood resistance characteristics) introduced by the project were in high demand and continue to proliferate.

2.5 Farmers have adopted improved production practices and technologies; some have been scaled up. The project promoted various production technology packages to enhance productivity. For rice, the technologies included improvements in the application of fertilizer and fungicide, more efficient water distribution through flexible polythene pipes, and improved management practices in dry fields to mitigate climate change (see table D.1). Demonstration trials on the farms and training through field days led to technology uptake. For example, one of the successful technologies introduced was the production and use of vermicompost fertilizer. Vermicomposting is a simple technology that uses earthworms to convert households' biodegradable waste into organic manure. The land in some of the project areas had low micronutrients; thus, the introduction of vermicompost helped improve soil health. Farmers in the areas have learned to produce vermicompost for their own use, and some have also become entrepreneurs and are selling it to their neighbors and earning an income. In fact, adoption of vermicompost fertilizer has been increased nationally, which was pointed out by many stakeholders interviewed during the assessment mission and documented by reports and articles in Bangladesh (Shahidullah 2022).

2.6 Irrigation technologies introduced were successful in improving water use efficiency and mitigating climate change. To improve water use efficiency, buried pipe network connections, low lift pumps, and deep tube wells were installed. One of the technologies introduced for the first time in the southern region—buried pipes—was constructed covering 9,980 hectares of land. These flexible polyethene pipes promoted efficient water distribution and had high adoption rates (see table D.3). According to an analysis done by the Food and Agriculture Organization, the efficiencies associated with this technology led to water losses being reduced by 22.4 percent. Further, there was high adoption of other water management technologies, such as alternate wet and

drying, that also helped reduce water losses in rice area cultivation, which increased from a baseline of 8.5 percent to nearly 30 percent of farmers (BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016). This technology ultimately helped mitigate climate change. Various studies show the contribution of flooded irrigation fields that are applied with fertilizer to climate change through the release of methane,[6] which is avoided through this technology. Further, open canals require land from farmers, whereas underground pipes allowed farmers to continue cultivating their land, which was one of the key drivers for farmer adoption of this technology. Since the project closed, the government implementing agency, BADC, has increased investments in this technology in the northern districts of the country by constructing 60 deep tube wells and 30 kilometers of buried pipeline using the government's own resources. As a result, 600 hectares of land are under improved irrigation, reaching 10,000 beneficiaries.[7]

2.7 There were mixed results regarding the maintenance of rehabilitated water infrastructure and institutional development of water user groups (WUGs). IAPP had rehabilitated natural water bodies, public canals, and ponds for improved water conservation and use of surface water covering an area of 17,705 hectares. During project implementation, it established 605 WUGs, benefiting 51,690 farmers. IEG's assessment mission found mixed results, with some infrastructure in suboptimal condition and needing maintenance. This finding was also validated by the responses received from the questionnaire administered by IEG to district officials. One of the key reasons cited for limited or lack of maintenance of infrastructure was continuous weak capacity of the WUGs that were established and mandated to maintain the infrastructure. Further, IEG found that there was limited monitoring or follow-up from BADC on the status of some of the infrastructure rehabilitated through IAPP and on the institutional development of WUGs after the project had been closed. BADC was unable to provide information to IEG on the operational status of WUGs established under IAPP.

2.8 Yields for rice have increased, and use of HYVs of seed contributed to these results. As a result of high adoption of HYVs of seed, improved production practices, and access to irrigation, agricultural productivity in the project areas increased. Regarding the factors affecting the agricultural productivity gains, DIME found that the use of new seed and urea (fertilizer) was correlated with higher yields. For boro (winter) rice varieties, yields in the project areas increased to 6,300 kilograms per hectare compared with a baseline of 5,450 kilograms per hectare, which was validated by the third-party evaluation (see table D.4; BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016). More than 80 percent of crop farmers reported that their yield per hectare had increased since they joined the project (World Bank 2017a). Further, DIME reported the following results: (i) there was an increase of approximately 14 percent in yield for rice in the regulator treatment group compared with the control group; (ii) compared

with farmers in control villages, IAPP crop farmers were not only growing one of the specific rice varieties promoted by IAPP but were also more likely to diversify their production away from rice with greater adoption of mung (20 percent), lentil, and mustard (6 percent); and (iii) income levels of crop households increased by 15 percent during 2014–16. Further, these yield increases were achieved in all districts in both the northern and southern regions, which had different agroecological conditions. In both the regions, the drivers for success were the same, with the project releasing location-specific seed technologies suitable to the area that were adopted by farmers through the support of the extension services, along with the availability of irrigation. After the project closed, except for one district, there is evidence that yields for rice in the IAPP districts have increased (see table D.5).

2.9 Local institutions established by the project for technology dissemination and seed availability were important factors for the project's success, but most of the institutions are no longer functioning. Once the seed technologies and production packages were available from the research institutes, the project relied on the farmer field schools (FFSs). FFSs were conduits for the new and improved varieties and agronomic practices to be disseminated to farmers. During project implementation, 7,246 FFSs (25 members each) were established, serving more than the target of 180,000 farmers (about 33 percent were women farmers). Besides working with FFSs for technology dissemination and adoption, to address the challenges of seed availability, IAPP promoted community production of seed by establishing seed villages consisting of farmer groups that were supplied with foundation seed and that would produce seeds and sell to other farmers in the villages. Under the project, 246 seed villages were established to promote farmer-to-farmer seed exchange, with quality controls and field inspections conducted by the Bangladesh Seed Certification Agency. Each seed village consisted of 50 farmers with 10 hectares of land. At project end, the seed villages produced 12,960 metric tons of seeds against a target of 15,059 metric tons (World Bank 2017a). Training was provided to farmers on seed production, drying, and storage. The IEG assessment mission found that some farmers continued to produce seed, and a few had become local seed entrepreneurs. The seed villages approach was therefore considered by many respondents interviewed by IEG's assessment mission as a successful activity promoted by the project. However, since the project closed, without continued support and monitoring from the Department of Agricultural Extension, few of these institutions were sustained.

2.10 Use of improved varieties of fish, better production practices, and adoption of aquaculture by farmers have enhanced fish productivity. IAPP supported the Bangladesh Fisheries Research Institute, which introduced nine improved generations of fish varieties (four generations of tilapia, three generations of koi carp, and two

generations of pangas catfish). The Bangladesh Fisheries Research Institute and the Department of Fisheries provided technical assistance and germplasm to private and public hatcheries in the districts to produce quality fish fry. Fish production in the villages was supported through adaptive trials in farmers' ponds, which were provided good-quality seed from public and private hatcheries. IAPP worked with the Department of Fisheries, which offered training on aquaculture, pond productivity, integrated farming system, fish feed formulation, nutrition, and seed production techniques and delivered aquaculture technology packages. The Department of Fisheries mobilized demonstration, arranged field day and exchange visit for the fish farmers, and supported adopter farmers, who would get firsthand knowledge from demonstration farmers. The project supported, on a sliding basis, with training in nursery management and provision of quality seed. Key results for fisheries are presented in this chapter.

2.11 Yields for fish have increased, and farmers have adopted the technologies introduced. At project end, the project had reached 60,000 members of total 2,433 fish farmer groups. As a result, 48,177 farmers increased their fish productivity, and compared with a baseline of 2,700 kilograms per hectare, fish yield increased to 5,420 kilograms per hectare. According to the DIME evaluation conducted at project end, compared with the control group, IAPP fish farmers had a significantly higher percentage of households with larger-size mature fish production (19 percent) and had overall a more efficient use of inputs to fishery ponds. Over the period of 2014–16, income levels of fishery households also increased by 37 percent, compared with non-IAPP households (World Bank 2017a). Further, a separate study conducted at project end found that production of fish fry increased in all hatcheries, and the farmers were making profits (BFRI 2016). These findings were validated during the IEG assessment mission's interviews with stakeholders, including with district fisheries officers and fish farmers. In particular, the feedback from the districts in the southern region (for example, Barisal and Patuakhali) was that before the project, tilapia and catfish (pangas) fish breeds introduced by the project were limited in production and scale, but now they are widely adopted by farmers and have made an important contribution to people's livelihoods. The majority were marginal and small-scale farmers. One of the reasons for the success of the technology adopted was that the tilapia fish variety released adapted well to variability in climate, particularly its tolerance to low water levels and inferior water quality with rainfall variation, temperature fluctuations, and salinity changes (Rahman, Shahjahan, and Ahmed 2021).

2.12 Fish varieties adopted were in high demand in the local market, but high prices for fish feed were a challenge. During project implementation, fingerling nurseries among farmers grew from 17 percent to 69 percent (BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016). In the project districts, the IEG assessment mission found

that fish fry is easily accessible and available to farmers from the hatcheries (both public and private). The fish raised by farmers had high demand in the local markets, which were generally accessible to farmers where the rural road network was good. Further, some of the technologies introduced, such as cage and pen cultures, benefited poor fishers and farmers (World Bank 2017a). The fish varieties that were developed under IAPP continued to increase in the follow-on World Bank–supported National Agricultural Technology Project II, which is currently under implementation in 56 districts (including one IAPP district). In the fish breeds supported by the project, there has been growth in production at the national level. Although technology adoption is high, stakeholders interviewed by IEG stated that prices for fish feed had increased (which is a challenge for marginal farmers). Fish feed produced by local feed companies is dependent on imported raw materials (for example, corn and soybean), and current price increases in world markets have raised their production cost. IAPP did not finance any major activity on fish feed, but the follow-on project (National Agricultural Technology Project II), which is currently under implementation, includes interventions that provide training and investment support to fisheries producer organizations. These have established pellet machines for formulating fish feed using locally available ingredients to enhance local access to and availability of fish feed (World Bank 2021b).

What Worked

Project Design

2.13 The project design appropriately targeted inputs, such as seed varieties and improved irrigation—key constraints faced by farmers to increase productivity. The project was appropriately designed to address on-farm productivity constraints among farmers in environmentally challenged districts in the north and south, who had limited knowledge of and access to relevant technologies, production practices, and irrigation. IAPP's support to demand-driven public extension services, which promoted adoption of high-yielding seed for rice and various other high-value crops suitable for the locations, was relevant because before the project, the farmers in the pilot areas were using traditional, low-yielding crop varieties.

2.14 The stakeholders interviewed during the IEG assessment mission and feedback received through the questionnaire administered by the Department of Agricultural Extension officials validated these constraints. They also acknowledged the contribution that HYVs of seed and production practices provided through the extension system under IAPP, and improvements in irrigation management that helped increase yields for crops. The project did not focus on delivery of chemical fertilizer; this was found to be less of a constraint for farmers in the districts covered by the project. In Bangladesh, more than 95 percent of farmers already use chemical fertilizer, and it is available at

affordable prices (World Bank 2016a).[8] Reforms undertaken by the government in the 1990s, which enabled increased participation of the private sector in the distribution of fertilizer, are credited with this achievement.

2.15 The farmer group-based approach to extension at the village levels was effective for adoption of technologies. A group-based approach that focused on bottom-up planning and farmer participation and promoted learning from each other was a well-tested method that has worked in other countries in the region. With the help of the Department of Agricultural Extension, the Department of Fisheries, and BADC's field staff, alongside district or community facilitators hired by the project, local communities were organized into groups (that is, FFS crop groups, fishery groups, seed villages, and WUGs) for planning and promoting the adoption of technologies and production practices. A phased approach was followed, in which a few farmers were selected for demonstration of varieties and technologies and were provided with inputs (seed, fertilizer, and agronomic practices) during the first year, whereas other group members were sensitized through demonstration plots. In the second year, the project supported other members known as adoption farmers, who were provided with the technologies, along with a limited set of inputs. The project then started monitoring adoption of new varieties and technologies after the third year (which was an effective technology adoption and demonstration model). The process of community mobilization focused on technical support, which involved dissemination of technologies and production practices, including training of farmers to develop norms and values of working in groups and improving their governance (World Bank 2011). This participatory approach brought ownership of the activities among the farmers that resulted in higher adoption of the technologies and practices.

2.16 The project interventions were closely aligned with the government's strong commitment to technology generation and adoption through decentralized and demand-driven agricultural research and extension services. This commitment was laid out in various policy documents (for example, the 2012 National Agricultural Extension Policy).[9] The government's endorsement of the Country Investment Plan that was prepared as part of the application process for the GAFSP funding also demonstrated the project's alignment with the country's needs and government priorities at appraisal (World Bank 2017b).[10] Further, in Bangladesh, before the project, several donors (for example, the Danish International Development Agency, the United States Agency for International Development, and the International Fund for Agricultural Development) were active in the sector with the World Bank and the International Fund for Agricultural Development and had invested in a national program to build the capacity of the country's agriculture research system to develop relevant technologies. This project's design focused on the next generation of support in assisting with links

between agricultural research (technology generation) and extension—which was found to be timely and appropriate. Notably, these links were built on platforms that understood how to engage with and facilitate the uptake of the innovations among farmers.

2.17 Finally, the project's focus on three key areas of agriculture production—crops, livestock, and fisheries—was relevant to the structure of mixed farming followed in rural Bangladesh and was important for food security and nutrition. Addressing the challenges farmers faced in the districts covered by the project related to climate change and population pressure and volatile food prices, the project's focus on all these key areas of agriculture production was justified. As discussed in chapter 1, poverty rates in these districts were higher than the national average; therefore, this project's approach was important for food and nutrition security, including for addressing challenges small-scale and marginal farmers in the districts faced as a result of high risks and uncertainty from their seasonal or irregular income.

Implementation and Sustainability

2.18 Technologies disseminated were suitable for districts with different agroecological and environmental challenges. During implementation, crop and fisheries technologies were introduced that were suitable for districts with different environmental challenges. Districts in the south were exposed to salinity and tidal submergence, whereas in the north, districts were prone to droughts and flash flooding. In the south, one of the successful rice varieties introduced by the Bangladesh Rice Research Institute was BRRI dhan 61, which could tolerate saline water for several weeks and was well accepted and cultivated by the farmers in the southern region.[11] Similarly, for fish, the varieties introduced tolerated salinity and temperature fluctuations. Given that Bangladesh has been facing increased soil and water salinity because of rising sea levels,[12] technologies that were adapted to and suitable for their areas were a critical contribution of the project. In addition to introducing HYV seeds for rice that were salinity tolerant, drought resistant, and faster to mature, introducing other seed varieties for high-value crops (such as mustard, sunflowers, mung beans, and local vegetables) promoted crop diversification, which was suitable for communities that faced low and variable productivity and those that followed mixed farming.

2.19 Improved links between research and extension promoted by the project led to faster and more efficient dissemination of technologies. During project implementation, the institutional arrangements put in place based on the project's design were effective in promoting useful links among research-extension farmers (which led to faster delivery of technologies from research to farmer adoption). According to stakeholders interviewed during the assessment mission, before the project implementation, the

duration between technology generation and dissemination was as much as 10 years. During the project's implementation, those technologies that were at the final stages of release or shelf ready were introduced (which reduced the duration to 3–4 years). The Project Management Unit had a strong capacity that facilitated collaboration among implementing agencies that focused on research and those that disseminated technologies at the farm level. They were supported by two regional implementation units, located in the northern and southern regions, respectively, which closely monitored project activities in each of the four districts the regions covered. Further, each implementing agency deputed technical coordinators to work with the Project Management Unit housed at the Ministry of Agriculture. For governance and oversight of the project, several committees existed at the national, regional, and district levels that met regularly to guide project management. These decentralized mechanisms were critical for improved project planning, monitoring, and coordinating activities of implementing agencies.

2.20 The technical assistance and capacity-building activities worked well and contributed toward the strengthening of a decentralized model of extension. The technical assistance component managed by the Food and Agriculture Organization to build the capacity of the Project Management Unit, implementing agencies, and farmer organizations complemented the project interventions well and helped the project promote a decentralized extension for technology adoption. The Food and Agriculture Organization trained local extension staff and community facilitators on social and group mobilization and helped develop training modules, which were embedded in the curriculum of the government's training institutes. The exposure visits that were organized for lead farmers, their representation on the project's steering committee, and the establishment of an umbrella organization of farmers (that is, Sara Bangla Krishok Jote)[13] helped give prominence to the role of farmer-based organizations and their contribution to improving the productivity of the sector.

2.21 The monitoring and evaluation of the project was generally implemented well and relied on externally managed baseline, midterm, and endline impact evaluations. During project implementation, monitoring and evaluation activities were based on a monitoring and evaluation strategy and a plan that had laid out roles and responsibilities for each of the implementing agencies. The indicators in the results framework included methodologies for data collection (source and type of data collection), which were then used as a tracking tool. The project relied on an impact evaluation by the World Bank's DIME, which included baseline and midterm surveys whose results were used during project implementation, along with an impact evaluation done at project end. An additional external third-party evaluation was also conducted by a local firm. At Mid-Term Review, some weaknesses were identified

related to delays and data collection in the field, which were addressed. At the same time, a web-based project management information system was introduced that allowed real-time monitoring of information at all levels (that is, central, regional, upazila [subdistrict], and community) based on input-output cards completed by the beneficiaries through a mobile application. This regular and effective collection of project performance data made an important contribution to design and implementation iteration.

What Didn't Work

Project Design

2.22 IAPP's interventions focused primarily on enhancing agriculture productivity, without promoting market access. During design, the government had requested that a marketing component be included in the project to support farmers with their surplus production. The final project design did not include it; hence, the supply-side approach with no attention to market access was a missed opportunity of project design, considering that commercialization of farm production is high in the country. In Bangladesh, approximately 7 out of 10 households sell part of their produce in the market (Genoni et al. 2021). Stakeholders interviewed during the assessment mission reported that crop farmers faced marketing challenges.[14] Limited information about markets and the inability to aggregate and supply adequate quantities as per market demand were mentioned as challenges, whereas broader enabling factors, such as the quality of roads and distance to markets, were also highlighted. International experience shows that to accelerate smallholder-based agricultural transformation, interventions are needed, in tandem, to address the joint challenges of productivity, market access and connectivity, value addition and distribution, and risk mitigation (Farmer Income Lab 2022). Despite the absence of a marketing component in this project, the follow-on project (National Agricultural Technology Project II) that the World Bank is currently supporting in Bangladesh does include support for marketing infrastructure. This could be based on the lessons learned from the IAPP project, although the new project documents do not explicitly refer to this gap in terms of lessons from this project.

2.23 The project design did not address the enabling environment for the private sector's participation in the seed market. As part of the reforms introduced in the early 1990s, Bangladesh prepared its National Seed Policy 1993, which promoted greater engagement of the private sector with the seed industry. In particular, the policy aimed at (i) limiting government (BADC) seed production of notified varieties—rice, wheat, potato, jute, and sugarcane; (ii) gradual withdrawal of BADC from seed production of all other crops; (iii) requiring BADC seed prices to better reflect their cost; and (iv) phasing out of subsidies to BADC (Ahmed, Islam, and Mujeri 2021). Since then,

although reforms, including the enactment of the Seed Act 2018 and Seed Rules 2020, have opened the seed market to the private sector, the high dominance of the public sector in producing and distributing subsidized seed for notified crops may be crowding out private sector investments. During this period, Bangladesh's private sector in the seed market has increased its capacity on technology generation and dissemination, as well as on production and distribution of seed.[15] However, the private sector continues to face certain regulatory barriers that prevent it from participating in research and development of seeds. Further, the certification process for seeds developed by the private sector takes a long time (Genoni et al. 2021). Several analytical products produced by the World Bank and others have alluded to this important barrier. Considering that there continues to be a high deficit between demand and supply of seed in Bangladesh,[16] the project design did not include any policy or capacity-building activities to support the government to implement reforms that would enhance private sector participation in the seed market.

Implementation and Sustainability

2.24 Building the capacity and sustainability of seed villages was given inadequate attention during project implementation. Establishment of seed villages aimed to promote farmer-to-farmer seed exchanges and enhance sustained availability of HYVs of seed for farmers. Given that Bangladesh continues to have a deficit of seed availability, community production of seed was an important source of seed supply in the villages. However, there is no evidence in the Implementation Completion and Results Report, or anything discovered by IEG during field interviews, that the project paid attention to sustaining the capacity of seed villages to enhance their role in producing and distributing seed after the project closed. During implementation, the project had been unable to produce timely information about the activities supported by the project on the number of seed growers or the quantity of seed produced and distributed through the formation of seed villages (which were repeatedly highlighted as missing in the World Bank's supervision reports). The Implementation Completion and Results Report also raised concerns about the lack of sustainability of seed villages. Absence of institutions of farmers, such as seed villages established by the project for enhancing the availability of HYV seeds, could negatively impact the sustainability of increases in agricultural productivity.

2.25 The project aimed to link farmers to the private sector, but such collaboration was found only in the fisheries sector. The Project Appraisal Document (World Bank 2011) stated that the project would promote the formation of seed growers' associations and that seed out-grower schemes would be encouraged to link with the private sector. However, no evidence was found that a seed growers' association was formed or that partnerships were developed between farmers and private seed producers. Conversely,

the project's collaboration with the private sector was better in the fisheries sector,[17] where private hatcheries actively participated and played an important role in the production and sale of fish fry to farmers.

2.26 The exit strategy developed by the project to sustain the FFS established by the project was weak. IAPP provided various technical and capacity-building training to farmers through FFSs. The project registered FFSs with the Department of Cooperatives, and, at project end, about 83 percent of the FFSs were registered and federated at upazila and district levels (World Bank 2017a). As per the aide-mémoire of the Mid-Term Review, FFSs were still at formative stages, and they required continuous support and guidance so that they did not disintegrate after the project closed (World Bank 2014). The Mid-Term Review had advised the project to develop an exit strategy, but given that not many of the FFSs were operational, the implementation of the strategy was found to be weak. Nevertheless, a few FFSs do exist in the project areas and have been receiving support from the GAFSP Missing Middle Initiative.[18]

2.27 Sustainability of institutional arrangements for research and extension activities was not built beyond project implementation. One of the successful design features of the project was the promotion of links between research and extension and institutional arrangements through interdepartmental coordination. However, the limitation of this design was that links and coordination were planned for the short-term, during project implementation. When the project closed, all institutions returned to how they worked before, without any oversight by a coordinating body. Although the IEG field mission found that there was some evidence that after IAPP closed, there were better information flows between research agencies and those involved in extension, the formal links established during the project had ceased. Further, at the field level, only a few staff (for example, community facilitators) hired during project implementation were retained by subdistrict extension offices. Most were let go, which meant that the capacity built through training provided to field-level staff was lost after the project closed.

3. Lessons

3.1 **A design based on participatory demand-driven technology research and adoption programs, with strong community mobilization efforts, attracts strong buy-in from farmers; however, sustainability of the design requires continued monitoring and technical support.** The project intervention of involving farmers through a group-based approach (for example, FFSs) encouraged farmers' participation in technology dissemination and ultimately adoption. One key factor was the project's strong emphasis on community mobilization, including the phased process of dissemination

and adoption, which helped farmers learn about new technologies from their peers and ultimately brought trust and ownership to project activities among farmers. Although this model was quite successful not only in this project but also in the region, unless sustained effort is put into building the capacity of these farmer organizations, the results achieved by the project may not be sustained after the project is closed.

3.2 **Improving links between research and extension and farmers requires strong governance and oversight structures to be in place.** This was evident in the ex post review of this project, which found that sustainability is threatened by a lack of public financing of these links to ensure the utility of the outcomes as public goods. The project was implemented by eight different institutions, and IAPP created a platform that established clear roles and responsibilities for each of them and provided a mandate for the institutions to work together. The research institutes (the Bangladesh Agricultural Research Institute, the Bangladesh Rice Research Institute, and the Bangladesh Fisheries Research Institute) that generated new and improved varieties of seed closely coordinated with the extension agencies, such as the Department of Agricultural Extension, the Department of Fisheries, and BADC (which was not always the case before the project). These activities were implemented through effective governance and oversight arrangements that included several committees, which existed at the national, regional, and district levels and which met regularly to guide project management. These mechanisms were critical for improved project planning, monitoring, and coordinating activities of implementing agencies. Following the closure of the project, links have been weak because of insufficient budgets. If links between research and extension become weak, technology development and its adoption at the farm level will also be weak. Therefore, continued resources are needed for such governance structures and links to be sustained. Although private funding of agricultural research exists, often financed by industry groups, there is justification for the allocation of public resources to research-extension-farmer links to achieve a more efficient agricultural sector. For this, there is evidence of broad spillover benefits for a wide range of beneficiaries in many sectors of the economy based on a wealth of research on agricultural technology and rural development (Johnston and Mellor 1961 and numerous subsequent studies).

3.3 **Monitoring and evaluation systems need to be built, not only to separately assess the impact of single project interventions but also to track multiple interventions, such as the joint effects of irrigation and improved seed technologies on yield increases similar to those achieved in this project.** The project's emphasis on seed and irrigation technologies was relevant and addressed key constraints of increasing agricultural productivity among small-scale and marginal farmers. It is obvious that rice will not do well without irrigation. Research from Bangladesh shows that farmers who have irrigation systems tend to be faster adopters of new rice varieties

and continue for longer periods of time (Ahmed, Hernandez, and Naher 2016). In the project, extension of technical advice to farmers was provided by the Department of Agricultural Extension, whereas a separate agency with the Ministry of Agriculture—BADC—was mandated to work on irrigation technologies at the farm level. In some areas, irrigation activities were paired with technology dissemination activities. However, in a significant number of cases, the IEG assessment mission's field visits found that there were separate groups of farmers that the project worked with to support either the adoption of improved rice varieties or irrigation efficiency, but not both. In such cases, it would have been important for the project's monitoring and evaluation system to have assessed the impacts of the joint effects of irrigation and improved rice seeds on yield increases.

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[1] The Global Climate Risk Index ranks Bangladesh as the world's seventh most affected country over the period of 2000–19 (Eckstein, Künzel, and Schäfer 2021).

[2] The Bangladesh Agricultural Development Corporation is a parastatal agency that has the mandate for multiplication of foundation seeds and production of certified seeds, mainly for seeds of key notified crops. The notified crops are those that have higher government regulation because of their importance for food security. These crops are rice, wheat, potato, jute, and sugarcane.

[3] The Seed Certification Agency has the legal mandate for seed certification and undertakes variety and quality testing services for seed varieties developed by research institutions before they are released.

[4] A third-party impact evaluation was conducted at project end by a local consulting firm covering treatment and control group approach. The third-party evaluation surveyed 17,250 farmers at endline (that is, about 5 percent of the Integrated Agricultural Productivity Project sample), including 8,750 crop farmers, 3,000 fish farmers, 3,000 livestock farmers, and 2,500 water users, using a stratified random sampling method; a baseline study was reconstructed using a recall method (World Bank 2017b).

[5] The Development Impact Evaluation initiative used a randomized controlled trial method based on a panel data set of 1,732 households constructed from three rounds of surveys (baseline in 2012, midline in 2014, and endline in 2015). The assessment covered crop and fisheries activities.

[6] When rice is grown under continuous flooded soil conditions, it can contribute to the formation of the anoxic environment, leading to the production and emission of methane (Smartt et al. 2016).

[7] Scaling up of investments in buried pipes was based on information provided by a Bangladesh Agricultural Development Corporation official.

[8] The government provides subsidies to fertilizer, which increased eightfold from mid-2005 to 2015 (World Bank 2016a).

[9] The National Agricultural Extension Policy was updated in 2012 with greater focus on providing decentralized and demand-responsive extension services to farmers. The lead agency to implement this policy is the Department of Agricultural Extension. The key principles of the National Agricultural Extension Policy are (i) increasing production (horizontal and vertical) and productivity as a whole; (ii) cost-effective, efficient, decentralized, and demand-responsive extension services; (iii) targeting and mobilizing farmer groups and their federations; (iv) bottom-up planning and implementation; (v) coordinated and integrated extension services through the National Agricultural Extension System; (vi) development of agribusiness and contract farming for export promotion; (vii) adoption to climate change and development of specialized extension service for climatically distressed areas; (viii) broad-based extension support (in-time input support and subsidies, credit, price enhancement, and so on); and (ix) digitalized agricultural extension services—e-agriculture (Government of Bangladesh 2012).

[10] The Global Agriculture and Food Security Program is a multilateral financing platform related to improving food and nutrition security in the world's poorest countries. It was established after the 2007–08 food price crisis.

[11] The seedlings of this variety can tolerate salinity of 12–14 decisiemens per meter for three weeks and 6 decisiemens per meter for a whole cropping season.

[12] Increased soil and water salinity because of sea level rise in Bangladesh is expected to result in a 15.6 percent yield reduction in high-yielding rice varieties by 2050 (World Bank 2019).

[13] Following the closure of the project, the umbrella organization (Sara Bangla Krishok Jote) was selected in October 2016 to receive additional grants from the Global Agriculture and Food Security Program to further support institutional and technical capacity.

[14] Fish farmers interviewed did not tend to have marketing challenges. There was high demand for fish, which was either sold in local markets or to traders who collected fish from the farms.

[15] As of 2013, there were approximately 200 seed companies with 17,000 registered and 50,000 mobile seed vendors with a market value of over $125 million (Genoni et al. 2021).

[16] In 2021–22, the total demand for crop seeds was 1,254,836 metric tons, but supply of crop seeds was 405,939 metric tons (USAID 2023).

[17] The World Bank report (Genoni et al. 2021) states that the fisheries subsector in Bangladesh is considered a diversification success story. This success has been due to the efforts of the private sector and a domestic market where 90 percent of farmed fish (excluding shrimp) are sold. Enabling factors are related to expansion of rural road networks, rising affordability, and access to new technology. The domestic market has been the main trigger behind aquaculture transformation.

[18] The Missing Middle Initiative was launched in 2016 as a pilot project of the Global Agriculture and Food Security Program, which aimed to directly support producer organizations. Bangladesh was one of the first countries to receive a grant, and the project is under implementation, which helps facilitate access to finance and complementary services (extension, capacity building, technology, or access to markets) to smallholder farmers through their producer organizations.

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Appendix A. Ratings

Bangladesh Integrated Agricultural Productivity Project (P123457)

This Project Performance Assessment Report (PPAR) rates the outcome and the World Bank's performance to be satisfactory. Bank performance is satisfactory, and the quality of monitoring and evaluation (M&E) is substantial (table A.1). These ratings are in line with the conclusions of the Implementation Completion and Results Report (ICR) and the Independent Evaluation Group (IEG) Implementation Completion and Results Report Review (ICRR).

Table A.1. ICR, ICRR, and PPAR Ratings

Indicator	ICR	ICRR	PPAR
Outcome	Satisfactory	Satisfactory	Satisfactory
Risk to development outcome	Modest	Modest	n.a.
Bank performance	Satisfactory	Satisfactory	Satisfactory
Quality of monitoring and evaluation	n.a.	Substantial	Substantial

Sources: World Bank 2017a, 2017b.
Note: The ICR is a self-evaluation by the responsible Global Practice. The ICRR is an intermediate Independent Evaluation Group product that seeks to independently validate the findings of the ICR. ICR = Implementation Completion and Results Report; ICRR = Implementation Completion and Results Report Review; PPAR = Project Performance Assessment Report; n.a. = not applicable.

1. Components—Original

Component 1: Technology generation and adaptation (appraisal estimate: $7.57 million; actual cost: $6.83 million). This component aimed to adapt and release yield-increasing and production-intensifying technologies and management practices to crop and fish farmers. The activities included the generation, adaptation, and release of new technologies for (i) rice; (ii) other crops, such as wheat, maize, pulses, and oilseeds; and (iii) fish. Three national institutions, the Bangladesh Agricultural Research Institute, the Bangladesh Fisheries Research Institute, and the Bangladesh Rice Research Institute were responsible for the development and release of new or improved crop varieties, brood stock improvement and development of pure-breed lines in fish, development of location-specific crop husbandry practices, adaptive trials of aquaculture technologies, and training and capacity building in their respective subsectors (rice, other crops, and fish).

Component 2: Technology adoption (appraisal estimate: $35.15 million; actual cost: $37.64 million). This component aimed to incentivize and support targeted farmers in the project areas to adopt improved agricultural production technologies and management practices for crops, livestock (milk), and fish production to increase their productivity and promote production intensification and diversification. For the

respective subsector (crops, livestock, and fish), the Department of Agricultural Extension, the Department of Livestock Services, the Department of Fisheries, and the Bangladesh Agricultural Development Corporation were responsible for farmer capacity-building and extension activities, increasing the availability of quality seed and breeds, and expanding their productive assets and social capital base.

Component 3: Water management (appraisal estimate: $11.71 million; actual cost: $11.07 million). This component aimed to increase the availability of water for irrigation to project farmers, improve water usage efficiency, and expand the irrigated agricultural land area for enhanced cropping intensity and patterns. Activities included the conservation and use of surface water through rehabilitation of natural water bodies, canals and ponds, existing natural channels, and rainwater harvesting practices. Activities to improve irrigation efficiency included the installation of a buried pipe network and repair of selected deep tube wells.

Component 4: Project management (appraisal estimate: $5.26 million; actual cost: $3.38 million). This component was to ensure appropriate project planning, coordination, compliance with fiduciary and safeguard standards, and monitoring of implementation and results.

2. Relevance of the Objectives

Objectives

The project development objective was "to enhance the productivity of agriculture (crops, livestock, and fisheries) in pilot areas" (World Bank 2017b, 1). This objective was not revised during project implementation.

Relevance

During appraisal, the project's objective was closely aligned with the government's strong commitment to improve food and nutrition security in the country in the aftermath of the food crisis of 2008. This commitment led the government to prepare the Country Investment Plan in 2011, which laid out priority investment programs that focused on supply of good-quality agricultural inputs (seeds, fingerlings, artificial insemination, and so on), water resource management and irrigation, nutrition, capacity development of farmer organizations, and strengthened research and extension services. All these priority areas were captured by the project's activities. Furthermore, the project design was well aligned with the various policy documents (for example, the National Strategy for Accelerated Poverty Reduction 2009, the Sixth Five Year Plan, the National Agricultural Extension Policy 2012, and the Bangladesh Agricultural Research Council Act 2012) that promoted a sustainable and diversified agriculture sector that focused on

increasing yields for rice and other crops, with an emphasis on technology generation and adoption through a decentralized and demand-driven agricultural research and extension services, climate change adaptive technologies, and irrigation development. At completion, the project objectives continued to remain relevant and were clearly linked to the government's Seventh Five Year Plan, which focused on food security through productivity gains based on science-based technology systems that promoted research and adoption of modern agricultural technologies and practices. Overall, the relevance of the objectives is rated **high** by this review, which is the same conclusion that was reached by the ICR and the ICRR.

3. Efficacy

The main objective of the project was to enhance the productivity of agriculture (crops, livestock, and fisheries) in pilot areas. The project successfully achieved its objective and exceeded all its outcome indicator targets.

Productivity of crops (rice). At project closing, against a target of 5,950 kg/ha of (boro) rice yields, the project achieved a yield of 6,300 kg/ha for rice. The project surpassed its target and reached 250,829 farmers (25 percent women) whose productivity increased. These achievements were due to (i) generation of seed technologies that were appropriate for the environmental challenges (salinity, flooding, and drought) faced in the pilot areas; (ii) dissemination of technologies and production practices through a demand-driven approach, with increased participation of farmers through farmer field schools that helped with the phased approach on-farm demonstrations; (iii) availability of seed through seed villages for farmer-to-farmer exchange of seed; and (iv) availability of irrigation and improved water management. As noted earlier in this report, IEG interviews and secondary data for rice for the districts covered by the project show that there has been a sustained increase or stable performance in yields over time in most of the districts covered by the project. Farmers are more knowledgeable about high-yielding varieties that are demanded and are increasingly adopted instead of the local varieties that they used to plant before the project. Farmers have also diversified their crops and are planting other high-value crops, such as sunflowers, mustard, mung beans, and so on.

Productivity of fisheries. The project exceeded all its outcome targets related to interventions in fisheries. Yields of fish increased to 5,420 kg/ha (against the target of 3,400 kg/ha) from a baseline of 2,700 kg/ha. The fish breeds (tilapia, koi, and pangas) introduced at the field level through extension department (the Department of Fisheries), which were provided by the research institute (the Bangladesh Fisheries Research Institute), had high demand for adoption by farmers, with 48,177 fish farmers increasing their fish productivity during the project. One of the causes of the high

adoption was that the varieties developed adapted well to environmental challenges in districts that had salinity issues and low water quality. Further, the breeds introduced received good responses from the private and public hatcheries that partnered with research and extension agencies to produce fish fry sold to the farmers. Since the project closed, availability of fish fry has been continued to be provided by both private and public hatcheries. As stated earlier, interviews conducted with fish farmers and other local stakeholders during the IEG assessment mission found that the fish breeds introduced by the project (for example, tilapia, pangas, and koi) have been widely adopted by the farmers. There is high demand for fish in the local markets. Although data on production of these breeds by farmers were unavailable at the district level, the national production data (table A.2) were used as a proxy to demonstrate an increase in adoption and thereby production of these breeds in Bangladesh.

Table A.2. Species-Wise Annual Fish Production (metric tons)

Species/Group	2013–14	2016–17	2019–20[a]
Tilapia	298,062	370,017	371,263
Pangas (catfish)	371,068	510,097	405,059
Koi (major carp)	728,695	811,588	962,049

Source: Yearbook of Fisheries Statistics of Bangladesh 2019–20 (Government of Bangladesh 2021).
Note: a. Preliminary.

Productivity of milk. Like crops and fisheries, the project's interventions on livestock led to a productivity increase in milk. Against the target of 2.21 liter per day per cow, the project achieved a yield of 2.86 liter per day per cow. There were 50,652 farm families (target: 48,000) who benefited from increased productivity. According to the ICR, "compared to non-IAPP [Integrated Agricultural Productivity Project] groups, milk productivity of cows in IAPP groups was reported to be 147 [percent] higher; household milk consumption nearly doubled (96 [percent] increase); and milk sales and earnings were [fourfold to fivefold] higher than control, respectively" (World Bank 2017a, 18). During project implementation, based on the success of technology adoption on crops through the farmer field schools, the project helped establish farmer groups through which training was provided on fodder cultivation and husbandry practices.

In all these areas (particularly for crops and fisheries), the project's success in achieving its objective was well documented in the impact evaluation conducted by the World Bank's Development Impact Evaluation (DIME) initiative, as well as the third-party impact evaluation mentioned in chapter 2 of the main text in this review. District-level secondary data reviewed by this PPAR for rice (representative for crops) confirm that yields have either been sustained or increased since the project closed. Production of fish varieties at the country level shows that adoption of the varieties promoted by the project has improved uptake.

As mentioned in the main text, although achievements in terms of productivity have been positive, the project paid limited attention to ensuring the sustainability of local institutions (for example, farmer field schools and seed villages) supported through the project, many of which were not functioning at the time of the IEG assessment mission to Bangladesh.

Overall Efficacy

At project closure, all the project development objective indicators and the intermediate result indicators for the project were achieved (as shown in table A.3). Since then, the research institutes have been introducing newer varieties of seed in the districts, and there was evidence that farmers have greater knowledge of improved production practices and are using high-yielding varieties of seed. Overall, the efficacy of the project's achievements is rated as **substantial**; however, we note that the limited attention given to the sustainability of local institutions after the project's closure may have a negative impact on the sustained increase of agricultural productivity over time in the project areas.

Table A.3. Result Indicators

Indicators	Unit	Original Baseline	Original Targets	Revised Targets	Actual
Project development objective					
Enhance productivity of agriculture (crops, fisheries, and livestock) in selected project areas					
Increase productivity of targeted farmers in					
Crops (10% women)	No.	0	140,000	n.a.	152,000 (33% women)
Fisheries (25% women)	No.	0	48,000	n.a.	48,177 (25% women)
Livestock (50% women)	No.	0	48,000	n.a.	50,652 (89% women)
Incremental increase in productivity of paddy (rice)	kg/ha	2,200[a]	2,700	Boro: 5,950 kg/ha Aus: 3,300 kg/ha Aman: 3,300 kg/ha	Boro: 6,300 kg/ha T-Aus: 4,650 kg/ha Aman: 4,560 kg/ha
Incremental increase in yield of fish	kg/ha of WSA	2,700	3,400	n.a.	5,420
Incremental increase in yield of milk	Liters/day/cow	1[b]	2[b]	2.2	2.86

Indicators	Unit	Original Baseline	Original Targets	Revised Targets	Actual
Intermediate results					
Improved varieties released for farmers' use in					
Crops	No.	0	14	n.a.	15
Fish	No.	0	9	n.a.	9
Improved production packages released for farmers' use in					
Crops	No.	0	13	18	18
Aquaculture	No.	0	9	n.a.	9
Adoption of improved crop varieties by farmers	No.	0	175,000	180,000	180,000
Adoption of improved aquaculture by fish farmers	No.	0	60,000	n.a.	60,000
Adoption of improved breed and husbandry practices by farmers	No.	0	60,000	n.a.	60,000
Certified seed processed by BADC in the new facilities	Ton	0	3,500	n.a.	3,546
Area under improved irrigation	Hectare		25,000	n.a.	27,750

Source: World Bank 2017a.
Note: BADC = Bangladesh Agricultural Development Corporation; kg/ha = kilogram per hectare; n.a. = not applicable; WSA = water spread area.
a. During midterm, this baseline value was considered too low, so it was revised, and the indicator was disaggregated to reflect the three main rice varieties: boro, 5,450 kg/ha; aus, 2,700 kg/ha; and aman, 2,700 kg/ha.
b. During midterm, this baseline value was revised and set at 1.6 liters/day/cow. The target value was also adjusted to 2.2 liters per day.

4. Efficiency

Ex Ante Efficiency

At appraisal, the economic rate of return (ERR) for the project was 21.4 percent, with a net present value of $35.3 million and financial benefits of $23 million. The benefits were analyzed based on number of farmers (estimated to be 80 percent of all farmers) who adopted the various agricultural technologies and practices promoted by the project. The benefits were expected from (i) a 12–29 percent increase in the productivity (that is, yields) of major crops in 175,000 farms; (ii) a 25–60 percent increase in animal productivity for milk for 60,000 farmers; (iii) a 21 percent increase in fish productivity for 60,000 fish farmers; and (iv) 25,000 ha, or about 50,000 farmers, with improved efficiency of water use and increased irrigated area. Benefits to be expected from farmers outside the project sites were not included in the analysis.

Ex Post Efficiency

At project completion, the ERR was calculated for each of the activities, which resulted in ERRs of (i) crops—39.4 percent; (ii) fisheries—24.2 percent; (iii) livestock—58.1 percent; and (iv) water management—50.1 percent, with an aggregated rate of ERR of 37.9 percent and a net present value of $138 million. The ex post economic and financial analysis's source of data was based on 22 crop-activity models (crops, fisheries, livestock, and water management) collected from farms in all the project districts. According to the ICRR, these data were validated with other available data, such as third-party impact assessment, interviews with local officials and beneficiaries, and a 2013 Food and Agriculture Organization study. Along with the calculation of the ERR, the ex post economic and financial analysis conducted a sensitivity analysis, which tested changes such as reduction in output prices to adoption rates, which only reduced adoption from 37.9 percent to 32.7 percent. The ICRR found the methodology of the ex post review to be sound, and this PPAR concurs. With the sound data that had been collected by the project's M&E system and two impact evaluations, we did not collect additional data or revisit the calculations done for the ICR.

Operational Efficiency

The operational efficiency of the project was also found to be sound. During project implementation, there were some delays with M&E in the initial stages of the project, which improved later. Other than that, no significant delays were reported, and as per the ICR, the committed funds were fully disbursed with little deviation between component-wise allocations and expenditures.

This PPAR agrees with both the ICR and ICRR assessments that the project's implementation efficiency was **high**.

5. Outcome

The project's objectives were well aligned with both the government and World Bank strategies. The project met its project development objective indicators and exceeded all its intermediate indicators, and the evidence based on the impact assessments was credible. The efficacy with which the objectives were achieved was substantial, but this PPAR highlights the shortcomings in the sustainability of local institutions that may negatively impact sustained future increases in agricultural productivity in the project areas. The project's efficiency rating was **high**, with an ERR of 37.9 percent. In summary, based on high relevance of design, substantial overall efficacy, and high efficiency, this project's achievements had minor shortcomings. This PPAR, therefore, concludes that the project's overall outcome was **satisfactory** (as did the ICR and the ICRR).

6. Risk to Development Outcome

Both the ICR and the ICRR assessed the project to have modest risk to development outcome. Both the documents identified two risks to development outcome:

Technical risks: Maintaining the same level of coordination and links among the various implementing agencies of the project that are involved in technology generation and adoption.

Institutional risks: Availability of financial resources that continue to support and enhance the capacity of local-level institutions, such as the farmer field schools.

This PPAR concurs with the ICR and the ICRR that these risks continue to be relevant and are critical in sustaining the development outcomes (that is, increase in agricultural productivity) of the project in the long run. Since the project closed, limited support has been provided to maintain the same level of links among the various institutions for technology generation and adoption. As a result, the links have weakened. Further, with limited resources, and an absence of additional staff that the project had hired during project implementation (for example, community facilitators), extension agencies were unable to provide the same level of services to farmers.

7. Bank Performance

Quality at Entry

As outlined by the ICRR, the project was well aligned with the government of Bangladesh's priorities for the agriculture sector and the World Bank's strategic focus in Bangladesh at the time. The project design was based on a good understanding of constraints related to on-farm productivity in the project areas. First, the project targeted constraints related to inadequate access and availability of seed technologies for crops and fish, and production practices for crops, fish, and livestock, by introducing relevant technologies that were suitable for the environmentally challenged districts. This was an area where the World Bank had in-country experience from past projects and knowledge from similar projects in the region. Second, the project laid out an effective process that promoted collaboration and coordination among institutions (the Bangladesh Agricultural Research Institute, the Bangladesh Rice Research Institute, and the Bangladesh Fisheries Research Institute) involved in research and those (the Department of Agricultural Extension, the Bangladesh Agricultural Development Corporation, the Department of Fisheries, and the Department of Livestock Services) that provided technology dissemination and extension to farmers. Third, the strong focus of the project on community mobilization by supporting establishment of farmer

field schools and seed villages was instrumental in addressing the challenges of technology adoption and access to and availability of seed among farmers.

The gap at project entry was related to the following design features of the project: (i) absence of a marketing component, (ii) lack of activity promoting greater private sector participation in the seed market through policy or capacity-building support, and (iii) limited attention given to the sustainability of institutional links between research and extension activities. On M&E, during preparation, the project had been unable to complete a baseline study. However, it was completed during the first year of project implementation when the World Bank's DIME team was commissioned to conduct the baseline study. Later, DIME was also engaged in a midterm survey and an endline impact evaluation.

Overall, the quality of entry is rated **satisfactory**.

Quality of Supervision

During implementation, the project was systematically supervised with 10 review missions, which included periodic field visits that allowed for greater feedback from project beneficiaries. Over the project period, there was continuity of the World Bank team, which was led by only two task team leaders, one of whom was later based in Dhaka. This allowed for periodic engagement with the project team and with the various implementing agencies. The Mid-Term Review was conducted as scheduled and provided candid feedback on the project's progress on various activities. Finally, the project faced no significant delays, with all activities completed on time at project end.

The quality of supervision is rated **satisfactory**.

Overall, this PPAR concurs with the ICR and the ICRR in its assessment of Bank performance as satisfactory.

8. Quality of Monitoring and Evaluation

Design

The M&E system of the project was well designed, with the responsibility of the M&E function given to the Project Management Unit. The project design developed an M&E strategy and a plan that laid out roles and responsibilities for each of the implementing agencies. The project development indicators were outcome oriented, and the results framework included methodologies for data collection (source and type of data collection), which was used as a tracking tool. At the local level, the community facilitators were responsible for the collection of M&E data as an input to the project's monitoring. Further, during project design, the plan for an external evaluation, which

included a baseline, midterm, and impact evaluation at project end, was carried out by the World Bank's DIME team.

Implementation

During project implementation, M&E activities in the project went smoothly, and each of the respective implementing agencies carried on with their responsibilities. At Mid-Term Review, some weaknesses were identified related to data collection in the field (which were addressed). Targets were also revised to be more ambitious. At the same time, a web-based project management information system was introduced that allowed real-time monitoring of information at all levels (that is, central, region, upazila, and community levels) that was based on input-output cards filled by the beneficiaries through a mobile application. Finally, the Mid-Term Review recommended a third-party evaluation that helped validate the project's own M&E data collection and monitoring and DIME's impact studies (World Bank 2014).

Use

The Project Management Unit was able to use the results from the project management information system to monitor the progress of the project's activities and milestones. The project's monitoring data and impact studies helped adjust targets (that is, changes in targets for yields) and enhanced improved data collection. According to the ICR, the productivity estimates of the various impact studies came close, which helped validate the quality of data that assessed the outcomes of the project.

Overall, the M&E quality is rated **substantial**.

References

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World Bank. 2017a. "Bangladesh—Integrated Agricultural Productivity Project." Implementation Completion and Results Report ICR00003973, World Bank, Washington, DC.

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Appendix B. Fiduciary, Environmental, and Social Aspects

Financial Management

During project appraisal, the World Bank conducted a financial management assessment, and actions were agreed with the project implementing agencies to strengthen the financial management capacity of their respective agencies. Financial management functions went smoothly during implementation, and the required reports were submitted on time. All audit reports were unqualified, except for one qualified audit opinion for the fiscal year 2015–16, which was later found to be erroneous by the auditors and was corrected. The final audit report of the project was unavailable at either the time of project closing or the time of the preparation of the Implementation Completion and Results Report and the Implementation Completion and Results Report Review. Nevertheless, we obtained and reviewed the audit; it received an unqualified opinion.

Procurement

Project design entrusted most of the procurement responsibilities to the Project Management Unit to simplify the process and efficiently address the needs of eight different implementing agencies. Most of procurement activities were completed on time, although there were some delays during the initial project period. To expedite the process, a procurement consultant was hired by the client, which helped improve the procurement capacity. Further, the project introduced an electronic tendering process during the last two years of project implementation, which helped safeguard the efficiency and accountability of procurement activities. During implementation, the project did not confront any major procurement issues.

Environmental and Social Safeguards

Environmental: The project was classified as Category B (Partial Assessment) under the World Bank environmental safeguard policies. Four environmental safeguard policies were triggered: Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Pest Management (OP/BP 4.09), and Project on International Waterways (OP/BP 7.50). During appraisal, an Environmental Management Framework was drafted, and consultations were held with key stakeholders to assess any negative impacts from project activities. Environmental impacts could have resulted from increased use of agrochemicals, minor irrigation infrastructure construction, increased use of surface water, and so on. To assess such impacts, subprojects of the project were screened for

environmental impacts (which found no significant negative environmental changes). We also found no further evidence to raise concerns about the conclusions of the Implementation Completion and Results Report and the Implementation Completion and Results Report Review that compliance with environmental safeguards was achieved.

Social: The project activities were implemented in districts facing environmental challenges, by focusing on small-scale and marginal farmers, including women and poor, landless, and vulnerable people. Thus, the World Bank's social safeguard policies related to Indigenous Peoples (OP/BP 4.1) and Involuntary Resettlement (OP/BP 4.12) were triggered. During appraisal, a social assessment was prepared to assess adverse social impacts from project activities that could lead to loss of land or structures, loss of livelihoods support, elite capture, and so on. A Social Management Framework was prepared to guide a participatory and socially inclusive engagement of project beneficiaries in technology generation and adoption and water and irrigation activities. During implementation, there was no private land acquisition or displacement of people; neither were there any adverse impacts on the vulnerable population.

Appendix C. Methods and Evidence

This report is a Project Performance Assessment Report. This instrument and its methodology are described at https://ieg.worldbankgroup.org/methodology/PPAR.

Overview

In preparing this Project Performance Assessment Report, we followed a mixed method and based the report on evidence gathered through review of (i) key project documents and data from the World Bank, the government of Bangladesh, relevant donors and development partners, and academic literature; (ii) impact evaluation done by the World Bank's Development Impact Evaluation team; (iii) third-party impact evaluation administered by the project; (iv) other project documents for ongoing and previous agriculture projects in Bangladesh; (v) semistructured interviews with World Bank staff, government counterparts, representatives of the implementing agencies (for example, research institutes, such as the Bangladesh Agricultural Research Institute, the Bangladesh Rice Research Institute, and so on, and extension agencies, such as the Department of Agricultural Extension, the Department of Fisheries, and so on), key development partners active in agriculture, and beneficiaries (project related and nonrelated); (vi) a questionnaire distributed to the Department of Agricultural Extension staff in all participating districts; and (vii) a field mission, including observations during site visits.

Field Mission

The project covered eight districts—four districts in the north (Rangpur, Kurigram, Nilphamari, and Lalmonirhat) and four districts in the south (Barisal, Patuakhali, Barguna, and Jhalokati). The districts in the north and south face unique environmental challenges: seasonal droughts, cold snaps, and flash flood submergence in the north; varying levels of salinity and tidal submergence in the south. The project implemented all activities (crops, fishery, livestock, and water) in the eight districts.

A purposive sampling method was followed to select two districts in the north and two districts in the south, based on high-performing and low-performing districts on productivity measures (that is, yields of rice). In each of the districts, one upazila (subdistrict) and up to two unions (rural areas) were selected in consultation with district agriculture and extension officers and former coordinators of the project (table C.1).

Table C.1. Purposive Sampling

Region	Districts	Study Area Sampling	Selected Study Area	Respondent Sampling
South	Barisal, Patuakhali, Barguna, and Jhalokati	Barisal (high performing) Patuakhali (low performing)	Barisal: 1 Upazila Wazipur Patuakhali: 1 Upazila Kalapara	Random
North	Rangpur, Kurigram, Nilphamari, and Lalmonirhat	Rangpur (high performing) Lalmonirhat (low performing)	Rangpur: 1 Upazila Mithapukur Lalmonirhat: 1 Upazila Aditmari	Random

Sources: World Bank 2011; *Yearbook of Agricultural Statistics 2020* (Government of Bangladesh 2021).

During the field mission to the districts, key informant interviews were conducted using semistructured questionnaires with district and subdistrict level staff of implementing agencies, lead farmers, members of farmer field schools, water user groups, and seed villages. The field interviews qualitatively assessed the project interventions and implementation results in line with the theory of change.

Questionnaire Distributed to the Department of Agricultural Extension Staff

In addition to the field mission and interviews conducted by the Independent Evaluation Group, the following questionnaire was distributed to the Department of Agricultural Extension staff in all eight districts covered by the project. In total, 27 officials responded to the questionnaire distributed, some of which were also filled by the Department of Livestock Services and the Department of Fisheries staff. More than 40 percent of officials had worked on the project, although there was uneven representation from each of the districts.

The questions were as follows.

1. As an agricultural extension/fisheries/livestock officer, which administrative division do you serve now? Please provide the name. [District/Upazila/Union]
2. Did you work with the Bangladesh Integrated Agricultural Productivity Project? [Yes/No]
    a. If "Yes," could you briefly state your main roles in the project and for how long? Main role? How long (months)?

3. In the Integrated Agricultural Productivity Project, there were eight implementing agencies: Bangladesh Rice Research Institute, Bangladesh Agricultural Research Institute, Bangladesh Fisheries Research Institute, Bangladesh Agricultural Development Corporation, Seed Certification Agency, Department of Agricultural Extension, Department of Livestock Services, and Department of Fisheries. Which factors listed below do you consider were important for improved links and coordination among all project activities? Please circle "Yes" or "No" for the factors suggested below.

    a. The project had designated coordinators in each of the agencies, as well as districts (a total of 16), who met regularly to plan and coordinate the activities of each of the agencies. [Yes/No]

    b. The Project Management Unit played a critical role in coordinating activities of all agencies. [Yes/No]

    c. The project's monitoring and evaluation system played a crucial role in closely monitoring and disseminating information on project activities of all agencies. [Yes/No]

    d. Others. Please specify.

4. When the project ended in December 2016, average yields for rice production had increased. Which factors listed below do you consider were important for the successful outcome and changes in farmers' behaviors? Please circle "Yes" or "No" for the factors suggested below:

    a. High-yielding improved seed varieties released by the Bangladesh Rice Research Institute that were adopted by farmers with the help of the Department of Agricultural Extension. [Yes/No]

    b. High-yielding improved seed variety that withstood natural calamities, such as droughts and salinity. [Yes/No]

    c. Increased availability of certified seed provided by Bangladesh Agricultural Development Corporation and its dealers. [Yes/No]

    d. Increase availability of seed through the seed villages. [Yes/No]

    e. Field demonstration, including technology adoption based on a phased approach. [Yes/No]

    f. Provision of technology packages to farmers. [Yes/No]

    g. Community mobilization of farmers through Farmer Field Schools with the help of the community facilitators. [Yes/No]

h. Training on good production practices. [Yes/No]

i. Others. Please specify.

5. What percentage of farmers in your upazila/union do you estimate adopted improved crop production technologies promoted by the project during implementation and use them at present? Please tick your best estimate in two of the boxes below for "During Implementation" and "At Present":

	During Implementation	At Present
All farmers		
About 75%		
About 50%		
About 25%		
Less than 10%		

6. When the project ended in December 2016, yields for fish production had increased. Could you kindly let us know which key factors below you consider were important for the successful outcomes and changes in farmers' behaviors? Please circle "Yes" or "No" for the factors suggested below:

   a. High-yielding improved fish varieties released by Bangladesh Fisher Research Institute that were adopted by fish farmers with the help of the Department of Fisheries. [Yes/No]

   b. Increased availability of improved generations of fish seed from commercial hatcheries. [Yes/No]

   c. Training to fish farmers. [Yes/No]

   d. Training to hatchery operators. [Yes/No]

   e. Others. Please specify.

7. What percentage of farmers in your upazila/union do you estimate adopted improved fish varieties promoted by the project during implementation and use them at present? Please tick your best estimate in two of the boxes below for "During Implementation" and "At Present":

	During Implementation	At Present
All fish farmers		
About 75%		
About 50%		
About 25%		
Less than 10%		

8. When the project ended in December 2016, yields for milk production had increased. Could you kindly let us know which key factors below you consider were important for the successful outcomes and changes in farmers' behaviors? Please circle "Yes" or "No" for the factors suggested below:
    a. Training on animal husbandry, nutrition. [Yes/No].
    b. Breed development through artificial insemination. [Yes/No].
    c. Provision of inputs.
    d. Vaccination.
    e. Others. Please specify.
9. Was irrigation necessary for raising crop productivity?
    a. Yes/No (circle answer).
    b. If "Yes," what activities promoted by the project were the most important to increase irrigation for farmers? [Please rank from 1–5; 1–most important].
        i. Installation of buried pipe networks in farmer fields. (...)
        ii. Repair of selected deep tube wells. (...)
        iii. Rainwater harvesting practices. (...)
        iv. Efficient water delivery technologies, for example, drip irrigation. (...)
        v. Training for water user groups. (...)
        vi. Others. Please specify.
    c. If "No," why not?
10. Did the project usually coordinate assistance to farmers on irrigation (for example, investments in canals and wells) with assistance on agriculture (for example, technology dissemination, training on agronomic practices, and so on)?
    a. Yes/No (circle answer).

b. If “No,” why not?

11. What are the key constraints faced by the farmers to sell their surplus production? Please circle “Yes” or “No” for the constraints suggested below:
    a. Physical marketplace is far from the villages. [Yes/No]
    b. The quality of roads is substandard. [Yes/No]
    c. Limited number of trucks in the area to transport the goods. [Yes/No]
    d. Farmers do not have enough volume to sell. [Yes/No]
    e. No constraints. [Yes/No]
    f. Others.
12. How do farmers receive information about prices?
    a. Radio. [Yes/No]
    b. Phones. [Yes/No]
    c. Traders. [Yes/No]
    d. Extension workers. [Yes/No]
    e. Others.
13. Are farmers continuing to use improved seed varieties?
    a. Yes/No (circle answer).
    b. If “Yes,” where do they usually buy improved seed from?
        i. Bangladesh Agricultural Development Corporation dealers.
        ii. Private dealers.
        iii. Department of Agricultural Extension.
        iv. They produce their own seed.
        v. Others. Please specify.
    c. If “No,” why not?
14. Are seed villages formed and supported by the project still functioning?
    a. If “Yes,” please fill the information in the table below:

Seed Villages (Incl. Farmer Members) Formed During Implementation (No.)	Seed Villages (incl. Farmer Members) Still in Existence (No.)

b. If "No," why not?

15. Are farmers continuing to use improved fish varieties?

a. If "Yes," please fill the information in the table below:

Fish Farmer Groups (Incl. Farmer Members) Formed During Implementation (No.)	Fish Farmer Groups (incl. Farmer Members) Still in Existence (No.)

b. If "Yes," where do they usually buy improved seed?

i. Department of Fisheries.

ii. Private hatcheries.

iii. Farmer groups.

iv. Individual farmers produce their own fish seed.

v. Others. Please specify.

c. If "No," why not?

16. Is the extension system still using the Farmer Field Schools and phased approach promoted by the project for dissemination of farming technologies?

a. If "Yes," please fill the information in the table below:

Farmer Field Schools (Incl. Farmer Members) Formed During Implementation (No.)	Farmer Field Schools (incl. Farmer Members) Still in Existence (No.)

b. If "No," why not?

17. Since the project closed, have farmers maintained the water/irrigation infrastructure?

a. If yes, are water user associations collecting fees from their members? [Yes/No]

b.

c. If "No," why not?

18. Would you like to share any other information about the project?

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Appendix D. Additional Data

Table D.1. Rice Varieties and Production Practices Generated by the Bangladesh Rice Research Institute for Farm-Level Adoption

Activity and Targets	Actual Achievement
Developed and released varieties (5)	Five varieties of rice were released: BRRI dhan61, BRRI dhan67 (salt-tolerant boro varieties), BRRI dhan62 (short-duration T. aman with moderate zinc content), BRRI dhan65 (moderately drought-tolerant broadcast aus variety), and BRRI dhan66 drought-tolerant aman variety).
Conducted technology demonstrations on farmers' fields for the existing technologies (350)	A total of 350 demonstrations were conducted at farmer's fields for the existing technologies.
Improved crop production packages released for farmers' use (9)	Nine improved crop production technologies were developed: • Preventive application of fungicides for increasing aromatic rice yield • Flexible polythene pipe for efficient water distribution • Use of rice straw as a supplement source of potassium in rice production • Management practices of direct seeded rice in dry field in aman season to mitigate climate change • Deep placement of NPK briquette, environmentally friendly technology for rice production for favorable and tidal submergence-prone ecosystems • Weed control options for BRRI dhan56 and BRRI dhan57 for yield maximization in drought condition in T. aman season (Rangpur region) • Nitrogen management for yield maximization after de-submergence for T. aman variety BRRI dhan52 (Rangpur region) • Management of rice sheath blight disease for increasing the yield of T. aman rice • Eco-friendly insect pest control with no or minimal insecticide application

Source: BRRI 2016.
Note: BRRI = Bangladesh Rice Research Institute; NPK = nitrogen, phosphorus, and potassium.

Table D.2. Types of Seeds Used by Farmers under the Integrated Agricultural Productivity Project

	Share of Farmers' Responses (%; *n* = 7,151)		
Types of Seed Used Exclusively	Baseline year (2011)	Endline year (2016)	Baseline-to-Endline Change (%)
Local	81.87	5.37	−93.44
High-yielding variety	9.20	62.21	576.20
Hybrid	8.93	32.42	263.05

Source: BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016.

Table D.3. Use of Buried Pipes for Irrigation under the Integrated Agricultural Productivity Project

Region	District	Share of Farmers Who Used Buried Pipe (%; *n* =1,778)		
		Baseline year (2011)	Endline year (2016)	Baseline-to-Endline Change (%)
Southern region	Barguna	0.0	42.0	42.0
	Barisal	0.0	39.5	39.5
	Jhalokati	0.0	38.9	38.9
	Patuakhali	0.0	43.9	43.9
	Regional average	0.0	41.1	41.1
Northern region	Kurigram	0.0	86.2	86.2
	Lalmonirhat	11.1	77.3	596.4
	Nilphamari	14.4	91.3	534.0
	Rangpur	24.7	99.3	302.0
	Regional average	12.6	88.5	602.3
Overall average		6.3	64.8	929

Source: BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016.

Table D.4. Productivity of Boro Rice before and after Integrated Agricultural Productivity Project Interventions

Project District	Rice Production (MT/ha) under IAPP		Endline Production (MT/ha) beyond IAPP (control)	Production Increase (%)	
	Baseline year (2011)	Endline year (2016)		Over baseline	Over control
Barguna	4.97	6.35	5.40	27.77	17.59
Barisal	5.39	7.00	5.52	29.87	26.81
Jhalokati	4.80	5.73	4.84	19.38	18.39
Patuakhali	4.91	6.46	5.30	31.57	21.89
Kurigram	5.60	7.02	5.83	25.36	20.41
Lalmonirhat	5.53	7.07	5.73	27.85	23.39
Nilphamari	5.09	6.52	5.18	28.09	25.87
Rangpur	5.54	7.72	5.82	39.35	32.65
Average	5.23	6.73	5.45	28.65	23.37

Source: BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016.
Note: IAPP = Integrated Agricultural Productivity Project; MT/ha = metric ton per hectare.

Table D.5. Yield for Rice (metric ton per hectare)

Year	2016–17	2019–20
Barisal	3.83	4.04
Patuakhali	2.65	2.91
Barguna	3.18	3.31
Jhalokati	3.87	3.83
Rangpur	4.26	4.41
Kurigram	4.00	4.06
Nilphamari	4.21	4.28
Lalmonirhat	4.12	4.02

Source: Yearbook of Agricultural Statistics 2020 (Government of Bangladesh 2021).

Table D.6. Amount of Irrigation Cost Reduction in Project Areas

Project Districts		Cost of Irrigation (Tk/Decimal[a])		
Region	Districts	Baseline year (2011)	Endline year (2016)	Baseline-to-Endline Change (%)
Southern region	Barguna	70.70	24.50	−65.35
	Barisal	51.60	21.60	−58.14
	Jhalokati	43.30	30.20	−30.25
	Patuakhali	44.60	26.40	−40.81
	Regional average	52.55	25.68	−48.64
Northern region	Kurigram	53.50	18.70	−65.05
	Lalmonirhat	73.20	21.30	−70.90
	Nilphamari	39.70	19.90	−49.87
	Rangpur	44.50	19.10	−57.08
	Regional average	52.73	19.75	−60.73
Overall average		52.64	22.71	−54.68

Source: BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016.
Note: a. Decimal is one hundredth of an acre of land (1 acre = 100 decimal).

References

Bangladesh, Government of. 2021. *Yearbook of Agricultural Statistics 2020*. Dhaka: Bangladesh Bureau of Statistics, Ministry of Planning.

BETS Consulting Services Ltd. and Arc Bangladesh Ltd. 2016. *Impact Assessment of Integrated Agricultural Productivity Project Final Report*. Dhaka: BETS Consulting Services Ltd. and Arc Bangladesh Ltd.

BRRI (Bangladesh Rice Research Institute). 2016. *Project Completion Report: IMED 04/2003 (Revised)*. Gazipur: BRRI.

Appendix E. Borrower Comments

Government of the People's Republic of Bangladesh
Ministry of Finance
Economic Relations Division
Shere Bangla Nagar, Dhaka-1207
www.erd.gov.bd

Record Number: 09.00.0000.060.24.071.10.118 Date: 27/8/2023

Subject: **'Bangladesh Integrated Agricultural Productivity Project': Draft Project Performance Assessment Report for Comment**

Reference: Draft PPAR on Integrated Agricultural Productivity from the WB; Dated: June 9, 2023

Dear Mr. Abdoulaye Seck,

Please refer to the subject and the reference. Ministry of Agriculture agreed with the draft Project Performance Assessment Report (PPAR). However, Ministry of Fisheries & Livestock has some comments on draft PPAR.

2. Hence, as per direction, I forward herewith the comments of Ministry of Fisheries and Livestock for your information and necessary action.

Thanks for your cooperation as always.
With kind regards,

Enclose: As stated (3 pages)

27-8-2023
Kawshar Jahan
Deputy Secretary
Phone: 48113342
Email: wb2@erd.gov.bd

Mr. Abdoulaye Seck, Country Director
World Bank Office, E-32, Agargaon, Sher-e-Bangla Nagar, Dhaka

Record Number: 09.00.0000.060.24.071.10.118/1(5) Date: 27/8/2023

Copy for Kind Information and Necessary Action,
1) Secretary, Office of the Secretary, Ministry of Agriculture
2) Secretary, Ministry of Fisheries and Livestock
3) Mr. Christopher Nelson, Manager, Infrastructure and Sustainable Development Project, Evaluation Unit Independent Evaluation, World Bank Dhaka Office, Agargaon, Dhaka
4) Personal Officer, Wing-2 (World Bank), Economic Relations Division
5) Personal Officer, World Bank Branch-II, Economic Relations Division

27-8-2023
Kawshar Jahan
Deputy Secretary

Department of Fisheries
www.fisheries.gov.bd

Opinion of the Department of Fisheries (DoF) on "Project Performance Assessment Report (PPAR)" of the Integrated Agricultural Productivity Project (IAPP):

SL No.	Page No.	Existing	DoF Opinion
1	2	3	4
1.	ii	• DOF for Department of Fisheries	• DoF is the correct form of the Department of Fisheries. In the full documents of PPAR this acronym need to be changed.
2.	5	1.1 Activities: Technology adaption under theory of change • Supply of quality seed stock for fish nurseries • Training and exposure visits for farmers (Crop, Livestock)	May be substituted by the following: • Development of brood in the fish farms and supply of mass quality fish seed for fish farmers and nurseries. • Training and exposure visits for farmers (Crop, Fisheries and Livestock)
3.	10	In the first para... • BRRI provided technical assistance and germplasm to private and public hatcheries in the districts to produce quality fish fry. • IAPP worked with the Department of Fisheries (DOF) that offered training on aquaculture, pond productivity, fish feed formulation and nutrition, and delivered aquaculture technology packages. The DOF mobilized demonstration fish farmers and supported adopter farmers who would get first-hand knowledge from demonstration farmers and would be supported by the project on a sliding basis with training in nursery management, and provision of quality seed. Key results for fisheries are presented below.	May be substituted by the following: • DoF as well as BRRI provided technical assistance and germplasm to private and public hatcheries in the districts to produce quality fish fry. May be substituted by the following: • IAPP worked with the Department of Fisheries (DoF) that offered training on aquaculture, pond productivity, integrated farming system, fish feed formulation and nutrition, seed production techniques and delivered adaptive aquaculture technology packages. The DoF mobilized demonstration, arranged field day and exchange visit for the fish farmers and supported adopter fish farmers who would get first-hand knowledge from demonstration fish farmers. The project supported on a sliding basis with training in nursery management and provision to distribute quality seed to the beneficiaries. Key results for fisheries are presented below:

SL No.	Page No.	Existing	DoF Opinion
1	2	3	4
4.	10	2.11 • At project end, the project reached 60,000 members of fish culture groups. As a result, 47,520 farmers increased their fish productivity, and …..	May be substituted by the following: • At project end, the project reached 60,000 members of total 2433 fish farmers groups. As a result, 48177 fish farmers increased their fish productivity (PCR, IMED 2017) and ….
5.	28	Productivity of Fisheries: • The project exceeded all its outcome targets related to interventions in fisheries. Yields of fish increased to 5,420 kg/ha (against the target of 5,420 kg/ha) from a baseline of 2,700 kg/ha… • The fish breeds (Tilapia, Koi and Pangus) introduced through the research institute (BFRI) had high demand for adoption by farmers with 47,520 fish farmers increased their fish productivity during the project.	May be substituted by the following: • The project exceeded all its outcome targets related to interventions in fisheries. Yields of fish increased to 5,420 kg/ha (against the target of 3,400 kg/ha) from a baseline of 2,700 kg/ha……. May be substituted by the following: • The fish breeds and seed (Tilapia, Koi and Pangas) introduced in the field level through extension departmet (DoF) provided by research institute (BFRI) had high demand for adoption by fish farmers with 48177 fish farmers increased their fish productivity during the project.

02/08/23

মোঃ ইউসুফ আলী
উপজেলা মৎস্য কর্মকর্তা (রিজার্ভ)
মৎস্য অধিদপ্তর, মৎস্য ভবন
রমনা, ঢাকা।

12.08.2023

Dr. Md. Iftakharul Alam
Senior Assistant Director
Department of Fisheries
Matshya Bhaban, Dhaka

০৮/০৮/২০২৩

(Md. Shahed Ali)
Deputy Director (Finance & Planning)
Department of Fisheries
Matshya Bhaban, Dhaka.

DLS

Comments of Department of Livestock Services on Project Performance Assessment Report (PAR) Of Bangladesh Integrated Agricultural Productivity Project (IAPP)

- The specific objective of the project was to improve household food and nutrition security by increasing milk. meat and egg production. In the assessment report only change in milk production was mentioned Meat and egg production pattern change and nutrition security was not mentioned.
- Impact of the project on poverty reduction in livestock farmers is not mentioned
- Impact of technology dissemination and training on livestock farmers was not described in the report
- Backyard poultry rearing and fodder nurseries are not mentioned in the report
- In Section 1 11 Theory of Change: Activity. outputs and outcomes are not properly aligned with specific objectives of the Project DPP
- Section 2 Results part (2.3-2.12): no activity of Livestock sector was described. we don't know why
- In Implementation and Sustainability Section 2.18 only crop and fisheries technologies are mentioned. Why livestock technologies are not described is not clear
- Section 2.19 Improved linkages between research and extension promoted by the project led to faster and efficient dissemination of technologies Livestock sector was not linked with research it could be a drawback of the project
- Section 2.22 IAPP's interventions focused primarily on enhancing agriculture productivity. without promoting market access: Livestock farmers also faced marketing challenge but it is not stated
- Section 3.2 Improved linkages between research-extension and farmers requires strong governance and oversight structures in place This was evident in the ex-post review of this project where sustainability is threatened by a lack of public financing of the linkages to ensure the utility of the outcomes as public goods: No research organization from livestock sector was not involved in project implementation. it could be write as a drawback of the project
- In Page 31 and 37 DLS is mentioned as DOLS it should be corrected
- Appendix C Section B mentioned Questionnaire distributed to DAE staff. whether it was distributed to DLS/DOF staff not clear
- Appendix D. Additional Data: Only crop sector data is showed. why other sector data not showed is not clear

Q. 08. 23

Appendix F. Map

Figure F.1. Map of Bangladesh Integrated Agricultural Productivity Project

Source: World Bank 2017.

Reference

World Bank. 2017. "Bangladesh—Integrated Agricultural Productivity Project." Implementation Completion and Results Report ICR00003973, World Bank, Washington, DC.