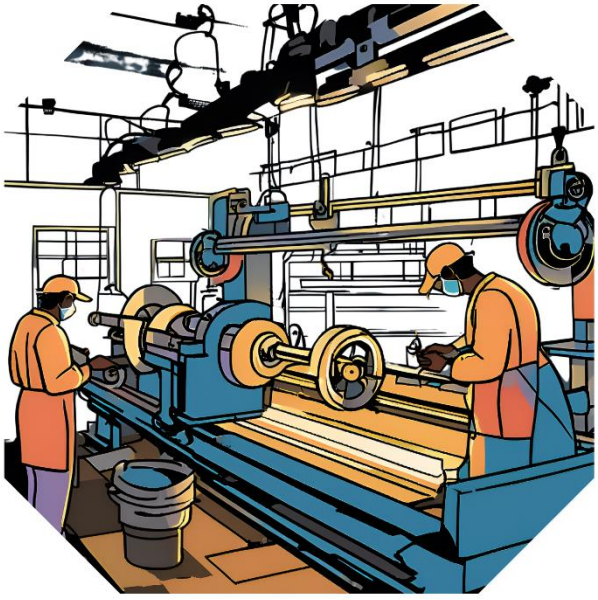
FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

ANNUAL REPORT

October 2023 - September 2024



Cereal Systems Initiative for South Asia—Mechanization Extension Activity (CSISA–MEA)

USAID
আমেরিকার জনগণের পক্ষ থেকে

CIMMYT | CGIAR

iDE

Georgia Tech

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Acronyms and abbreviations

ABLE	Agriculture-based light engineering
ADO	Agriculture Development Officer
BARI	Bangladesh Agricultural Research Institute
BEIOA	Bangladesh Engineering Industry Owners Association
BISA	Borlaug Institute for South Asia
BITAC	Bangladesh Industrial Technical Assistance Center
BJRI	Bangladesh Jute Research Institute
BRAC	Bangladesh Rural Advancement Committee
BRRI	Bangladesh Rice Research Institute
BSP	business service provider
CSISA–MEA	Cereal Systems Initiative in South Asia – Mechanization and Extension Activity
CIMMYT	The International Maize and Wheat Improvement Center
CNC	computer numerical control
DAE	Department of Agriculture Extension
EOI	Expression of Interest
FDMN	forcibly displaced Myanmar nationals
FMPE	Farm Machinery Postharvest Process Engineering
FSI	financial services institution
Georgia Tech	Georgia Institute of Technology
GESI	Gender Equality and Social Inclusion
GUK	*Gram Unnayan Karma* (Village Development Karma)
GBV	gender-based violence
iDE	International Development Enterprises
IDLC	Industrial Development Leasing Company
iDQA	Internal Data Quality Assessment
IFPRI	International Food Policy Research Institute
IR	Intermediate Result
IT	information technology
JVA	joint venture agreement
LAN	Livestock and Nutrition Activity
MFI	micro finance institution
MEL	monitoring, evaluation and learning
MDO	Machinery Development Officer
MSP	machinery service provider
NARS	National Agricultural Research Station
NBR	National Board of Revenue
NGO	non-governmental organization
OHS	Occupational Health and Safety
OMD	Officer, Market Development
OVC	online video commercial
PAC	Practical Action Consulting
PTOS	power tiller-operated seeder
RRF	Rural Reconstruction Foundation
SAAO	Sub Assistant Agriculture Officer
SME	small and medium enterprise
TML	The Metal (Pvt.) Limited
TSP	training service provider
US	United States
USA	United States of America
USAID	United States Agency for International Development
USD	United States dollar
VPKA	Voluntary *Parivar Kalyan* Association

ZOI	Zone of Influence
ZOR	Zone of Resilience

Executive Summary

This report covers the period from October 1, 2023 to September 30, 2024.

The United States Agency for International Development (USAID) Feed the Future (FtF) Bangladesh Cereal Systems Initiative for South Asia – Mechanization and Extension Activity (CSISA–MEA) operates in the Feed the Future Zone of Influence (ZOI) in south-west Bangladesh and the Feed the Future Zone of Resilience (ZOR) in the Rohingya refugee crisis-impacted Cox's Bazar region in south-east Bangladesh. It also operates in north-west Bangladesh in Bogura, a major producer of and market for agricultural machines and their parts that are used or made nationally including in the ZOI and ZOR.

The Activity was due to end on September 30, 2024, but has now been extended for a further 18 months by using USD 6,000,000 from the USAID Bangladesh Ukraine supplemental fund. The extension will focus on the activities of Intermediate result three with an emphasis on technologies that will improve fertilizer use efficiency.

CSISA–MEA focuses on supporting farmers to reduce costs and time spent on arduous manual labor by facilitating access to new labor-saving technology through businesses that provide farmers with machinery services. This is accomplished by developing the capacity of the private sector to develop, manufacture, and market innovative, climate-resilient technologies and then make them available to farmers through machinery service providers (MSPs) enabling the country's farmers to mechanize their agricultural production and increase their resilience to climate change.

At the start of CSISA-MEA it was given ten key performance indicators and targets that should be met within the five years of the Activity. At the end of year five of the Activity all these targets have been met and in many cased exceeded (see annex 4 for more details). Headline numbers are:

- **245,933 of individuals in the agriculture system** who have applied improved management practices or technologies with USG assistance. These are the number of farmers who have benefited from the use of agricultural mechanization services provided by MSPs businesses developed with assistance from the Activity.
- **USD 10,954,895 of annual sales** of farms and firms receiving USG assistance. This is the value of machinery sales and the value of services given by MSPs
- **USD 4,133,243 in agriculture-related financing** accessed as a result of USG assistance. This is the value of loans facilitated by CSISA-MEA from financial service institutes for ABLE enterprises, dealers and MSPs.
- **26% of female participation and 18% of youth participation** in CSISA-MEA facilitated activities
- **2,622 ABLE enterprise workforce staff** receiving training to improve their machinery manufacturing skills.

These have been achieved through three intermediate results.

Intermediate result 1: Competitiveness and efficiency of domestic and private sector-led agricultural machinery manufacturing boosted.

During the reporting period, the Activity signed agreements with 140 new partner ABLE enterprises. Through these partnerships it has facilitated training in metalworking and management skills for staff and managers, and linked them to new markets and finance through meetings with dealers, MSPs, and financial service institutes (FSIs). This brings the number of ABLE enterprises the Activity has supported since its inception in October 2019 to 647. Cost-sharing agreements were also signed with 42 ABLE enterprises, bringing the total number of businesses to which CSISA–MEA has provided detailed support to 106. These agreements facilitated analyses of the business needs of enterprises, which showed that areas of collaboration should include facilitating access of entrepreneurs to drawing, designing, and internet-based marketing skills, as well as to new markets through business expansion into new regions and dealerships, new machinery manufacturing technology, and credit facilities for the finance of business operations.

ABLE enterprises partnering with the Activity made sales in this reporting period worth a total of USD 1,178,756. These were achieved in part as a result of new markets accessed through marketing events attended by lead firms, dealers, and MSPs, during which ABLE enterprise partners were supported to display their machines and parts by the Activity. ABLE enterprises were also able to gain access to markets through marketing materials developed with Activity support and uploaded on to social media platforms. Meetings facilitated by CSISA–MEA between ABLE enterprises, dealers, and MSPs with FSIs resulted in the provision of loans worth USD 1,253,821.

Technical support provided by CSISA–MEA, particularly when in collaboration with Bangladesh Agricultural Research Institute (BARI), resulted in the development and marketing of 27 new types of agricultural machine since the start of the Activity. One of the most successful of these is the onion blower that pulls air through bulk-stored onions, reducing storage losses caused by fungal diseases and dehydration. ABLE enterprises have already sold 185 of these machines since marketing began in January 2024.

Intermediate result 2: Institutional capacity for agricultural mechanization through the development of a skilled and youth workforce enhanced.

Between October 2023 and September 2024, 393 workforce staff, of which 60% were youth under 30 years and 20% were women, were provided with training in metalworking skills, facilitated by CSISA–MEA. This brings the total number trained in metalworking since the Activity's start to 2,662.

The training service providers (TSPs) were Gram Unnayan Karma (GUK) in Bogura, Rural Reconstruction Foundation (RRF) in Jashore, and Kushtia Engineering Works in Faridpur/Kushtia. In the ZOI and ZOR, the TSP was Bangladesh Industrial Technical Assistance Center (BITAC), a Ministry of Industry institution. Training comprised practical sessions held at leading ABLE workshops and foundries, with ABLE enterprise staff sharing their experience and skills with trainees. The TSPs also utilized specialists from universities, such as Bangladesh University of Engineering and Technology (BUET) and Jashore University of Science and Technology (JUST). All training included sessions on gender equality and social inclusion (GESI) and, for the first time, the awareness of climate change and environmental issues.

Specialist training was given to ABLE enterprise managers as follows:

- GSM Engineering, Kushtia and BITAC, Bogura provided training on the operation and maintenance of the computer numerical control (CNC) lathe, laser cutter, and laser welding machine.
- Semicolon IT Solutions held training in the use of software for inventory management.
- Involute Tech, a private business led by graduates from BUET, gave training in engineering design and drawing.
- Creavision provided training on how to improve sales and marketing skills.
- Green Consulting Firm, a certification agency, provided training and advice on how to apply for and obtain ISO certification.

Training in the use of a welding simulator produced by Lincoln Electric, a USA company that makes welding equipment, was given by the Activity to BITAC so that it can use it to train technical students from educational institutes.

Collaboration with the Bangladesh Rice Research Institute (BRRI)-implemented Strengthening Farm Machinery Research Activity for Mechanized Rice Cultivation (SFMRA) project resulted in the training by BRRI staff of 56 staff from five ZOR ABLE enterprises in the manufacture of the BRRI-designed rice thresher.

The GESI training provided in Year 4 of the Activity is now beginning to produce positive impacts on women's working conditions. To date, 36 ABLE enterprises have made infrastructure changes such as providing toilets and rest areas for women, and many are now employing women in skilled work such as lathe and metal drilling.

Intermediate result 3: Access for farmers to agricultural machinery, production, and marketing services improved.

Marketing events facilitated by the Activity have in part resulted in the sale to MSPs of machinery and spare parts worth USD 1,856,914. Combine harvester (101 units) sales accounted for 82% of these funds spent. Eight percent of machines sold were purchased by women. During this reporting period, 56,211 farmers bought machinery services worth a total of USD 2,861,900 from 414 MSPs.

Experience-sharing workshops shared market information between dealers, MSPs, and commission agents, and proved an effective method of supporting MSPs to expand their business networks and provide more farmers with machinery services. These events also supported lead firms and dealers to find new markets. To complement the workshops and machinery demonstrations, the Activity is exploring the possibility of using smartphone applications (or 'apps') to provide information about machinery and how to obtain services from MSPs.

CSISA–MEA continues to facilitate lead firms to train MSPs and mechanics to operate and maintain the machines they sell and to conduct pre-season maintenance campaigns. To support this process, it is facilitating the development of a combine harvester driving simulator in partnership with two lead firms, Abedin Engineering and Metal Agritech. The software is being developed by two Bangladeshi IT companies, Battery Low Interactive Ltd. and TechnoMagic Ltd., and will support new MSPs to learn to drive and operate combine harvesters before the harvesting season starts, greatly increasing safety and reducing the cost and time involved in training.

Increasing the availability of rice transplanter services continues to be a key activity of CSISA–MEA. A major contribution to achieving this is the support the Activity provides to the Government of Bangladesh's Department of Agriculture Extension (DAE) and lead firms to demonstrate the machines, as well as to train farmers and MSPs in how to raise seedlings for use with rice transplanters.

Feni district flood-impacted relief program

Floods in late August and early September 2024 caused by excessive rain affected 2,125,650 people across 11 districts in eastern Bangladesh. Agriculture was severely hit, with nearly 297,000 hectares of cropland flooded, and the fisheries and livestock industries reporting severely damage, causing a combined losses of crop, fisheries, and livestock losses of over USD 155 million.

To mitigate these losses in agriculture, CSISA–MEA, in partnership with Bangladesh Rice Research Institute (BRRI) grew 7,500 trays of rice seedlings for the flood-affected farmers. From September 13, 2024, a team of rice transplanter owners from Cox's Bazar, brought to Feni District by CSISA–MEA,

began to transplant rice seedlings raised in seed trays, providing coverage of 24 hectares for 150 farmers in Feni, one of the worst impacted districts.

Visitors

On October 22, 2023 a USAID team led by USAID Asia Deputy Assistant Administrator Anjali Kaur visited SMR Agro Engineering, Kanaitala, Jashore,.

On February 4, 2024, representatives from USAID Bangladesh and the Government of Bangladesh, Ministry of Finance visited SMR Agro Engineering to observe the manufacture of agricultural machinery and spare parts, and Vatpara, Jashore Sadar, to see rice transplanters planting out rice seedlings.

On April 17, 2024, a USAID Bangladesh team and senior CIMMYT team members from Dhaka and Mexico visited ABLE enterprises in Faridpur, Kustia, and Jashore, and rice transplanter MSPs in Faridpur.

On June 10, 2024, Bangladesh USA Embassy and regional USAID staff visited Cox's Bazar district to meet ABLE enterprise managers and MSPs to discuss their work.

On May 9, 2024, U.S. Ambassador Peter Haas, and Assistant Secretary of Commerce for Global Markets and Director General of the U.S. and Foreign Commercial Service Arun Venkataraman, visited the CSISA–MEA stand at the US trade show in Dhaka.

Sarah Michelle Fernandes, Communications Manager, CIMMYT HQ, Mexico and Nur-A-Mahajabin Khan, Communications Manager, CIMMYT Bangladesh visited Jashore on February 29, 2024 to meet MSPs providing farmers with rice transplanter and combine harvester services. They also visited Activity partner SMR Agro Engineering to meet the owner and workshop staff.

Challenges and lessons learned

Challenges. Foreign currency restrictions, inflation, the declining value of the Bangladesh *taka,* and the general elections in January 2024 were the main challenges for the Activity. Recent government changes caused a pause in activities in June.

Lessons learned. The primary lessons learned are the value of linking ABLE enterprises with markets through meetings with dealers and MSPs, the value of facilitating public–private sector collaboration for the development and dissemination of new agricultural machinery technology, the superior approach of delivering specific, targeted (rather than the inclusion of all) skills in training programs, the ability to change the light engineering sector in the ZOR through intense focus in the region, and the value of GESI training in improving working conditions for women.

Introduction

This annual report covers the period from October 1, 2023 to September 31, 2024.

The USAID Feed the Future Bangladesh Cereal Systems Initiatives for South Asia – Mechanization Extension Activity (CSISA–MEA) is a five-year development Activity, which started in October 2019. It is implemented by The International Maize and Wheat Improvement Center (CIMMYT) in partnership with International Development Enterprises (iDE) and Georgia Institute of Technology (Georgia Tech). Information about the Activity's partners is provided in Annex 1.

The Activity was due to end on September 30, 2024 but has been awarded an 18-month extension by USAID Bangladesh using USD 6,000,000 provided from the Ukraine supplemental fund. The extension will focus on the activities of Intermediate Result 3 with an emphasis on technologies that will improve fertilizer use efficiency. It will also begin work in the newly defined Zone of Influence (ZOI), which now consists of the 12 coastal districts of Khulna and Barisal Division and the four districts of Sylhet Division. The Activity will continue to work in Cox's Bazar and Bandarban districts in Chattogram Division.

CSISA–MEA focuses on supporting farming households to reduce costs and time spent on arduous manual labor by facilitating access to new labor-saving technology, either directly or through businesses that provide farmers with machinery services. This is accomplished by developing the capacity of the private sector to develop, manufacture and market innovative, climate-smart technologies. Machinery service providers (MSPs) then purchase the machines and use them to provide farmers with services that mechanize key crop and livestock production activities. This enables farmers to improve resource management and the timeliness of agricultural production operations increasing their resilience to climate change.

Therefore, the core objective of the Activity is to enhance agricultural resilience through the development of agriculture-based light engineering (ABLE) enterprises and of a youth and gender-inclusive workforce, with a special focus on the Rohingya refugee crisis-affected areas of Cox's Bazar and Bandarban districts. This will be achieved through three intermediate results:

- **Intermediate Result 1**: Boost the competitiveness and efficiency of domestic and private sector-led agricultural machinery manufacturing.
- **Intermediate Result 2**: Enhance the institutional capacity for agricultural mechanization through the development of a skilled and youth workforce.
- **Intermediate Result 3**: Improve access for farmers to agricultural machinery, production and marketing services.

By achieving these results, the Activity has, by the end of its term in 2024, enabled at least 200,000 farmers to gain access to new agricultural mechanization technology, encouraged agriculture-related businesses to make at least USD 7.7 million worth of new investments, facilitated the provision of at least USD 3.0 million worth of finance for agricultural mechanization value chain actors, and raised the skills of at least 2,000 members of the country's light engineering workforce.

Private sector engagement is the principal means used to deliver these results. To address constraints to the smooth functioning of agricultural machinery market systems, the Activity engages in partnerships with agricultural machinery value chain actors. It does not engage directly in interventions but rather assumes a market facilitating role by funding activities, facilitating linkages to other organizations such as the Department of Agriculture Extension (DAE) and national research institutions and universities, and by the provision of technical expertise. Interventions implemented by the private sector with CSISA–MEA support should be innovative, new and readily scalable. Costs and activities are rationally shared between partners and, wherever possible, confined to the provision of

technical support. As such, the Activity takes a market systems approach, building systemic change that will continue even after the Activity ends.

Area of operations

CSISA–MEA maintains field offices in locations across Bangladesh. These are crucial to USAID's activities and the light engineering and agricultural machinery manufacturing industry.

Khulna and Greater Faridpur region of Dhaka division. These are the locations of the main light engineering hubs in the Feed the Future Zone of Interest (ZOI).

Bogura district. This is the main light engineering center outside of Dhaka and is a major producer of and market for agricultural machine parts and agricultural machines that are used or made nationally, including in the ZOI and ZOR.

Cox's Bazar and Bandarban districts. These districts are close to the Rohingya refugee camps and make up the USAID Zone of Resilience (ZOR). Being remote from the major commercial centers in northern and central Bangladesh, they have not attracted significant commercial interest in terms of the manufacture and marketing of agricultural machinery.

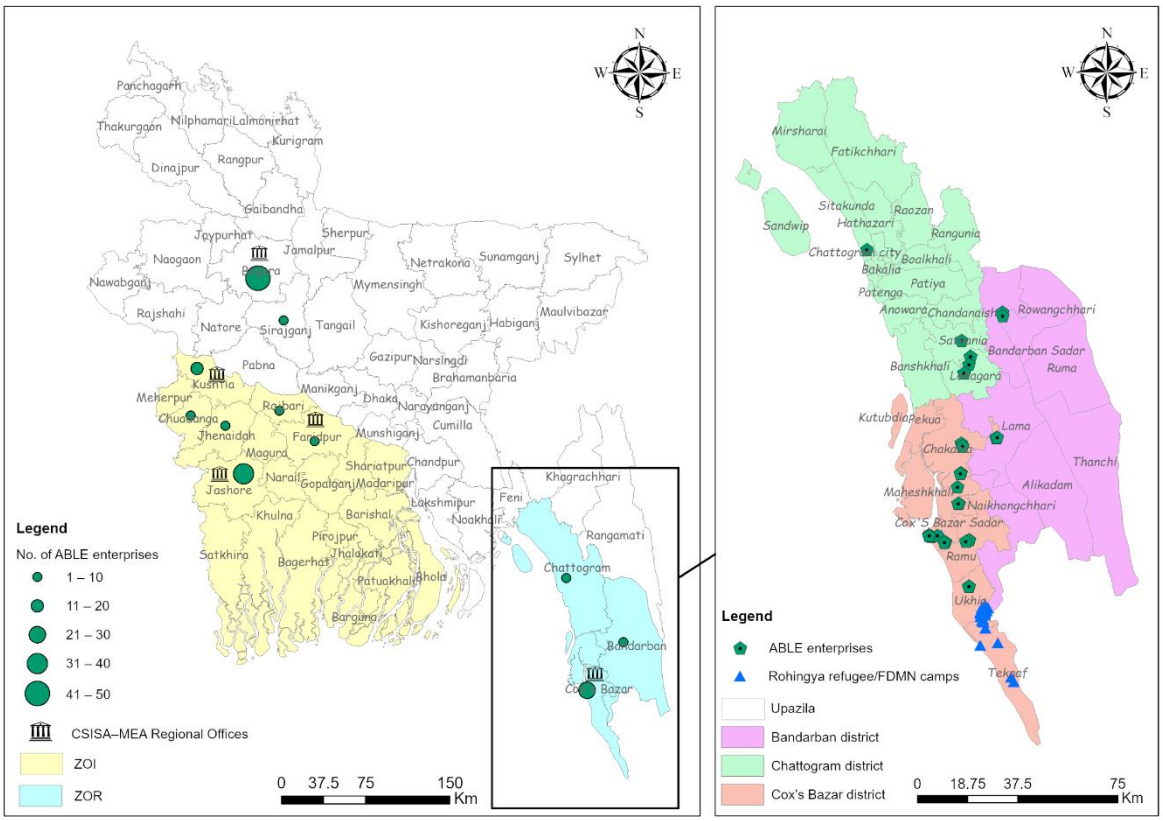

Figure 1: Maps showing location and size of ABLE enterprise hubs where CSISA–MEA and the USAID ZOI and ZOR operate.

* FDMN – forcibly displaced Myanmar nationals

Activity staffing

CSISA–MEA currently employs 74 staff (50 from CIMMYT 50, 24 from iDE). Nineteen are based in the Dhaka office, 53 in field offices, and two are home-based report-writing and editing consultants.

Georgia Institute of Technology (Georgia Tech) provides Professor Dr. Jonathan Colton as technical lead on the technical and engineering aspects of the Activity. Prof. Colton supervises Georgia Tech postgraduate engineering students who design machinery and conduct studies for the Activity as part of their thesis research.

The largest group of technical experts employed by the Activity are 15 engineers (Machinery Development Officers, or MDOs), followed by 12 marketing experts (Officers, Market Development, or OMDs) and 10 agronomists (Agriculture Development Officers, or ADOs).

Table 1: Activity staffing

CIMMYT	No. of posts	iDE	No. of posts
Dhaka Office			
Project Leader*	1	Team Leader	1
Project Manager (currently vacant)	1	Project Manager	1
Training Manager*	1	Senior Technical Specialist (currently vacant)	1
Training Assistant	1	Expert – MERL	1
Locally recruited consultant – training@	1	Technical Specialist	2
Market System Development Coordinator	1	Technology Advisor	1
Project Assistant	1		
Communications Manager@	1	Program Assistant	1
Communication Analyst	1		
MEL Manager@	1		
M&E Coordinator@	1		
Total Dhaka office	**11**	**Total Dhaka office**	**8**
Consultant – report writing *	1		
Consultant – editor*	1		
Field offices (Jashore, Faridpur, Cox's Bazar and Bogura)			
Field Team Manager@	4	Field Coordinator	4
Agriculture Development Officer	10	Officer Market Development	12
Machinery Development Officer (engineer)	13		
Machinery Development Assistant (diploma-level engineers)	2		
MEL Officer@	3		
Locally recruited consultant – MEL Officer	1		
Administration & Finance Officer@	4		
Total field offices	**37**	**Total field offices**	**16**
Total employed by CIMMYT	**50**	**Total employed by iDE**	**24**

*internationally recruited staff.
@position shared with other CIMMYT projects.

Administration and financial management support for the Activity is provided by a pool of staff, which also supports all the programs implemented by CIMMYT and iDE.

Visitors to CSISA–MEA activities

USAID visits CSISA–MEA-facilitated activities at SMR Agro Engineering, Kanaitala, Jashore

A USAID team led by USAID Asia Deputy Assistant Administrator Anjali Kaur visited SMR Agro Engineering, Kanaitala, Jashore on October 22, 2023. The visitors were shown the foundry and workshop by the owner, Mr. S. K. Mahfuzur Rahman. He described how CSISA–MEA facilitated his access to finance, as well as engineering and marketing support, enabling him to develop a modern workshop manufacturing quality agricultural machinery and spare parts. Delegates also viewed combine harvesters, reapers, rice transplanters, power tiller operated seeders (PTOS), axial flow pumps (AFPs) and fodder choppers, and met MSPs who use these machines to provide farmers with labor- and cost-saving services.

USAID delegates meeting the SMR Agro Engineering owner and workforce. Jashore, October 22, 2023.
Photo: Md. Khalekuzzaman, OMD, Jashore

USAID and senior Government of Bangladesh officials visit machinery manufacturing and machinery service provision activities, facilitated by CSISA–MEA, in Vatpara, Jashore

USAID and senior government officials visiting MSP rice transplanter service provision activities. Vatpara, Jashore Sadar, February 4, 2024.
Photo: A. N. M. Arifur Rahman MDO, Jashore

On February 4, 2024, representatives from USAID Bangladesh and the Government of Bangladesh, Ministry of Finance and Ministry of Agriculture, visited Jashore district to observe the manufacture of agricultural machinery and spare parts at SMR Agro Engineering, and to meet rice transplanter MSPs to see a demonstration of the machine in action. At SMR Engineering, the visitors viewed solar dryers, mango juice extractors, spice grinders, and maize grinders, some of the latest machinery to have been developed with support facilitated by CSISA–MEA. The USAID team was led by Mr. Muhammad Khan, Director, Economic Growth Office, and the government representatives included Mr. Tofazzal Hossain, Joint Secretary, America Desk, ERD, Ministry of Finance and Ms. Binita Rani, Deputy Secretary, Ministry of Agriculture.

USAID and CIMMYT senior staff visit CSISA–MEA activities in Faridpur and Jashore

A USAID team comprising Zachary P. Stewart, Production Systems Specialist from the Bureau for Resilience, Environment & Food Security, and John Laborde from the USAID Bangladesh Mission, visited CSISA–MEA activities in Faridpur and Jashore on April 17, 2024. The USAID team was accompanied by CSISA–MEA senior staff, Dr. Sieglinde Snapp, Program Director, Sustainable Agrifood Systems Program, CIMMYT Mexico, and Dr. Timothy J. Krupnik, Country Representative for Bangladesh. At Al Helal Engineering workshop, Kustia visitors observed the climate-smart agricultural machinery manufactured through technical and business development support provided by CSISA-MEA. These

machines included onion storage blowers, jute decorticators, AFPs and the production of combine harvester spare parts.

USAID visitors observing CSISA–MEA field activities in Faridpur and Jashore districts, April 17 2024. Photo: Masud Rana, Portfolio Coordinator, CSISA–MEA

At Kanaipur in Faridpur District, the visitors discussed the cost and benefits of using a rice transplanter with rice transplanter service providers, seedling growers, and farmers, and watched demonstrations of a mechanical rice seed sower and a rice transplanter. They also heard how the Activity is developing youth-managed MSP businesses.

At SMR Engineering, Jashore, the visitors were shown a display of the new agricultural machinery being developed through partnerships between BARI and ABLE enterprises, facilitated by CSISA–MEA. The machines are a solar dryer, mango juice extractor, mini power tiller, mungbean dehuller, mungbean dehuller, and sugarcane juice extractor. The visitors also saw machinery marketed by lead firms with support from CSISA–MEA – combine harvesters, reapers, PTOS, and fodder choppers. They visited SMR Engineering's foundry and machinery assembling facilities to see a display of the parts and machines SMR produces.

USAID and USA Embassy officials visit CSISA–MEA activities in Cox's Bazar, ZOR. On June 10, 2024, Mr. Jason Briggs, Deputy Director in Bureau of South and Central Asia Affairs, Ms. Ciera Dehmand, Bangladesh Desk officer, U.S. Department of State, Mr. Galen Tan, Policy & Strategy

Analyst, Office of Strategic Planning and Operations USAID/ASIA, Ms. Anne Daugherty, Human Rights Officer, U.S. Embassy Dhaka, Mr. Isteak Ahammed, Refugee Assistant, BPRM, U.S. Embassy Dhaka, and Upazila Agriculture Officer Md. Nizam Uddin of Ukhiya visited CSISA–MEA activities in Ukhiya *upazila*, Cox's Bazar District. After a CSISA–MEA team presentation, the visitors engaged in discussions with MSPs, ABLE enterprises, DAE officials, and farmers, about farm mechanization.

CSISA–MEA staff explain the Activity's interventions and their impact to USAID visitors. Ukhiya *upazila*, Cox's Bazar District, June 10, 2024.
Photo: Abdur Razzak, ADO, Cox's Bazar office

CSISA–MEA participation at the US Trade Show, Dhaka

CSISA–MEA stall at the 29th US Trade Show. This was visited by US Ambassador Peter Haas (second from right) and Arun Venkataraman, U.S. Assistant Secretary of Commerce for Global Markets & Director General of the US and Foreign Commercial Service (far right). May 9, 2024.
Photo: Jotirmoy, FC, Cox's Bazar

The 29th US Trade Show, co-sponsored annually by the American Chamber of Commerce in Bangladesh (AmCham) and the US Embassy in Bangladesh, took place from May 9–11, 2024 at the Intercontinental Hotel, Dhaka. More than 25 organizations, including development agencies, academies, and the private sector, participated in this premier annual trade event and introduced numerous American goods and services to Bangladesh. Jointly with partner lead firms, the CSISA–MEA team demonstrated prototypes of all the targeted agricultural machines at the fair. US Assistant Secretary of Commerce for Global Markets & Director General of the U.S. & Foreign Commercial Service Arun Venkataraman, and US Ambassador Peter Haas, visited the iDE and CSISA–MEA booths and expressed their strong support of the work CSISA–MEA is doing to promote agricultural machinery manufacture and the mechanization of agriculture in Bangladesh.

International Women's Day

In March 2024, CSISA–MEA participated in International Women's Day, marking the ongoing struggle for gender equality and women's rights. In collaboration with Kellanova, a US-based multinational food processing company, the Activity organized an event attended by 80 women farmers to celebrate the contribution women make to food production.

Women marking International Women's Day, participating in the rally organized by Kellanova and CSISA–MEA. Jashore, March 8, 2024.
Photo: A. N. M. Arifur Rahman, MDO, Jashore

CSISA–MEA initiative to support flood-affected farmers

A rice transplanter MSP from Cox's Bazar, transplanting rice in Chauddagram *upazila*, Cumilla District, as part of the flood response activities facilitated by CSISA–MEA with USAID support. September, 2023
Photo: Md. Shafiqul Islam, Technician, CSISA–MEA Cox's Bazar

According to a UNFPA report[1], the devastating flash floods between late August and early September, 2024 impacted 5.8 million people, with over 500,000 of them needing to be relocated and seeking shelter in evacuation centers. The floods affected 2,125,650 people across Moulvibazar, Habiganj, Sylhet, Feni, Cumilla, Noakhali, Khagrachari, Brahmanbaria, Chattogram, Lakshmipur, and Cox's Bazar districts. Agriculture was severely hit, with nearly 297,000 hectares of cropland flooded, and the fisheries and livestock industries reporting combined losses of over USD 155 million. Rice crops planted for the *aman* season, which were in their crucial tillering stage, were completely destroyed. The damage extends beyond rice, affecting a wide range of crops including pulses and vegetables. The disaster also resulted in significant livestock losses.

To mitigate these losses to agriculture, CSISA–MEA with partner Bangladesh Rice Research Institute (BRRI) produced 7,500 trays of rice seedlings for flood-affected farmers. It then facilitated a team of rice transplanter owners from Cox's Bazar to travel to Feni, one of the worst impacted districts, to transplant the 15 day-old rice seedlings.

Arfatul Mostofa Komol, an MSP involved in the effort, said, "Contributing to the recovery of flood-affected communities has been deeply rewarding. In Feni and Cumilla, we've successfully assisted nearly 150 farmers by transplanting rice across 24 hectares. I'm grateful for the opportunity to support those facing hardship."

By providing both immediate assistance, and tools for sustainable recovery, these efforts are empowering farming households to rebuild their livelihoods and resume agricultural production. Dr. Aminul Islam, Chief Scientific Officer at BRRI in Sonagazi, Feni, emphasized the severity of the situation: "The flood has devastated everything in Feni and Cumilla districts. Recovery is particularly challenging as we're nearing the end of the transplanting season." He emphasized the need for swift action, expressing gratitude for CSISA–MEA's timely response: "We appreciate CSISA–MEA's quick intervention in the flood-affected areas. In the aftermath of this disaster, collaboration is key to enhancing food security support for the affected population."

[1] Floods in eastern Bangladesh continue to place lives at risk, UNFPA Bangladesh Situation Report #3, Sep 6, 2024 to Sep 17, 2024.

Activity implementation progress

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The next sections of this report describe the progress made in implementing activities outlined in the USAID-approved work plan for Activity Year 5. Activities are presented under each of the three Intermediate Results.

Intermediate Result 1: Competitiveness and efficiency of domestic and private sector-led agricultural machinery manufacturing boosted

The mechanization of agriculture in Bangladesh started in the 1960s with the introduction of government-managed low lift irrigation schemes. The pace of mechanization was slow until machinery importing markets were liberalized and import taxes reduced in the 1980s. This led to a rapid introduction of power tillers and privately-managed shallow tube well irrigation schemes. This was followed in the 1990s by the manufacture within Bangladesh of crop threshing machines and maize shellers, and later by the introduction of imported four-wheel tractors and, most recently, combine harvesters.

The mechanization of agriculture in Bangladesh stimulated the development of a flourishing light engineering sector, not only to manufacture and repair machines but also to manufacture spare parts. The light engineering sector consists of about 50,000 enterprises, meeting about 30% of the total domestic demand. About 2,000 to 2,500 are involved in manufacturing agro-machine related items. They generally manufacture spare parts and simple machines such as crop threshers. The light engineering sector is characterized by a large number of micro and small businesses employing an average of 20 workers. There are also medium-sized businesses, representing 16% of the ABLE SME sector, which each employ on average more than 100 staff. The staff in most ABLE enterprises generally have not had any formal skills training. The use of outdated machinery and low skills of the workforce tends to result in the manufacture of machines and parts with low quality and low levels of productivity. This tends to make it difficult for the ABLE sector to compete with imported machines and parts in terms of both quality and price.

As agricultural mechanization expands and machines grow more sophisticated, developing the provision of more advanced skills and more efficient manufacturing technology allows the sector to compete with imports and expand. This creates employment, particularly for women and youth. It also supports the creation of an export-orientated light engineering sector which is Bangladesh-based and can supply MSPs with agricultural mechanization technology to provide farmers with labor- and cost-saving mechanization services.

Since inception therefore, a major focus of the Activity has been on developing the capacity of the ABLE sector to manufacture and market agricultural machinery and spare parts, to increase skills in the workforce, improve earning potential and job security particularly for women and youth, and contribute to Bangladesh's ability to compete and contribute to global markets.

Developing the manufacturing capacity of small- and medium-scale agriculture-based light engineering enterprises

Two key lessons learned in the first two years of the Activity were that it is difficult to provide all ABLE enterprises with the detailed support they need, and that, in fact, not all of them want this level of support. As a result, subsequent support to ABLE enterprises has been divided into two stages.

During the first stage, technical assistance has focused on raising the knowledge and skills of the workforce. In the second stage, ABLE enterprises showing a willingness and capacity to invest in changes in manufacturing equipment and methods, sign a cost-sharing joint venture agreement (JVA) with the Activity. This supports them by:

1. conducting a detailed analysis of their capacity and commitment
2. preparing a program of support that stimulates the growth of the enterprise
3. providing technical assistance to identify and implement appropriate investments in new equipment, improved factory layout, new markets and access to finance
4. providing training in key business skills such as inventory control, keeping financial records, customer relations, marketing, and human resource management.

First-stage ABLE enterprises

Over the course of the Activity, CSISA–MEA has supported 647 ABLE enterprises to develop and expand their businesses. This has been achieved through provision of training for staff, technical advice, market linkages, and access to finance. In this reporting year, out of 181 who responded to a Request for Expression of Interest (EOI), published in national and regional newspapers and other media, 140 ABLE enterprises joined the program.

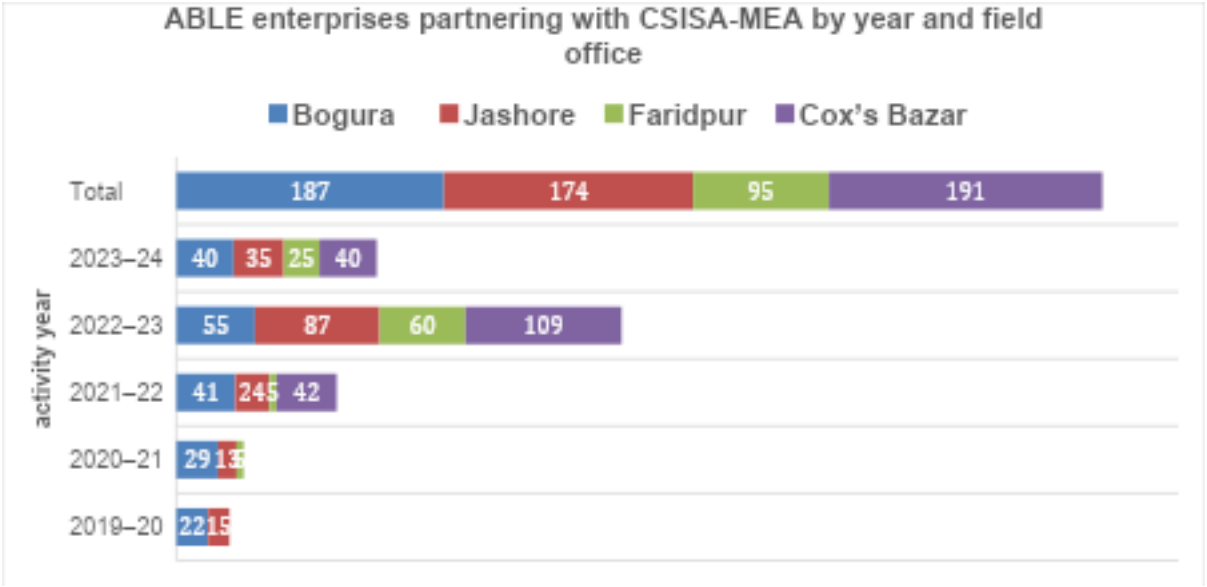


Figure 2: Number of ABLE enterprises partnering with CSISA–MEA

During the reporting year, CSISA–MEA field office teams organized eight kickoff meetings (two in each field office) to present to the selected ABLE enterprises the activities available to support them in expanding their business. The meetings also provided the enterprises with an opportunity to share the challenges they face and their ideas for strengthening the light engineering sector.

New ABLE enterprise partners signing JVAs at a kick-off meeting for 23 ABLE enterprise managers. Cox's Bazar, January 29, 2024.
Photo: Md. Rafiqul Islam, MEL Officer, Cox's Bazar

Support for ABLE enterprises in basic business development

During the reporting period, CSISA–MEA facilitated basic business development support for 342 ABLE enterprises (119 in Bogura, 105 in Jashore, 78 in Faridpur, 40 in the ZOR). Some joined the Activity this reporting year, others in previous years. The Activity's business development support comprises:

- access to new markets through facilitating meetings with dealers, lead firms, and MSPs
- access to finance (A2F) through meetings with FIs and capacity development on financial literacy, business and investment planning and management
- access to business support services (in metal testing, heat treatment, drawing, design, dice)
- links to raw material suppliers
- training and technical advice on the development of marketing materials and preparing for participation in promotional events such as trade fairs
- support for digital marketing and inventory system development
- providing information about modern technology
- introductions to capital machineries suppliers
- training in quality manufacturing techniques and processes.

Supporting ABLE enterprises to prepare marketing materials

ABLE enterprises that provide visually attractive and accurate marketing materials can increase brand awareness and persuade prospective customers to buy their products and services. During this financial year, 10 ABLE enterprises received technical support from the CSISA–MEA Bogura team to prepare marketing materials. These included leaflets, brochures, stickers, business cards, and key rings.

Promotional materials developed by Milon Engineering Workshop, Bogura with training support from CSISA–MEA in Bogura.
Photo: Ali Hayder, OMD, CSISA-MEA, Bogura

Facilitate business linkages between ABLEs enterprise and agricultural machinery market actors

Support ABLEs to supply parts to lead firms

From the start of the Activity, lead firms have always been considered a key market for spare parts manufacturers – but gaining access to this market has not been easy for ABLE enterprises. Before CSISA–MEA's involvement, lead firms considered the parts the enterprises produced to be inferior in quality to imported parts. In addition, for contractual reasons, some lead firms were obliged to buy any parts needed from the companies which supplied the original machine. However, over the course of the Activity the ability of ABLE enterprises to produce import quality parts has increased, and now many parts, for machines such as combine harvesters and tractors, are manufactured in Bangladesh.

In Year 5 of the Activity, lead firms provided ABLE enterprises with information about the parts they needed, negotiated prices, evaluated the quality of sample parts, and identified when the parts should be delivered. The lead firms provided technical backstopping, including standard specifications, drawing, design, pattern, and die development support, and, in some cases, provide heat treatment services, to ensure high quality parts were produced. CSISA–MEA facilitated this process by organizing meetings between lead firm representatives and ABLE enterprises. As a result, Metal Agritech, Alim Industries, SQ Group, Janata Engineering, and Uttaron Engineering bought 4,541 parts worth USD 23,554 from 10 ABLE enterprises.

Support ABLEs supply parts to dealers

Encouraging ABLE businesses to reach dealers has been a very effective way of supporting ABLE enterprises to expand their businesses. In order to help close geographic gaps, the Activity arranged 32 business linkage meetings between dealers from various regions and ABLE producers of

An ABLE enterprise owner delivering a sales pitch at a dealer–ABLE enterprise linkage workshop, facilitated by CSISA–MEA to support partners to extend their business network. Jashore, January 23, 2024.
Photo: Rowshon Anis, OMD, Jashore

agricultural machinery and spare parts. This involved arranging for groups of ABLE enterprises or dealers to visit dealers or ABLE enterprises in other regions. Other means used included arranging

for one-on-one visits and encouraging ABLE enterprises to advertise on social media sites. In the reporting period, the Activity supported Bogura ABLE enterprises to expand the marketing of their goods into ZOR and ZOI. As an example, 14 dealers from Cox's Bazar and Jashore visited 22 ABLE enterprises in Bogura, and 24 ABLEs from Bogura visited 54 dealers in Cox's Bazar (12), Faridpur (20), Jashore (10), and Patuakhali (12).

Through the 32 linkage events, 161 dealers linked with a total of 92 ABLEs in the ZOR and ZOI, resulting in total sales worth USD 1,178,756. This brings the total sales by ABLE enterprises to dealers through events and meetings organized by CSISA–MEA to USD 5,817,890 since the start of the Activity.

Table 2: Sales facilitated for ABLE enterprises by CSISA–MEA, in USD

Field offices	Activity year					Total
	2019–20	2020–1	2021–2	2022–3	2023–4	
Bogura			50,8554	1,062,397	456,846	2,027,797
Faridpur			0	680,026	113,575	793,601
Jashore			460,817	1,516,210	569,534	2,546,561
Cox's Bazar				411,130	38,800	449,930
Total			**969,371**	**3,669,763**	**1,178,756**	**5,817,890**

Facilitating linkage meetings between ABLEs and raw material suppliers

A study commissioned by the Activity from consulting company Inspira in 2022 showed that due to high import taxes and duties on imported metals, the bulk of metal raw materials used by Bangladesh's light engineering industry was obtained from ship-breaking operations in Chattogram. A major problem with this is that at the point of purchase the composition of this metal is unknown, which can lead to the manufacture of low quality parts. The report also showed that if ABLE enterprises bought metals directly from Chattogram ship-breaking companies in large volumes, they would be able to negotiate better prices and obtain higher quality metals than those supplied by intermediate metal dealers.

Based on these findings, the CSISA–MEA Jashore team identified six scrap metal suppliers and organized a business linkage meeting between them and ABLE enterprises in Jashore. Similarly, in the ZOR, eight ABLE enterprises from Cox's Bazar district visited scrap metal suppliers in Chattogram and established good business links with them. In both cases, it is anticipated that this will result in the direct bulk supply to the enterprises of metals of known composition and at competitive prices.

Service provision through light engineering business associations

Two collaboration agreements were signed between the Activity and Bangladesh Engineering Industry Owners Association (BEIOA) in Jashore and Kushtia districts. Under the agreements, the CSISA–MEA

Jashore and Faridpur teams supported BEIOA to improve the provision of services to its members, by implementing a number of activities:

- a meeting between BEIOA Kushtia members, Janata Engineering, and eight dealers to improve their spare part and machine sales
- a visit to Chittagong for BEIOA members to meet raw material suppliers and metal machining equipment company, Unique Machinery Supplier, to ensure a supply of metals of known chemical composition and supply of manufacturing machinery
- a visit to Dhaka by 13 BEIOA Jashore members, to three organizations:
    - BARI headquarters, Gazipur. BEIOA members met BARI engineers and observed the machines BARI developed.
    - Advanced Engineering Solutions, Mouchak, Gazipur. BEIOA observed the painting of machines using the powder coating technique, to better understand the technical and financial features of powder coating with the aim of installing similar equipment in their own manufacturing workshops. This would enable them to achieve a painting finish similar in quality to that of imported machines.
    - BITAC Dhaka, to observe the operation of CNC lathe and milling machines, vacuum heat treatment machines, chemical composition testing machines, hardness testing machines, coordinate measuring machines, and 3D printers. BITAC has agreed to provide CNC machine operation training and access to heat treatment and chemical composition testing services.

Members of BEIOA Jashore observing computer-controlled metalworking technology during their visit to BITAC Dhaka. March 20 2024.
Photo: A. N. M. Arifur Rahman MDO, Jashore

Accessing metal testing and heat treatment services

Metal testing services

During the reporting period, CSISA–MEA field teams facilitated three linkage meetings between ABLE enterprises and four testing service providers: BITAC, JUST, BUET, and Chittagong University of Engineering and Technology (CUET). These meetings will enable ABLE enterprises to gain access to

metal composition testing at a competitive price and ensure that raw materials of the correct chemical composition are used in machine and spare parts manufacturing. The linkage meetings were as follows:

- In **Bogura**, 12 ABLE enterprises visited the BITAC Bogura office to observe and discuss the utilization of BITAC facilities for heat treatment, hardness testing, and to analyze the composition of metals. They also saw CNC equipment that performs computer-controlled metal cutting, drilling, and grinding.
- In **Jashore**, seven ABLE enterprises visited JUST to observe its facilities for analyzing the composition of metal samples. Resulting from the visit, JUST agreed to analyze the metal composition of spare parts for these ABLE enterprises.
- In **Dhaka**, Metal-testing facilities were identified at BITAC Dhaka, BUET, and the private testing service provider, Kiam Metal Industries Ltd., Kushtia.
- In the **ZOR**, ABLE enterprise owners met CUET staff to determine the cost of hardness and chemical composition testing, and the procedure for arranging for these tests.

The meetings resulted in a total of 13 machine parts from six ABLE enterprises being tested for their chemical composition by JUST in Jashore and CUET in Chattogram.

Heat treatment services

To bring steel to a desirable level of hardness it must be heated to high temperatures. If this is not done, the steel will not be hard enough to resist wear and the parts will require replacing more frequently. The process known as "heat treatment" requires the use of specialist furnaces which smaller ABLE enterprises do not have. The Activity has been supporting its partner enterprises to find organizations which have this equipment and which offer heat treatment services,

During the reporting period, the Activity facilitated the provision of a heat treatment service for three Khulna-based, two Jashore-based, and two Bogura-based ABLE enterprises, with Haque Engineering in Mirpur, Dhaka. As a result, a total of 27,933 parts have been heat treated at a competitive total cost of USD 3,143.

Using computer-aided technology to improve manufacturing and marketing efficiency

Since the start of the Activity, there has been a significant adoption of computer-aided technology by its partner ABLE enterprises.

At the machinery manufacturing end of the value chain, the use of computer-aided machinery enables machine parts to be manufactured accurately and to manufacture the same parts repeatedly with the same dimensions. This automation of parts production, although involving a considerable investment, saves time, raises productivity, and produces high quality products. These actions include laser cutting, grinding, drilling, welding, and preparing technical drawings of parts. To demonstrate to ABLE enterprises the value of investing in computer-aided equipment and processes, the Activity has, over the last three years, taken groups of ABLE enterprises to see companies in Bangladesh and India that use computer-controlled equipment. As a result of these visits and with technical support from Activity engineers, 30 ABLE enterprises and two lead firms have invested in computer-aided mechanical processes such as laser cutting, welding, and drawing equipment.

Another computer-aided technique adopted by many Activity-supported ABLE enterprises has been the generation of service provider and customer databases. These allow them to contact customers with information about new products, and to call upon service providers when required. Two partner lead firms used a GPS tracker for tracking market actors, and two lead firms used interactive voice response (IVR) systems to monitor customer satisfaction.

To support ABLE enterprises to contact new customers, the Activity facilitated the development of their capacity to market their products through social media outlets such as FaceBook, YouTube, and WhatsApp. This was initiated in Year 4 through training delivered by the company SemiColon IT Solutions and through advice given by specialist companies. The training was repeated in this

financial year (see report on IR2 activities, below). Advertising on social media outlets has now been adopted by 11 lead firms and 34 ABLE enterprises. This has resulted in increased sales to customers through 140 dealers.

To support ABLE enterprise staff access technical information on manufacturing techniques, the Activity has posted 10 training videos on YouTube that were developed by the Activity in the last three years.

Combine harvesters are normally purchased before the harvesting season, making it difficult for the companies selling them to train their customers on how to use these complex machines. To enable two combine harvester marketing companies to train their customers to drive the harvester, the Activity has developed computer-based driving simulators (see report on IR3 activities, above).

Second-stage ABLE enterprises

Of the 311 ABLE enterprises which partnered with CSISA–MEA in Y4, in this reporting period 42 of them (10 from Bogura, 12 from Jashore, 10 from Faridpur/Kushtia in the ZOI, and 10 from the ZOR) signed cost-sharing agreements with the Activity to support them develop their businesses. This is in addition to the total of 64 who signed agreements with the Activity in 2022 and 2023, bringing the total second-stage ABLE enterprises to 106.

As part of the agreement development process, each of these 42 enterprises met with CSISA–MEA staff to identify what they needed to develop as a business. To support this process, the Activity used the strengths, weaknesses, opportunities and challenges (SWOC) participatory tool to collect insights into the wide range of issues constraining the ABLE sector market system.

The main areas of collaboration required by the ABLE enterprises were identified as:

- online marketing skills
- drawing and design skills
- linkages with dealers, and in some cases with lead firms and DAE
- die- and pattern-making skills
- access to heat treatment and testing services
- skills in manufacturing parts, particularly those that are new to the enterprise
- capital machinery purchase and technical advice.

Interestingly, lack of access to finance to purchase machinery or make infrastructure investments did not emerge as a major constraint, although difficulties with accessing working capital were frequently raised. Details of the results of the SWOC analysis are presented in Annex 2.

Business linkages between Stage 2 ABLE enterprises and agricultural machinery market actors

The SWOC exercise revealed that ABLE enterprises face difficulty linking with new customers outside their current market network. To counter this, the Activity's experience from previous years proved that facilitating meetings which connect enterprises with principal customers (dealers, lead firms, MSPs) is a very effective way of expanding their market networks.

In Jashore, meetings were held between dealers and 11 ABLE enterprises, which resulted in new markets with two lead firms, RK Metal and Janata Engineering, and 33 dealers. The Activity also facilitated three linkage meetings for Jashore-based SMR Agro Engineering to demonstrate the enterprise's newly developed climate-smart machines (sugarcane juicer, mango juicer, mobile maize sheller) to ABLE enterprises, dealers, MSPs, and farmers. The meetings attracted 57 participants (21 from ABLE enterprises, 10 MSPs, four dealers, two government stakeholders, 20 farmers) and resulted in sales to 10 customers. Through its cost-sharing agreement with the Activity, second-stage ABLE

enterprise Atiar Bengal Metal Industries Ltd., Kushtia visited the Al-Madina Metal Works and Raza Metals foundries in Bogura. The visit was aimed at exploring ways of reducing defects in foundry castes.

In Faridpur, the Activity organized 20 meetings for 10 second-stage ABLE enterprises, which resulted in 20 business agreements being forged with dealers. In addition CSISA–MEA also supported four second-stage ABLE enterprise-organized meetings to demonstrate their newly developed onion blowers. One enterprise organized meetings to demonstrate the newly designed jute fiber extraction machine, and another, M/S Shaheen Engineering Workshop, demonstrated the BARI-designed PTOS and mustard seed cleaner. M/S Shaheen Engineering Workshop went on to achieve the notable achievement of selling 25 PTOS in one month.

Technical support to second-stage ABLEs

In Jashore, Fatema Engineering Workshop received the Activity's technical support with the measurement of the length, diameter, thickness, and shape of newly developed patterns and spare parts. M/S Shaheen Engineering Workshop received technical support to manufacture the BARI model of the PTOS machine, selling 25 units in September 2024 as a result. It expects to sell 100 more next year. M/s New Shapla Engineering Workshop was given technical support to manufacture maize shelling machines.

Through their agreements with CSISA–MEA, eight of the 10 second-stage ABLE enterprises in Bogura have requested support to manufacture and market irrigation pumps, mini weeders, potato harvesters and graders, and wheel-drawn crop sprayers. In response, the Activity facilitated marketing and linkage events between eight of the enterprises, with dealers and farmers. It worked closely with the enterprises to ensure their machines and spare parts were manufactured to a high quality standard, and to test the machines to determine if they functioned properly.

S. K. Mahfuzur Rahman, owner of SMR Agro Engineering, Jashore, with a shearing and punching machine purchased following advice from Prof. Colton, Georgia Tech. Mr. Rahman explained how this small machine saves him considerable time and labor. Jashore, January 18, 2024.
Photo: A. N. M. Ariful Rahman, MDO, CSISA–MEA, Jashore

The ABLE enterprises in the ZOR are small businesses, mainly providing repair and maintenance services, although recently, as a result of training facilitated by CSISA–MEA, they have started to manufacture small agricultural machines. To support this process, the Activity signed JVAs with 10 ABLEs to facilitate them getting technical advice to make 10 machines previously not manufactured in the ZOR. These include mini-power tillers, self-driven rice threshers, 48" and 52" rice threshers, and mustard oil presses.

The Activity also supported ABLE enterprises to produce marketing videos, enabling them to market their machines through online social media platforms.

This support enabled 35 ABLE enterprises to develop marketing material to post online, including videos on 31 FaceBook sites and 21 YouTube sites.

Links to examples are:

- Sakar Engineering, Bogura https://www.facebook.com/agro.machinerybd.5?mibextid=JRoKGi
- Haque Metal, Bogura https://www.facebook.com/profile.php?id=100064455111871&mibextid=JRoKGi
- Latif Engineering Workshop, Chanchra, Jashore https://www.facebook.com/profile.php?id=100089959260626
- M/S Asa Engineering Workshop, Kushtia https://www.facebook.com/profile.php?id=100056898836089&mibextid=ZbWKwL

Screen grab of a video from the website of SMR Agro. This second-stage ABLE enterprise developed the video and website with CSISA–MEA support, and is now able to market its agricultural machinery online.
Photo: Md. Khalekuzzaman, OMD, Jashore

From migrant worker to leading light engineering business owner

Forty-nine-year-old Md. Ashraf Hossain began his journey out of poverty as a light engineering workshop worker in India, returning fifteen years ago with whatever savings he had to his native Jashore in Bangladesh. He set up a metalworking business with just one lathe, with support from his brother – hence its name, Bhai Bhai ("Brother Brother") Engineering. Over the following years the business expanded and now operates six lathes along with hydraulic, drilling, welding, and milling machines.

Ashraf's business trajectory took a significant upward turn in 2020 when he met CSISA–MEA staff. The partnership that followed provided him with training and financial linkages, and saw him visiting light engineering businesses in India "The visit was eye-opening," Ashraf said, "It taught me the importance of product quality and heat treatment."

Today Ashraf's workshop produces 84 different spare parts for tractors and employs eight workers, all of whom have gained metalworking skills training through CSISA–MEA. Saiful Islam, a 22-year-old employee, says, "The skills I learned, from precise measurements to welding techniques, have been invaluable – and I now understand the importance of using safety equipment."

The numbers tell a compelling story. "Our annual income has grown from USD 33,300 in 2019 to USD 58,300 in 2023," said Ashraf. This financial growth has allowed for significant investments in new machinery. With a USD 7,500 loan from IDLC Finance, facilitated by CSISA–MEA, Ashraf was able to buy two lathes, considerably expanding his manufacturing capacity. His business network has also grown, with the Activity's support enabling him to forge partnerships with large Dhaka-based lead firms. The Metal Pvt. Ltd. began by ordering 2,000 tractor engine shafts – and more orders are expected.

ABLE owner Ashraf Hossain, supported by CSISA–MEA to expand his business through access to finance, business and skills training, motivational visits to other industry actors, and vital links to high-value markets. Jashore, August 2024. Photo: Asmaul Husna, Communications Manager, CSISA–MEA

Perhaps the most inspiring part of Ashraf's journey is his embrace of technology. "I never had the chance to go to school," he says, "but now, thanks to CSISA–MEA, I know how to use a computer to manage my business records." He plans get ahead of the game by buying an induction furnace and starting to produce combine harvester spare parts, because, he says, "The market for combine harvester parts is growing – and I want to be ready to meet that demand."

Investments in capital equipment and improved factory layout and modifications

Modern capital machinery, factory designs and machinery layout, and modern business management methods make it much easier and faster to manufacture quality spare parts and machines, which together improve business productivity and competitiveness by utilizing imported machines and parts. To support and motivate partner ABLE enterprises to access these machines and facilities, in Year 3 CSISA–MEA organized trips to factories in Bangladesh, and in Year 4 to factories in India, enabling the visitors to see for themselves the advantages of investing in modern factory layouts, management systems, and machinery. For those interested in making these investments, the Activity organized meetings with suppliers of capital machinery, facilitated the design of new factory premises, and provided training in business and human resource management. It has also facilitated access to finance for those wanting to buy new machinery and factory premises, and to training in operating the new machines.

In this reporting period, 53 ABLE enterprises (Bogura 18, Jashore 12, Faridpur 10, and ZOI 12) invested a total of USD 2,109,309 in capital equipment including CNC equipment, small induction furnaces, lathes, shapers, welding machines, drill machines, shearing and punching machines, and in the expansion of production floors. ABLE enterprises also invested in raw material purchases and working capital. This brings the total investments facilitated by CSISA–MEA to USD 7,291,279.

Table 3: Investments made (USD) by ABLE enterprises through facilitation by CSISA–MEA

Particulars	Activity year					Total
	2019–20	2020–1	2021–2	2022–3	2023–4	
Amount in USD		558,506	1,095,213	3,528,251	2,109,309	**7,291,279**
No. of ABLE enterprises		13	36	43	53	**145**

Improving production efficiency through improved factory design

With guidance from Prof. Jonathan Colton of Georgia Tech, in 2023 the Activity engaged Bangla Bari architects to develop factory designs for 16 ABLE enterprises. These include a number of innovative features:

- improved wall insulation, natural lighting and natural ventilation to reduce energy requirements
- ergonomically designed factory layouts to improve the efficiency and safety of operating machinery
- staff-friendly features such as separate restrooms for women and men.

In this reporting period, the Activity supported Bangla Bari to provide Tota Engineering in Bogura and L. Krishi in Jhenaidah with new factory designs, with a focus on improving occupational health and safety (OHS) standards and providing safe drinking water facilities for workers. The factory design and layout plan for Tota Engineering is shown below.

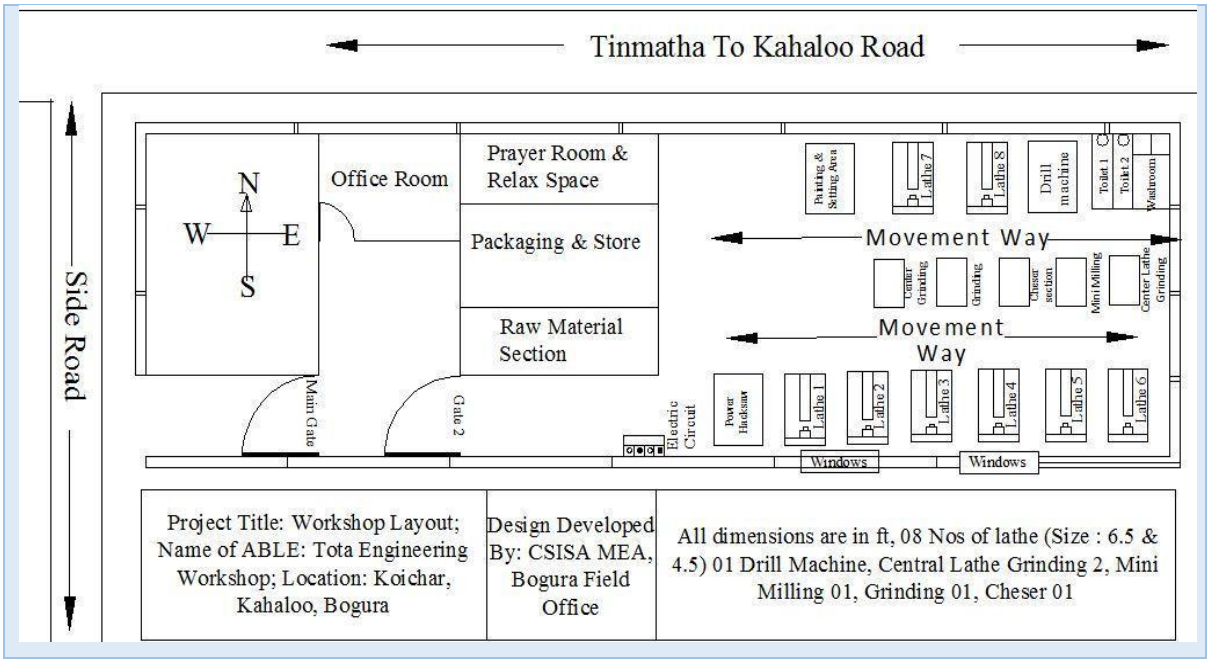


Figure 3: Workshop layout prepared by Bangla Bari Ltd. for Tota Engineering Workshop, Bogura.

The design for L. Krishi improved on the original to address several Activity aims. It contributed to improving productivity by increasing the wall height and thus the roof height to accommodate larger equipment, to issues of energy use and climate change by installing transparent panels on the roof for natural light to reduce electricity usage, and to OHS by adding more ventilation to reduce the temperature within the building and to get rid of exhaust fumes.

The Activity also supported Auritro Architects to prepare factory designs for RDF and A. Rahman Metal & Engineering (both in Bogura), Mawa Engineering Workshop in Jhenaidah, and Fatema Engineering Workshop, Jashore. The CSISA–MEA team worked with ABLE enterprises and Auritro Architects to develop a common understanding of the drawings and cost estimates by sharing the draft versions. Georgia Tech and the CSISA–MEA Jashore team will continue to support the enterprises and Auritro Architects through to completion of the project.

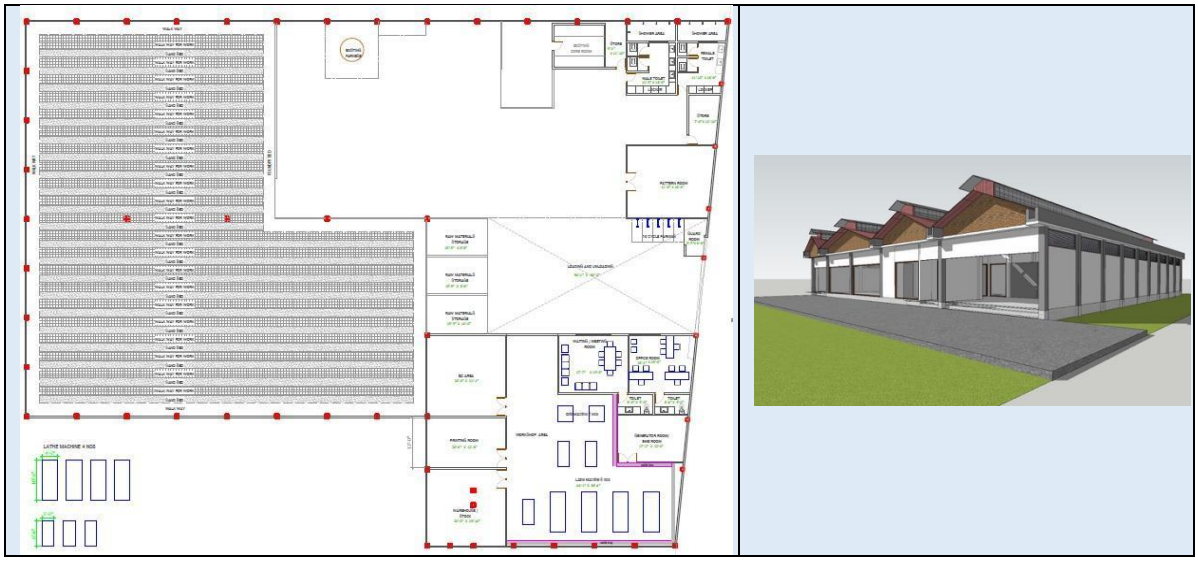


Figure 4: Workshop layout and factory design prepared by Auritro Architects. for A. Rahman Metal & Engineering, Bogura.

An ABLE enterprise, pictured in June 8 2022 before (*left*) and after in January 23 2024 (*right*) adopting workplace improvements, supported by the Activity.

Rahad Engineering and Machineries, Bogura, has been working with CSISA–MEA since 2019. After business training and a visit to engineering companies in India arranged by CSISA–MEA, and getting technical and business support from the Activity, the enterprise was ready to make major changes to its workshop layout. Using a design provided by CSISA–MEA engineers it set up a line production system, where machine parts are assembled in a logical process from one machine to the next. It also installed windows and electric lights, and painted the interior, creating a more conducive working environment.
Photo: Md. Faziul Karim, MDO, Bogura

Facilitating the development, testing and marketing of new agricultural machinery technology

Over the reporting year, collaborations between ABLE enterprises, and Activity engineers and marketing specialists, resulted in the development and marketing of a diverse range of machines (see Table 4, below). These machines are all relatively simple and have been manufactured in response to a market opportunity that the Activity identified after discussions with dealers, MSPs, and farmers. Many have been made from machines designed by BARI or BRRI, and many have been modified before manufacture according to changes identified by the ABLE enterprises, with technical support from BARI or BRRI, facilitated by CSISA–MEA staff.

Table 4: New agricultural mechanization technology developed by ABLE enterprises with CSISA–MEA support

Operation	Machine	Collaborator	No. of ABLE enterprises
Land preparation	mini power tiller	BARI	Jashore 6, Faridpur 3, Bogura 2, ZOR 1
	farmyard manure crusher		Faridpur 2 Bogura 2
Sowing/planting	manual maize planter		Jashore 1 ZOR 1
	onion transplanter	BARI	Jashore 1
	garlic clove planter	BARI	Jashore 1
	rice seed tray sower	BRRI	Faridpur 1
Weeding	line crop weed and earthing up		Jashore 1, Faridpur 3 Bogura 2, ZOR 1
	mungbean weeder		Jashore 1 Faridpur 2
Irrigation	mobile solar irrigation pump		Kustia 1
Pest control	wheeled manual crop sprayer		Bogura 1

Harvesting	onion stem cutter	GUK–SEP, PKSF	Bogura 2
	jute decorticator	BARI	Jashore 1, Faridpur 2 Bogura 2
	groundnut pod stripper		Faridpur 1
	rice head feed thresher	BARI	Jashore 2 Bogura 1, ZOR 1
	fruit picker	BARI	ZOR 1
Crop processing	mungbean decorticator	BARI	Jashore 1 Bogura 1
	fodder & grain chopper/crusher		Jashore 28, Faridpur 8 Bogura 2, ZOR 2
	livestock feed pellet maker		Jashore 2 Bogura 1
	spice grader		Jashore 3
	mustard grader		Faridpur 1 Bogura 2, ZOR 1
	potato grader	BARI	Jashore 1, Faridpur 1 Bogura 1
	onion grader	GUK–SEP, PKSF, BWDB	Bogura 2
	solar food dryer		Jashore 1, Faridpur1 Bogura 1, ZOR 1
	mango juice extractor		Jashore 1
	sugar cane juice extractor		Jashore 1
	candyfloss maker		Jashore 2
Crop storage	onion blower	BARI	Faridpur 6

In terms of sales, the following machines were the most successful:

- onion blower – 185 sold
- manual maize planter – 30 sold
- fruit picker – 17 sold
- mango juice extractor – 8 sold
- fodder and grain chopper/crusher – 8 sold
- sugar cane juice extractor – 7 sold

CSISA–MEA also supported ABLE enterprises to manufacture – and in some cases, to modify – machines already in wide use. These machines, and the number sold by the ABLE enterprises, were:

- PTOS – 40
- irrigation pump – 75
- potato harvester –1
- rice thresher, tractor-drawn – 6
- rice thresher, self-drive – 3
- maize sheller – 20
- fodder chopper – 51
- mustard oil press – 1

Axial flow pumps (AFPs) are a fuel-efficient low lift pumps that can be used to pump water out of rivers, canals, and ponds, to irrigate crops growing near these waterbodies. They are of particular value in coastal areas of Bangladesh where ground water sources of water for irrigation have become saline and surface water sources are not saline. They were strongly promoted as part of the CSISA–MI Activity which preceded CSISA–MEA. To improve the quality of the AFP, RK Metal of Faridpur

changed the impeller manufacturing process from manual fabrication to being fabricated with dies, using a higher thickness shaft than earlier, improving the quality of the rear inlet net, and changing the oil seal and pulley quality. In a partnership with RK Metal, the use of this new AFP model was demonstrated to farmers and resulted in the sale of 15 machines to MSPs and 10 to dealers. RK Metal also sold 31 AFPs to BARI.

Lead firms have also been given technical assistance by CSISA–MEA to manufacture machines that they did not previously manufacture.

Table 5: New agricultural machines developed by lead firms with CSISA–MEA support

RK Metal	onion and garlic tops cutting machine
Uttaron Engineering	ride on-type power thresher tractor-mounted bed planter
Janata Engineering	tractor-mounted bed planter tractor-mounted seeder
GSM Engineering	auto rice seed sower (BRRI model) head feed power thresher fodder chopper (BRRI model) mini rice mill (BRRI model)

Machinery under development in collaborations between BARI and ABLE enterprises
BARI is a valued partner in the provision of technical engineering support to Activity ABLE enterprise partners in the design and manufacture of agricultural machinery. As part of this support, Georgia Tech provided engineering and manufacturing advice to both BARI and the enterprises. In September 2024, CSISA–MEA, BARI Farm Machinery Postharvest Process Engineering (FMPE) Division, Gazipur, and CIMMYT held an R&D workshop to showcase and report on the results of the past year's research on the following four machines:

- **Mungbean dehullers**. These can process 60 kg of mungbean per hour, with 600 ml/100 kg oil mixing as a processing aid.
- **Garlic planters**. The Activity developed and tested these for four-wheel and two-wheel tractors. Based upon the results, they will be modified and evaluated in the coming season.
- **Onion transplanter** has been designed and tested. As a result, a modified machine will be tested in the coming season.
- **Jute fiber extraction machines**.

BARI proposed that its research collaboration with CSISA-MEA be continued to ensure commercialization and further development of the machines.

BARI/CSISA–MEA-designed jute decorticator

BARI-designed mungbean dehuller

BARI/CSISA–MEA designed two wheel tractor garlic planter

Photo: Scientists, BARI

Jute fiber extracting machines

Traditional methods for extracting fiber from jute are labor intensive and involve retting the harvested jute stems by submerging them in ponds for up to three weeks, allowing the fibers to be removed. After washing and drying, the fibers are ready for marketing and the core is dried to produce a stick that has many uses in rural households, as well as being used as the basis for particle board manufactured by construction material companies.

Dr. Arshadul Haque (center left, in white cap), Senior Scientific Officer, BARI, training machinery manufacturers to construct and operate the newly developed BARI jute fiber extracting machine at Hosen Engineering Workshop. Pangsha, near Faridpur, August 29, 2024.
Photo: A. N. M. Arifur Rahman, MDO, Jashore

The Aashkol machine, originally designed by British NGO Practical Action and further developed in a partnership facilitated by CSISA–MEA between BARI, RK Metal, and Kamal Machine Tools, strips the fiber from jute stems without the need for retting in pods, but breaks the jute stick, rendering it unusable. A partnership between CSISA–MEA and BARI, with technical support from Georgia Tech, developed a machine that strips jute fiber from the stems, breaking only 25% of the sticks but with an operating speed that is lower than the Aashkol machine. A number of light engineering businesses in the Faridpur and Bogura regions now produce a jute fiber extraction machine, some the Aashkol and others the BARI model.

	
The Aashkol jute fiber extraction machine operating during a demonstration given by RK Metal in Gopalganj District on September 1 2024. The Aashkol machine rapidly separates jute fibers but breaks the jute sticks. Photo: Rowshon Anis, OMD, Faridpur	The BARI Jute fiber extraction machine designed with support from Georgia Tech extracts jute fiber with only 25% of sticks broken but the raw jute throughput is slower than the Aashkol machine. In this photograph, the machine is operating at a machine marketing event in Rajbari District given by the manufacturer, M/s Hossain Engineering Workshop. Photo: Rowshon Anis, OMD, Faridpur

Onion seedling and garlic clove planters

Prototype garlic clove planting machines developed by the Activity in 2022 and 2023 are currently being further tested and modified in a partnership between BARI and Mayer Doa in Bogura, Janata Engineering in Chuadanga, and RK Metal in Faridpur. Prototypes of onion seedling planters are being developed in a partnership between BARI and Janata Engineering in Chuadanga and GSM in Kushtia. It is anticipated that these models will be ready for commercial production during the next financial year.

Mungbean

Based on a portable mungbean dehuller machine developed by Australian Aid consultant Dr. Neogi and further developed by BARI with CSISA–MEA support, two Activity ABLE enterprises, Mawa Engineering, Jhenaidah, and Haque Metal Works, Bogura, have collaborated with BARI to develop a 4 hp diesel engine-powered mungbean dehuller that can be transported by a power tiller. The Activity facilitated a marketing event delivered by Mawa Engineering workshop that was attended by 23 farmers and resulted in the sale of four machines.

Farmers learning about the advantages of the BARI mungbean dehuller, demonstrated by BARI and CSISA–MEA staff. Dumki, Patuakhali District, Barisal Division, April 30,2024.
Photo: Rowshon Anis, OMD, Faridpur

Mungbean before (right) and after (left) dehulling by the BARI mungbean dehuller. This photograph was taken at a demonstration of the mungbean dehuller at BARI research station at Gazipur on April 4 2024. In this demonstration only 15% of mungbean grains were broken during dehulling
Photo A. N. M. Arifur Rahman, MDO, Jashore

Groundnut
During the reporting period, the Activity facilitated a collaboration between Al-Helal Engineering workshop in Kustia and BARI scientists to develop and manufacture a machine that strips groundnut plants of groundnuts after harvest.

Tools and machinery developed by ABLE enterprises with technical support from CSISA–MEA engineers
The mechanization of laborious tasks often involves the introduction of large complex machines such as tractors, rice transplanters, and combine harvesters. However, relatively small machines and hand-held tools can have just as big an impact on smallholder farming households as a combine harvester. Below are some examples of these tools and machines that have been developed and marketed by ABLE enterprises with CSISA–MEA technical assistance.

Mini power tiller
CSISA–MEA engineers have provided technical assistance to 12 ABLE enterprises to develop and manufacture mini power tillers. These are approximately half the width of a power tiller and are designed to weed between wide-row crops such as maize, some vegetable crops, and tree crops. Their use mitigates the need for weed control using environmentally damaging weed killers.

Onion blowers

Onion blowers are based on a design by BARI and further developed by the Activity's ABLE enterprises to suit farmers' specified needs. The blower pulls air through a tube positioned in bulk-stored onions. This creates a draft, drawing air through the onions, which reduces fungal disease infections and weight loss caused by dehydration. The Faridpur region is the largest producer of onions in Bangladesh, and it is here where CSISA–MEA is supporting six ABLE enterprises to manufacture and market the onion blowers. To date 185 onion blowers have been sold.

A model onion blower made by RK Metal of Faridpur, on display at the SME fair, Faridpur. The model shows the use of bamboo flooring to increase the flow of air through the onion store. May 20, 2024.
Photo: Diponkor Gosh, RK Metal, Faridpur

In support of these efforts, Georgia Tech provided a reference document on onion storage guidelines (Onion Storage Guidelines for Commercial Growers: Pacific Northwest Extension Publication: PNW277, May 1985) (Onion Storage Guidelines for Commercial Growers: Pacific Northwest Extension Publication: PNW277, May 1985). Georgia Tech also suggested several improvements to increase the efficiency and efficacy of these onion blowers by improving the flow of air in the stored onions. These include adding half-round, perforated metal ducting under the onions, manufactured by Dutch company, Mooij Agro (https://www.mooij-agro.com/en/solutions-for-onions/air-distribution/) and wooden crates with mesh on the bottom surface.

Fruit picker

Fruit crops such as mango are traditionally harvested by hitting the branches with a stick to make the ripe fruit fall onto the ground. This practice can bruise the fruit causing them to quick rot. An alternative used by farmers is a hand-held tool made of bamboo attached to a long pole but this tool can only harvest one fruit at a time, which is time-consuming. With assistance from CSISA–MEA, Miraz Engineering Workshop at Lamar Muk village, Lama *upazila*, Bandarban District developed and manufactured a fruit picker based on a BARI design that can pick up to eight fruits at a time.

Farmers at Gatsimonipara, Bandarban sadar, Bandarban District comparing the performance of a traditional fruit picker (*above left, left*) with the new one produced by Miraz Engineering Workshop (*above left, right and above right*). June 12, 2024
Photo: Md. Masud Karim, ADO, CSISA–MEA, Cox's Bazar

Maize planter

The Activity has supported one ABLE enterprise in Bandarban district to produce a hand-held jab planter designed to plant maize. In Faridpur a rotary jab planter imported from India was tested during a demonstration at Faridpur Sadar Upazila, Faridpur District.

A maize jab planter made by Miraz Engineering Workshop, Lama *upazila*, Bandarban district being tested by a farmer during a demonstration facilitated by CSISA–MEA. As a result of the demonstration, eight planters were sold. Gazaria village, Lama *upazila*, Bandarban District, June 3 2024
Photo: Md. Rafiqul Islam, MEL Officer.
Cox's Bazar.

Mango juice

With the Activity's support, SMR Agro Engineering of Jashore has manufactured a BARI-designed mango juice extractor. CSISA–MEA supported SMR to conduct marketing events, resulting in the sale of eight machines.

Solar food dryers

A new venture for CSISA–MEA initiated during this reporting period is the development and testing of solar food dryers. These facilitate quick and efficient drying and storage of fruits and vegetables, thereby reducing post-harvest losses, improving the nutrition of farming households, and providing them with new markets. Designs were made in partnership with SMR Agro Engineering, Jashore in 2023; modifications made in partnership with JUST in early 2024 incorporated a solar panel which powers an electric engine to drive a fan that draws air through the dryer.

Farmers look on with intense interest during the CSISA–MEA-designed solar fruit dryer demonstration by CSISA–MEA and JUST engineers (*right*). The dryer was manufactured by SMR Engineering of Jashore and designed in partnership with JUST. Bhojgati, Monirampur District, near Jashore. June 11, 2024.
Photo: Md. Enamul Haque, ADO, Jashore

To support CSISA–MEA engineers to facilitate the development of the dryer and its testing by interested ABLE enterprises, Georgia Tech provided technical guidance and several relevant documents. These include:
https://doi.org/10.1016/j.matpr.2020.04.041 and Chimney Solar Drying Manual https://horticulture.ucdavis.edu/information/chimney-solar-dryer-manual and https://horticulture.ucdavis.edu/sites/g/files/dgvnsk1816/files/extension_material_files/Chimney%20Dryer%20Manual%20V2.pdf

Solar powered water pumps and rooftop installations

In 2023, CSISA–MEA engaged Solar EPC Ltd. to conduct a study of 12 ABLE enterprises who had expressed an interest in installing roof-top solar panel systems. Solar EPC calculated the potential amount of solar energy available at each factory, the number of panels required, the necessary electrical systems, and the cost of installation. To date, three Bogura-based enterprises have installed solar panels, including Tota Engineering, which installed solar panels as part of its newly designed factory facility (see above).

An outcome of the Activity's work on solar fruit dryers and the knowledge gained by CSISA–MEA engineers is the development of a solar-powered water pump. With the Activity's support, Asa Engineering Works in Kushtia successfully developed and tested a portable solar panel-powered water pump which is transported on an automobile battery-powered carrier. This innovative system features a solar-powered centrifugal pump with 3-hp capacity, 4-inch delivery pipe, and a pumping rate of 50 to 60 gallons per minute. The solar panels have a total capacity of 3 KW and are folded on top of

each other on the roof of the carrier when they are transported. Designed for efficiency and mobility, this solution offers a sustainable approach to irrigation, making it ideal for agricultural use in remote and off-grid locations.

Managers of ASA Engineering Works, Kustia, with the mobile solar-powered irrigation pump system they manufactured with CSISA–MEA technical support. The system was demonstrated to farmers in Faridpur on September 18, 2024.
Photo: Ahadur Rahaman, Workforce, Asha Engineering Workshop, Kushtia

CSISA–MEA has also supported ABLE enterprises to visit solar-powered irrigation systems, cold stores, and factories to explore prospects for installing and or marketing solar panel systems. In May 2024, these included the following visits to solar panel installations:

- Four Able enterprises visited solar-powered irrigation pumps and cold stores in Dinajpur, marketed by Soloargaon and Gazi group.
- Seven ABLE enterprises and lead firm Janata Engineering visited the Janata Jute Mill at Boalmari, Faridpur to observe the rooftop solar panels that the jute mill had installed.
- Four ABLE enterprises visited the 35 kW-capacity solar panel system that provides power to the workshop at Rural Development Academy (RDA) in Bogura.
- ABLE enterprises visited wire factory in Faridpur belonging to the pharmaceutical company Renata to see its 18 kW-capacity solar system which it runs on a grid system.
- ABLE enterprise Asha Engineering from Faridpur visited a 4.6 kW solar-powered irrigation pump in Belgachi and Alamdanga, Kustia District.

In addition, CSISA–MEA in Bogura arranged a meeting between ABLE enterprises and Mission Asia Power Ltd. (AMPL) to discuss the installation of rooftop solar power systems. This was the second meeting with AMPL following a similar meeting in September 2023. Also in Bogura, Raza Foundry and Distribution installed a 550 W solar panel system after visiting Ananta garment factory in September 2023.

Fodder choppers

During the reporting period, the Activity supported eight ABLE enterprises to make modifications to fodder chopper designs that meet customers' demands and then went on to support them conduct marketing events which resulted in the sale of 56 fodder choppers.

A CSISA–MEA engineer explaining the modifications needed to improve the performance of a fodder chopper manufactured by Mr. Md. Alauddin, owner of MAA Machinery Workshop, Ramu Bypass intersection, Ramu, Cox's Bazar. November, 18 2023
Photo: Mohammad Shahidul Islam, ADO, Cox's Bazar.

Other machines developed with CSISA–MEA support
During the second half of the reporting period, ABLE enterprises supported by CSISA–MEA have developed potato graders to separate large and small potatoes, manually operated mungbean weeders, and maize seed sowers.

Efficiency Testing of Agricultural Equipment and Machinery
One focus of CSISA-MEA is to enable ABLEs and MSPs to produce and utilize equipment that is more efficient in terms of time, labor, and energy. In no small part due to the Activity, ABLEs now produce their own diesel- and electric-powered equipment, which in turn are purchased and operated by farmers and MSPs. It is important to ensure that these devices operate as efficiently as possible. To this end, Georgia Tech has created testing standards for testing various machinery for efficiency. These are based upon FAO, ISO, and additional international standards. CSISA-MEA engineers will use these standards and provide and explain them to our partners. The testing procedures are entitled:

- Procedure for Calibrating and Testing Backpack and Wheeled Sprayers
- Metal Identification Process
- Power Tiller Testing Procedure
- Procedure for Measuring the Efficiency of Power Threshers
- Procedure for Comparing the Efficiency of Combine Harvesters and Reapers

Spare parts catalogue and specifications

The regional office in CXB suggested that a parts catalog including specifications be created to support ABLE enterprises to fabricate fast-moving spare parts. Georgia Tech developed and shared the requirements for this parts catalog, which include photos of the parts, properly dimensioned drawings, alloy types, and mechanical and material properties. With this catalog, ABLE enterprises will not have to measure and compare exemplar parts to the ones that they are fabricating. This will reduce time, labor, and cost, and thereby increase productivity and quality. The engineers have been tasked with creating the catalog. The CAD/CAM software, computers, and training that the engineers received support them in completing the catalog.

Georgia Tech: post-graduate student research

Two post-graduate engineering Georgia Tech students, conducted studies for the Activity, completing theses that analyzed the fabrication of four fast-moving spare parts for agriculture machinery: tiller blades, rice transplanter forks, threshing teeth, and combine harvester cutter blades. The students' work provides guidance to ABLE enterprises on the machinery, dies, and processes which improve the productivity of their manufacturing operations, leading to better parts and greater profitability. The work was published in the open literature:

- "Variation of the friction conditions in cold ring compression tests of aluminum 1100-O and aluminum 6061-T6 as applied to room temperature forging in low and middle income countries" (Mesmer) can be viewed at https://www.tandfonline.com/doi/full/10.1080/23311916.2024.2399961
- "Design and Analysis of Manufacturing Methods for Tiller Blades and Threshing Teeth in Bangladesh" (Lundquist) can be viewed at https://www.mdpi.com/2227-9717/12/7/1393

Access to financial services for ABLE enterprises, dealers and MSPs

To finance investments in new machinery, stocks of raw materials, parts or machines, and to finance operating costs, machinery market systems actors often need loans from financial service institutes (FSIs). Supporting ABLE enterprises, dealers, and MSPs to access finance has been a major activity of CSISA–MEA since its start of the Activity. This has largely been achieved by bringing together market systems actors with FSIs, either individually or in group meetings. In Activity Year 5, CSISA–MEA has facilitated 18 meetings and 24 visits. These resulted in 16 FSIs providing loans to 32 ABLE enterprises totaling USD 914,892, loans to four dealers totaling USD 217,273, and to 18 MSPs totaling of USD 24,191. This brings the total value of loans facilitated by the Activity since 2019 to USD 4,192,187.

Table 6: Finance facilitated by CSISA–MEA from FSIs for ABLE enterprises, dealers and MSPs.

Actors	Activity Year					Total
	2019–20	2020–1	2021–2	2022–3	2023–4	
ABLE (USD)	0	462,941	874,118	1,134,094	914,892	3,386,045
ABLE (#)		12	30	39	32	113
Dealer (USD)	0	23,529	49,412	303,809	217,273	594,023
Dealer (#)		2	3	7	4	16
MSP (USD)	7810	20,667	15,239	46,747	24,191	114,654
MSP (#)	12	6	20	33	18	89
Total (USD)	**7810**	**507,137**	**938,769**	**1,484,650**	**1,253,821**	**4,192,187**
Total (#)	**12**	**20**	**53**	**79**	**54**	**218**

Intermediate result 2: Enhanced institutional capacity for agricultural mechanization through the development of skilled and youth workforces

Foundry skills trainees trained at Raza Engineering and Foundry Bogura by GUK Bogura., March 16, 2024. Photo: Jannatul Ferdous Asha, MDO, Bogura

The light engineering sector in Bangladesh is largely composed of small to medium-sized enterprises that employ a workforce of mainly young men who have learned their skills from older workers in the same workplace. Poor practices and skills often are passed from generation to generation, resulting in low quality work and making it difficult for the light engineering sector to compete with imported parts and machines. To address this issue, a major focus of the Activity has been on improving workforce skills for ABLE enterprise partners.

From the start of the Activity in October 2019 to the end of Year 5 in September 2024, the Activity has facilitated the training of a total of 2,662 workforce staff from 513 ABLE enterprises. This 33% of the estimated 1,500 agricultural machinery and spare parts manufacturing workshops and foundries in Bangladesh.[2] Of the workforce trained so far, 445 are women and 1442 are youth under 30 years.

Over the past five years, the activity has engaged over 90 trainers from various technical institutes, partnering with more than 13 Training Service Providers (TSPs). This collaboration strengthens the training system, ensuring sustainability through capacity building and knowledge exchange. By fostering networks among trainers and TSPs, the initiative creates a robust framework for continuous skill development. The partnerships have been key in enhancing the overall quality and reach of the training

[2] Alam, M. M., Khan M. I. N., Saha C. K., Rahman A., Bhuyian M. G. K. Manufacturing of agricultural machinery in Bangladesh: Opportunities and Constraints, AgricEngInt: CIGR Journal. Open access at: http://www.cigrjournal.org, Vol. 19, No. 1. June, 2017.

programs. These training skills and the technical knowledge will continue to be available to the light engineering sector after the Activity ends

From October 2023 to September 2024, the Activity has provided training to 393 workforce members, 303 from machining shops and 90 from foundry shops. These workers were from 149 ABLE enterprises in both the zone of influence including Bogura and the zone of resilience. While the curriculum remained the same for technical knowledge, a session on gender equity and social inclusion was added from Year 3 onwards and Year 5 witnessed a session on environmental awareness across all the training courses provided by the Activity.

Table 7: Number of ABLE enterprise workforce members trained.

CSISA field office	Activity year					Total
	2019–20	2020–21	2021–22	2022–23	2023-24	
Bogura	-	312	475	440	173	1,400
Jashore	-	200	160	180	100	640
Faridpur	-	-	20	162	40	222
Cox's Bazar	-	-	100	180	80	360
Total	**-**	**512**	**755**	**962**	**393**	**2,622**

Some lessons learned from implementation of the training program this year are:

1. *Refreshing young minds*. Workshop staff specialize in specific tasks such as welding or machining on lathes. However, the current training curriculum covers all tasks and operations of all the commonly used machinery, meaning that the workforce only uses a small portion of what they learn. It has therefore been recognized that the workforce needs to have access to a repository of information in the form of training material that they can refer to when faced with a new task or one they have not performed since they were trained. It was considered that this information would be more accessible to the workforce staff if it was presented as videos rather than written manuals. As a result, the Activity engineering team led by Prof. Colton at Georgia Tech, developed a set of lessons in the form of videos that workforce staff will be shown how to use during Year 6 of the activity. These videos will be held in the workshops and will provide the workforce staff with a degree of technical support after the Activity has ended. The videos cover the following subjects:

   - Engineering Drawing
   - Fits, Limits, Tolerance & Allowance
   - Grinding Operation
   - Inside and Outside Calipers
   - Occupational Health and Safety
   - Facing Operations on the Lathe
   - Workpieces Set Up for the Lathe
   - Cold Saw
   - Drill Machine
   - Painting Machine
   - Unit Conversion
   - Foundry Defects and Remedies
   - Knurling Operation
   - Measuring Tools
   - Vernier Calipers

2. *Raising awareness of environmental issues.* Industries such as the light engineering sector can have impacts on the environment ranging from poor waste disposal practices to greenhouse gas emissions from engineering machinery and energy generation. To make the engineering sector more aware of these issues and introduce a culture of environmental protection into the light engineering sector, the Activity initiated the inclusion of training to raise awareness of the impact of the sector on the environment, and how this might impact the lives of the workshop staff and the profits of the enterprise owner.

3. *A need for gender equality and social inclusion*. A limited understanding of the value of developing a gender sensitive and inclusive working environment means that workshops fail to use efficiently the resources their workforce can offer. To address this issue the Activity included Gender Equality and Social Inclusion (GESI) training in all the courses it provided.

This poster was displayed during the Activity's GESI training, and given to ABLE enterprises to display in the workplace.

The impact of this training has been rapid. Following the GESI training, 12 ABLE enterprises in Jashore and Faridpur and 24 in Bogura have made infrastructural changes, such as providing toilets and rest areas for women, to facilitate a more GESI-friendly work environment.

Mrs Joshna Khatun, an employee of Abdur Rahman foundry in Jashore, happy with her working conditions. Following GESI training the foundry installed a washroom and restroom for women and began to pay their female employees overtime and provide a breakfast before they start work.
Photo A. N. M. Arifur Rahman, MDO, Jashore

ABLE enterprise training in the Zone of Influence and Bogura

Workforce training in machining skills

In the reporting period, CSISA–MEA extended its contracts with NGO training providers Gram Unnayan Karma (GUK) in Bogura and Rural Reconstruction Foundation (RRF) in Jashore.

In a new development, the growing partnership with Bangladesh Industrial Technical Assistance Center (BITAC), a Ministry of Industry institution, was extended to include BITAC's Khulna branch. This has enabled the Activity to facilitate the training of 40 workforce staff from Khulna and districts in coastal Bangladesh for the first time, using the engineering skills and facilities of BITAC Khulna for training. In Faridpur, the Activity collaborated with light engineering enterprise, Kushtia Engineering Works, to train Faridpur-based ABLE enterprise staff. Training in the ZOI and Bogura included practical sessions conducted by business experts and senior skilled technicians from partnering ABLE enterprises. Classes in the theory of manufacturing were mostly delivered by experts from government polytechnic institutes and BITAC. The Activity supported the two training service providers by helping them to source expertise from across these institutes.

Trainees from 19 Khulna region ABLE enterprises being taught by a BITAC engineer (right) on how to use a vertical drill machine. Khulna, March 2024.
Photo: A. N. M. Arifur Rahman, MDO, Jashore

During the reporting period from October 2023 to September 2024, 313 workers were trained from Jashore, Faridpur and Bogura regions. Of these 50% were youth, 223(184 men and 39 women) received machining skills and 90 workers (55 men and 35 women) foundry skills. After receiving training for around a month, the trained women started technical operations independently, which were traditionally men's work. In addition to the workers, the management staff of the ABLEs received training on inventory management software, ISO certification and technical engineering drawing skills.

Machining skills training outcomes. To determine the success of the training, participant knowledge was assessed before and after the training, using a 20 questions multiple-choice questionnaire. Before training participants could answer no more than 12 out of 20 questions correctly but after training all could answer at least 13 out of 20 questions correctly.

Impact of skill enhancement training on improving manufacturing spare parts
Manu Engineering Workshop manufactures the spare parts of Iron wheel of power tiller (2WT). He received skill enhancement training from CSISA MEA in Year 4. After receiving the training, he is using their training to improve their manufacturing day by day in terms of welding joints, precision measurement, hole size, diameter, bolt size, boring, etc.

Sayed Engineering Workshop from Khulna had received skill enhancement training from BITAC Khulna by CSISA-MEA. After training, this workshop is manufacturing quality bevel gears, spur gears, and pinions for climate-smart agricultural machinery including reapers and PTOS, and is providing them to MSPs and dealers. CSISA–MEA Jashore team has provided technical and business support to the Sayed Engineering Workshop.

Md. Mamun Shakh (24), started his career in 2010 first as a helper in his uncle's workshop. He later became a lathe operator. In 2024, he participated in a skill enhancement training course facilitated by CSISA-MEA. During that training he gained skills in TIG welding, basic shaper operation, and lathe machine operation. He also learned to make accurate measurements and cutting angles. Following the training, he started to use protective clothing and comply with OHS. As a result of this training the owner of the workshop has found that the quality of his parts has improved and therefore increased his salary from BDT 9,500 to BDT 11,200 a month.
Photo: Jannatul Ferdous Asha, MDO Bogura

Occupation health and safety training

All the above training included a session on OHS, with each participant learning how to operate a fire extinguisher, the importance of personal protective equipment and clothing and how to use them, and how to respond to emergencies in the workplace.

Mr. Tota Mondal, proprietor of Tota Engineering Workshop, Bogura, realized after participating in visits to modern machinery workshops and business training sessions organized by CSISA–MEA that worker productivity increases when the working environment improves. He installed fans above the work benches to keep his staff cool and provided safety equipment such as helmets and gloves. His workforce, seen here operating lathes, are very pleased with these improvements which make work easier and safer. Employees in ABLE enterprises working in machining workshops and foundries now routinely use safety gear, which was seldom the case before CSISA–MEA initiated its training. Bogura, April 28, 2024.
Photo: Jannatul Ferdous Asha, MDO Bogura

Training provided to the foundry workforce by foundries

GUK Bogura in partnership with leading foundry enterprises trained 75 foundry workers in Bogura in advanced foundry skills. The support provided by CSISA–MEA empowered both GUK and the enterprises to emerge as vocational training providers, and will enable GUK and foundries to sustain training for the light engineering sector as a business venture.

Providing women with training to improve their skills and working conditions

Continuing the training support provided to women in previous years, between January and September 2024 the Activity facilitated training for 35 women, who received hands-on training over one month in Bogura and Jashore in foundry skills, including painting, grinding, and fettling.

Also in Year 5, CSISA–MEA identified that if women were trained in machine operation, it would increase their job security, employment status and salary, and at the same time reduce the drudgery of the routine work available to them. Workshop owners and women workers had shown an interest in lathe operations, and in response the Activity facilitated customized training for a group of 28 women in Bogura on precision measurements, lathe operations, drilling, and tapered turning.

Women in the workforce at Reza Engineers, Tota Engineering, Joy Metal Engineering and Al-Madina Metal Works in Bogra were provided with training to use tapering, lathe, and drill machines at their places of employment.

Bedana Begum (35) started work at Tota Engineering Workshop as a temporary helper in 2024. Her work involved moving products and packaging around the shop floor, for a modest monthly income of BDT 4,000 (ca. USD 40). Her interest was sparked by watching the men using the machines, and in Year 5 of the Activity she participated in 25 days of training in machining, tailored for women workers and facilitated by CSISA-MEA. This hands-on training provided Bedana with the immense support needed for a woman to become skilled in drilling, grinding, and shaper machine work. She is now one of the main drill workers in the workshop and her job is permanent, with a secure monthly salary of BDT 5,200 (USD 52).
Photo: Jannatul Ferdous Asha, MDO Bogura

Training impact on women workers

In 2023, the female workforce at Janata Engineering in Chuadanga engaged in painting training facilitated by the CSISA–MEA Jashore team. After training and apprenticeship, the now-skilled women transitioned from daily paid laborers to monthly paid staff, with official job titles such as head painter or painter. The owner of Janata Engineering takes pride in the leadership of his painting zone, which includes skilled women painters from the team.

Machining skills training for ABLE enterprise staff - Zone of Resilience

During the reporting period, a total of 80 workforce members from 48 ABLE enterprises of the Cox's Bazar and Bandarban districts were given training in machining skills by the Ministry of Industry, Chattogram BITAC office. The 10-day training was residential and delivered in four batches of 20 trainees each. Of those trained, 84% were youth.

Machining skills training outcomes. To determine how successful the training had been, participants were tested at the start and finish with a set of 20 multiple-choice questions. Before training, trainees answered an average of just nine questions correctly, which increased to an average of 16 correct answers after training.

Advanced technical and business-related training for ABLE enterprise management

Inventory management software

To increase the efficiency with which ABLE enterprises manage their stocks of raw material, parts, and products, the Activity contracted Semicolon IT Solutions, a company that sells software it developed for managing stock inventories. Semicolon provided two days of training on how to use its software to staff from two Activity lead firms and 49 ABLE enterprises. This was delivered in five locations: Bogura, Jashore, Faridpur, Kushtia, and Cox's Bazar. Afterwards, 15 ABLE enterprises expressed interest in subscribing to the app that provides access to the Semicolon inventory management software.

Trainers from Semicolon IT Solutions providing hands-on support during inventory management training for 10 ABLE enterprise managers at AIT, Haji Bhaban, Cox's Bazar. February 8, 2024.
Photo: Shahabuddin Shihab, MDO, Cox's Bazar

Engineering design and drawing

A major issue identified by the Activity is the limited ability of ABLE enterprise staff and management to interpret and comprehend technical drawings. Instead they copy existing parts to produce parts, with many failing to meet the precise technical specifications required. Enabling ABLE firms to produce specific parts directly from drawings and to use accurate measuring tools is therefore regarded by the Activity and also the enterprises as an important training requirement, which will enable them to produce the parts catalogs mentioned in IR1. To initiate this process, the Activity published a call for EOIs on the bdjobs.com website to identify a firm able to provide training and services in engineering

design and drawing. A contract was signed with Involute Tech, a private business led by graduates from BUET. With support from Georgia Tech, Involute Tech developed a training curriculum, which the Activity used to facilitate one-day training sessions for a total of 32 ABLE enterprises and two lead firms in Jashore, Faridpur, and Cox's Bazar, in February 2024.

The owner of SMR Engineering of Jashore practicing making technical engineering drawings during the one-day training program delivered by Involute Tech. Lead firm Metal Agri Tech secured an advertising opportunity by providing t-shirts and caps for course participants.
Photo: A. N. M. Arifur Rahman, MDO Jashore

Lincoln Electric welding simulator, BITAC

Welding is an important process for the ABLE enterprises that the Activity supports. CSISA–MEA purchased a VRTEX® virtual reality welding trainer from the USA-based welding equipment manufacturer, Lincoln Electric. This portable computer-based device facilitates safe training for welders and is more cost-efficient and safer than using actual welding equipment. After CSISA–MEA regional offices around Bangladesh demonstrated the use of the simulator to ABLE enterprises and training organizations, it was moved to a permanent home at BITAC Chattogram, where to date 39 trainees have used the equipment.

Sales promotion and marketing

The market research-focused firm Creavision was employed to train ABLE enterprises on how to improve their sales and marketing skills. The one-day training was delivered in Cox's Bazar, Faridpur, Jashore, and Bogura during August and September 2024, to a total of 75 participants comprising ABLE owners, dealers, and lead firm sales staff. Topics covered how to develop better marketing techniques including how to advertise online, provide aftersales services, identify potential customers, make attractive branding, establish a reliable supply chain, and establish dealerships. Participants were also trained to negotiate business deals through mock sales negotiation exercises.

Orientation on ISO certification

To create awareness among ABLE enterprises of the types of ISO certification available for light engineering companies, the importance and need for certification, and potential options available for the companies to explore, the Activity has engaged Green Management Consulting certification agency on two occasions. In Year 2 of the Activity Green Management Consulting provided advice on ISO certification to 100 ABLE enterprises. In this Activity year (year 5) the same company was engaged to provide training to a total of 61 ABLE enterprises in Bogura, Jashore, Faridpur, and Cox's Bazar.

CNC-aided manufacturing

With partner GSM Engineering, CSISA–MEA facilitated a training program on the operation and maintenance of CNC lathe, laser cutting, and laser welding machines for 12 ABLE workers from the Faridpur region. The training began with machine setup and calibration, teaching participants how to ensure precise and accurate cuts through proper initial adjustments. It then covered operating procedures in details, guiding trainees from loading materials to executing cutting programs effectively. Essential maintenance techniques were also taught, with staff learning vital practices such as cleaning, lubrication, and part replacement to keep the machines in optimal condition. There was a strong emphasis on safety protocols, and the precautions needed to prevent accidents and injuries during machine operation.

The Jashore field office organized a program of learning visits for five ABLE enterprises and one machinery service center from Jashore and Jhenaidah to observe and learn to operate CNC machinery. The visits demonstrated CNC milling, lathes, laser cutters, welding machines, and induction furnaces at GSM and Atiar Bengol Metal Industries Ltd. in Kushtia, and Reza Engineering and BITAC in Bogura.

Training in the use of CNC-aided machinery

The CSISA–MEA Bogura team facilitated BITAC Bogura to deliver a one-day training course in CNC operation and maintenance, for five participants from each of three ABLE enterprises. The quality of parts made by the CNC operators has increased as a result and trainees are confident in seeking support from BITAC Bogura when they encounter problems.

Also in Bogura, CSISA–MEA supported seven engineering students from Bogura Polytechnic Institute to find work experience placements (six at RF Tota, one at Sarkar Agro & Multipurpose Works).

Training of CSISA–MEA engineers

To improve the technical skills of CSISA–MEA engineers and their ability to support the ABLE enterprises, the Activity purchased CAD stations and CAD/CAM software and provided them with two weeks of CAD/CAM training. Georgia Tech selected the computer equipment and software and developed the training curriculum. The training also will skill the engineers to develop the parts catalogue mentioned in IR1.

Intermediate Result 3: Enhance farmer access to mechanization and other crop production and marketing services with particular emphasis on remote and underserved markets

Mechanized rice transplanting in front, manual rice transplanting behind. Jashore District, February 4, 2024. Photo: Owen Calvert, Chief of Party, CSISA–MEA

Since the early 2000s in Bangladesh, the proportion of labor in agriculture has fallen from 64% in 1990 to 37% in 2021, and the food wage (the amount of rice a rural wage could buy) doubled between 1995 and 2015[3]. This rapidly rising cost (and at times scarcity) of farm labor is driving farmers to seek machines that will reduce costs, provide a substitute for labor when it is not readily available, and reduce the drudgery of planting and harvesting. Increasingly importantly, allowing crops to be planted and harvested rapidly and on time also helps farmers avoid adverse weather events at planting and harvesting times.

Bangladesh is one of the most mechanized countries in Asia when it comes to land preparation, crop threshing and irrigation, with more than 97% of land prepared by 700,000 power tillers[4] and 74% of rice is threshed by 370,000 threshers. While land preparation and rice threshing is highly mechanized, Bangladesh has one of the lowest levels of rice planting and harvesting mechanization in Asia. Less than 1% of rice is planted or harvested by machines (0.1% by transplanters and 0.8% by combine

[3] Hassan, M. F., Kornher, L., Food wage and rice price dynamics in Bangladesh, Food Security (2022) 14:127–146.

[4] Gurung,T. R., Kabir, W. & Bokhtiar S., M., 2017, Mechanisation for Sustainable Agricultural Intensification in SAARC Region, SAARC Agricultural Centre, Dhaka, Bangladesh.

harvesters)[1]. This means that almost all of the 11 million hectares of rice planted and the 50 million tons of rice harvested annually is done by hand.

Most farmers do not own agricultural machines but instead hire machine owners to provide them with machinery services. To support this key part of the agricultural mechanization value chain, during its five years of implementation, the Activity has partnered with lead firms. These partnerships support machinery service providers to access information about the use and value of agricultural machines, how to operate and maintain them, how to improve access to farmers seeking their services, and how to access the government agricultural machinery subsidy program and finance to purchase the machines.

During this reporting period, the 414 MSP businesses supported through these partnerships have provided 56,211 farmers with machinery services worth a total of USD 2,861,900. Since the start of the Activity, of the 226,957 farmers of which 11 percent were women have bought agricultural machinery services from MSPs

Table 8: Number of farmers buying agricultural machinery services, disaggregated by gender

Gender of farmer	Activity year					Total	Total (%)
	2019–20	2020–1	2021–2	2022–3	2023–4		
Male	33,459	35,873	42,535	53,741	55,344	220,952	89
Female	9,552	5,275	8,304	983	867	24,981	11
Total	43,011	41,148	50,839	54,724	56,211	245,933	

Strengthening agriculture mechanization markets through partnerships with lead firms

To support lead firms to market agricultural machinery, thereby increasing the availability of agricultural machinery and machinery services for farmers, CSISA–MEA partnered with seven agriculture machine manufacturing firms (Metal AgriTech Ltd., Abedin Equipment Ltd., Alim Industries, Janata Engineering, GSM Engineering, Uttaron, RK Metal). To ensure that MSPs have the finance they need to purchase these machines, the Activity also partnered with three micro financial institutions (VPKA Foundation, Society Development Committee and Satkhira Unnayan Shongtha) and one financial services institute (LightCastle Partners). The partnership agreements dictate that CSISA-MEA and the partner to share the cost of investments in the agriculture machinery and spare parts market. In Activity Year 5, with an investment of USD 119,679, CSISA–MEA leveraged an investment of USD 161,164 from its lead firm partners. Similarly, with an investment of USD 58,160, it leveraged an investment of USD 72,535 from the FSIs. Through these partnerships CSISA-MEA was able to leverage investments totaling USD 233,699 from lead firms and FSIs.

As well as formal partnerships with lead firms, the CSISA–MEA Cox's Bazar team developed a joint workplan to implement several initiatives through an informal partnership with SQ Agriculture and BANGLAMARK. With an investment from the Activity of just technical support, in Year 5 the lead firms sold 61 agricultural machines, including 39 rice transplanters.

Farmers in Pakua Upazila, Cox's Bazar, taking delivery of rice transplanters they purchased from BanglaMark through the government subsidy program. Demand for rice transplanters was stimulated through marketing events given in the *upazila* by BanglaMark with CSISA-MEA support. DAE office, Pakua, April 15 2024]. Photo: Masud Karim, ADO, Chakaria, Cox's Bazar

Supporting lead firms to extend their agricultural machinery market activities

Surveys conducted in 2023 and reported in the 2023 CSISA–MEA Annual Report showed that a lack of information is one of the reasons why farmers do not adopt combine harvester and rice transplanter machinery services, among others. To address this, the Activity supported companies to enable them to provide farmers with more information about new agricultural mechanization technology. This was provided through marketing campaigns conducted through machine demonstrations and online marketing. It also included assistance from government agricultural extension services.

In the ZOI, four CSISA-MEA lead firm partners implemented a total of 61 marketing events for the machines and spare parts that the lead firms sell. These events were attended by 390 MSPs and farmers. The marketing activities included the development and distribution of sales promotional materials such as festoons, leaflets, and brochures, as well as dealer point branding, product demonstrations, social media marketing on Facebook and YouTube, roadshows, and wall painting. Five lead firms conducted 47 marketing events attended by 1,855 farmers, which focused on the marketing of combine harvesters, rice transplanters, reapers, threshers, and fodder choppers. Three lead firms developed marketing materials to advertise their products and boost sales. Janata Engineering printed 1,500 copies of pamphlets and 100 after-sales service cards; Abedin Equipment performed three TV shows; and Metal Agritech developed 1,000 copies of leaflets.

Extending and strengthening the dealership network

Despite lead firm partners having agricultural machinery supply chain networks throughout Bangladesh, there tends to be far fewer in more remote areas such as the coastal districts of the ZOI, and generally throughout the ZOR. A survey conducted in August 2024 of MSPs in the ZOI showed that new machinery and spare parts are much more difficult to access in these underserved markets

compared with better-served areas in greater Jashore and Faridpur regions. However, establishing a dealership, particularly in less accessible areas, involves risk, time and money.

Since 2023 the Activity has supported lead firms (especially medium scale) and spare parts suppliers, to extend dealership networks into these underserved areas. In this Activity year, CSISA–MEA supported lead firms to establish new dealerships by facilitating meetings between the firms and dealers. As a result, Janata Engineering, GSM, and Uttaron signed dealership agreements with a total of 16 dealers in the ZOI, and Abedin Equipment, Bangla Mark, Metal AgriTech, and ACI signed dealerships with a total of 20 dealers in the ZOR. In many cases, the agreements provided for branding of dealers' shops with the lead firm's signboards.

A Janata Engineering marketing officer with a machinery dealer in front of the dealer's shop, which displays branding identifying it as a Janata Engineering dealer point. Janata Engineering and GSM established 35 shops as machine service centers, as well as a machine and spare parts suppliers. These outlets provide MSPs with machinery repair and maintenance services. Narail District,
Photo: Md. Kamal Hossain, Marketing Officer, Janata Engineering, Chuadanga District

This support from CSISA–MEA, provided through the partnership agreements with lead firms, facilitated impressive sales figures. According to data presented in reports from lead firms on exiting an agreement with CSISA–MEA, they sold a total of 1,400 machines worth USD 14,847,079.

Combine harvester operator training by lead firms

It is impossible for MSPs to keep the machines functioning in the field without troubleshooting and spare parts support from market actors such as lead firms, dealers, spare parts shopkeepers, and mechanics. MSPs need to be trained to operate and maintain the machines in good working order. They should also be able to buy spare parts easily and have access to mechanics trained in their repair. The machines will be idle instead of providing farmers with the mechanization services they require if a machine breaks down because an MSP has not been shown how to use or maintain the machine, or because they do not have access to the services of a trained mechanic and a supply of spare parts.

In Year 5, CSISA-MEA supported Janata Engineering, GSM, and Metal Agritech to organize 11 combine harvester driver training events for 110 drivers. In addition, 78 MSPs who bought combine harvesters from Abedin Equipment and Metal Agritec were given driving and maintenance training by these companies.

As well as sales by lead firm partners, informal partnerships with lead firms SQ Agriculture and BanglaMark facilitated the sale of a total of 41 rice transplanters and 20 combine harvesters in the ZOR.

Metal Agritech delivering training to 10 young combine harvester operators and mechanics in Faridpur District. For Metal Agritech, the primary objective was to improve aftersales services by developing the skills of drivers and mechanics, enabling them to operate and maintain Metal Agritech machines correctly, know what spare parts would be needed and how to replace broken parts, and to inform potential MSP customers about new agricultural machinery now available and the business benefits from owning these machines. Faridpur District, July 16, 2024.
Photo: Rowshon Anis, OMD, Faridpur

Mechanics training by lead firms

To ensure availability of quality technician services at the customers' doorstep, and to provide on-time services to MSP customers, Activity lead firms Janata Engineering, Abedin Equipment, Metal Agritech, and Uttaron Engineering arranged 12 training events for a total of 120 mechanics in the ZOI and ZOR, to learn about and repair combine harvesters, rice transplanters, and reapers.

Mechanics training, organized by Janata Engineering. Here, mechanics are using a model of rice transplanter to practice repairing the transplanter that Janata engineering sells. Janata Engineering workshop, August 2024
Photo: Khalek, OMD, Jashore

Pre- and post-season maintenance services

Part of the commitment to customers, and as an embedded service, lead firms will normally service the machines they have sold before and after the planting or harvesting seasons as part of their sales agreements with new customers. This Activity year, Uttaron Engineering, Abedin Equipment, Metal Agritech, and RK Metal provided pre- and post-season machine maintenance services for 210 MSPs in the ZOI and ZOR.

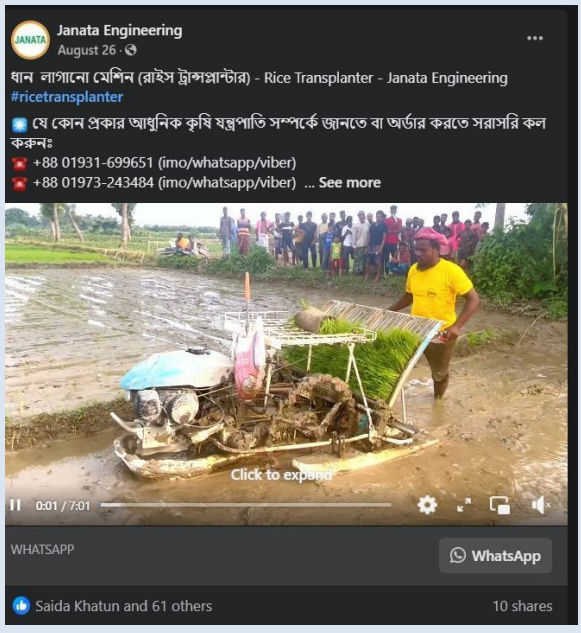
Pre- and post-season maintenance services organized by Uttaron Engineering in Magura district. August 2024
Photo: Uttaron Engineering

Aftersales services and commitment to the customers

Assurance of good aftersales services is seen as an important selling point by lead firms. Janata Engineering developed an aftersales service card for customers, which provides a warranty and service, valid for a certain period of time.
Photo: Janata Engineering

Online marketing by lead firms

The use of online platforms to market machines has now become an important part of an agricultural machinery marketing strategy. In this reporting period, Activity lead firms Janata Engineering, GSM, Metal Agritech, and Uttaron all developed Facebook pages that provide marketing information and videos about the machines they sell. Janata Engineering uploaded 16 commercial posts on its page, including an online video commercial (OVC) presenting the machines it sells and their usability to MSPs and farmers. GSM developed Facebook pages for 12 machines, Metal Agritech for three machines, and Uttaron for five machines.



The Janata Engineering Facebook page is now an important part of the machine sales marketing strategy.
Photo: Janata Engineering

Building the capacity of MSPs to promote their businesses on digital platforms

An online-based digital marketing company, Bangla Traders, based in Jashore, facilitated two orientation sessions on utilizing online-based marketplaces such as YouTube channels and Facebook pages for a total of 39 combine harvester and rice transplanter MSPs from Jashore and Jhenaidah

districts. The objective of the orientation event was to learn about digital ways of increasing machinery service sales.

The CSISA–MEA Faridpur team organized a meeting with the Kolapara *upazila* combine harvester MSP association, Patuakhali district, where they discussed how to utilize online marketplaces such as WhatsApp, YouTube, and Facebook for business expansion. The session was attended by 18 combine harvester MSPs.

The CSISA-MEA Faridpur team also organized a meeting in Faridpur Sadar *upazila* with combine harvester, rice transplanter and PTOS MSPs, on how to utilize online marketplaces such as WhatsApp, YouTube, and Facebook. A total of 20 MSPs attended the event.

Young entrepreneurship development.

Entrepreneurship development, especially for youth, plays a vital role in the agriculture sub-sector in Bangladesh, and promoting youth as entrepreneurs is a strong focus of CSISA–MEA. In this reporting period, Janata Engineering, Abedin Equipment, GSM, and Alim Industries conducted 15 trainings on rice seedling raising, actively engaging 150 aspiring young business owners.

Rice seedling entrepreneur training for CSISA–MEA's youth demographic. Ukhiya, Cox's Bazar district, July 6, 2024.
Photo: Md Shafiq Islam, Technician, Cox's Bazar

Another income opportunity for both female and male youth is to work as commission agents for lead firms to support them find new customers for their machines and to support MSPs to find groups of farmers wanting their services. CSISA-MEA assisted Alim Industries at a meeting to recruit 20 sales agents/commission agents, five rice transplanter MSPs in ZOR, find 13 commission agents, and in the ZoI combine harvester and rice transplanter MSPs recruited 33 commission agents.

How a tea shop conversation turned a share cropper into a multimachine entrepreneur

Thirty-three year old Md. Min Kashem started out as a sharecropper from Ruhulleradeba village in Ukhiya *upazila*, Cox's Bazar district, growing *boro* and *aman* rice on two hectares of land. His first step on the agricultural mechanization journey was to buy a power tiller and sell tillage services to his neighbors. A chance encounter in a teashop with CSISA–MEA staff resulted in a conversation about other machines he could invest in. He had already seen a combine harvester working in a nearby village and thought owning one way beyond his dreams – but the CSISA–MEA team suggested he start at the beginning of the cropping season with a rice transplanter. They invited him to learn to operate a transplanter, at training in nearby Ramu *upazila*, after which he agreed to host a rice transplanter demonstration for the 2023 dry season *boro* rice crop. First, the Activity trained him to raise seedlings for the demonstration, suitable for use with a rice transplanter.

With CSISA–MEA steering him through the financials, Kashem bought a rice transplanter in time to plant rice in the monsoon *aman* season. First he planted his own rice crop, and the following year, 15 of his neighbors, very impressed with the results, hired him to plant *boro* rice for them on eight hectares land. With his profits from the rice harvest, USD1,250 earned from the rice transplanter services, and 70% government subsidies, Kashem was able to buy three more rice transplanters. Seeing a business opportunity, four of his neighbours also bought rice transplanters. Suddenly there was competition and to keep ahead of the pack he decided to offer rice transplanter and combine harvester services for an *aus* crop in an area of Bangladesh where it is not normally grown. *Aus* rice is a third rice crop that is squeezed in between the boro and aman crops, transplanted in May and harvested in August, not commonly grown as it requires a very quick turnaround between crops. This is made much easier if a combination of short season rice varieties and mechanized planting and harvesting is used. His neighbours bought into the idea and he raised and planted eight hectares of *aus* rice with the newly released 100-day medium fine grain BRRI Dhan 98 *aus* rice variety. The crop was harvested using a hired combine harvester and the farmers harvested an amazing five tons per hectare. Business flew in! For the aman season, 85 farmers bought his transplanter services which with three hired machine operators transplanted 21 hectares of Aman rice. As Kashem says, thanks to tea shop conversations with Activity staff, "I'm now not just a farmer – I'm also a businessman, providing a package of mechanization services". The combine harvester remains a dream, but dreams can come true!

Md. Kashem on his journey from sharecropper to MSP, with the support of CSISA– MEA.

Bringing agricultural mechanization to the Bangladesh Hill Tracts, Bandarban District, in the ZOR

Bandarban, one of the districts in the Feed the Future ZOR, was a severely underserved agricultural mechanization market before CSISA–MEA started activity in 2022. In collaboration with ABLE enterprises, dealers and the DAE, machinery promotional activities initiated by CSISA–MEA, have resulted in farmers beginning to purchase agricultural machines, ranging from PTOS and rice transplanters to combine harvesters. This year, the CSISA-MEA team in Cox's Bazar district continued this work by organizing nine training events to show farmers how to raise seedlings for use with the rice transplanter. These were attended by a total of 94 farmers and interested local entrepreneurs. This included supporting an innovative MSP to conduct four of these training events. In Bandarban Sadar and Lama, with support from CSISA-MEA, dealers organized four rice transplanter demonstrations to show farmers how rice transplanters work and discuss the labor and savings that can be made by hiring an MSP to plant out rice seedlings. After crop establishment, with the Activity's support, the MSPs organized two farmers' field days to demonstrate to farmers the efficiencies to be gained by using a rice transplanter. This resulted in farmers starting to request MSPs for fee-based services, with 22 farmers hiring rice transplanter services from MSPs in this reporting period.

In addition, Uttaron, Engineering, Banglamark, and Abedin Equipment each conducted a rice transplanter demonstration and RK Metal conducted a fodder chopper demonstration in Bandarban. As a result, three rice transplanters and four fodder choppers were sold in Bandarban this year.

MSPs attending a demonstration of a mechanized rice transplanter, provided by Uttaron Engineering to increase their skills, employability and income. Lama, Bandarban. July 2024.
Photo: Amitabh Paul, CEO, Uttaraon Engineering

Business expansion of MSPs

Through nine training events initiated by three lead firms and supported by the Activity, Janata Engineering, GSM, and Uttaron Engineering provided training to a total of 90 MSPs, increasing their capacity to operate their machines.

Business expansion meeting for MSPs, Patuakhali.
Photo: Anisur Rahman, OMD, Faridpur

Besides the lead firm's initiatives, the Activity facilitated MSP business expansion and learning sharing workshops, to support MSPs to expand their services and exchange information about potential new markets for their services. The workshops focused on underserved market areas in Cox's Bazar and Faridpur, and on the promotion of new machines including rice transplanters and onion blowers. The Faridpur field team facilitated six awareness and demand creation meetings in Patuakhali, Borguna, and Kushtia districts, and through these meetings supported five MSPs to find rice transplanter customers from the 145 farmers who attended the meetings. Lead firms representatives from BanglaMark, ACI, Metal Agrotech, and Abedin Equipment attended the meetings and provided information about the function, efficiency, and cost of the rice transplanters they sell.

The CSISA–MEA teams in Jashore, Faridpur, and Cox's Bazar supported 105 MSPs who had recently bought machines, in particular combine harvester and rice transplanter MSPs, to acquire new markets and customers through machinery provision.

The CSISA–MEA ZOR team supported 12 rice transplanter MSPs, one combine harvester MSP, and one reaper MSP to conduct business expansion meetings with a total of 345 farmers. Lead firm representatives from BanglaMark, ACI, Metal Agrotech, and Abedin Equipment also attended the meetings. The MSPs demonstrated the use of their machine and presented the savings farmers could make from hiring machinery services from an MSP. The lead firms provided information about their machines and costs.

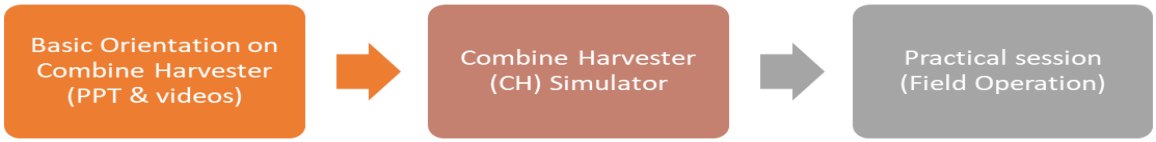
Business record-keeping to secure repeat customers

CSISA–MEA provided MSPs training on record-keeping and its use for calculating income and expenditure of agriculture machines. To support the MSPs to maintain records, 164 logbooks were given out to MSPs operating in Rajbari, Kushtia and Faridpur districts, 146 logbooks to MSPs operating in the greater Jashore region, and 46 logbooks to MSPs operating in Cox's Bazar district.

Combine harvester simulators.

Since 2019, CSISA–MEA has supported lead firms to train 1,160 MSPs in combine harvester use. As the rice and wheat harvesting season is very short, at ~60 days a year, operators/MSPs are anxious to start using the combine harvester as soon as the season starts and cannot afford to lose income by spending time learning how to operate it. To address this, MSPs often learn how to use their combine harvester in a yard rather than in a field, harvesting crops. The knowledge from off-season training remains at basic level and increases the risks of machine damage in the field or when driving on roads,

which creates a poor impression among farmers of the value of the machines. As an alternative first step, drivers can practice using a combine in the company office in the same way that new pilots learn to fly airplanes: on a combine harvester driver simulator.



The simulator can train operators/MSPs before they test drive or operate the machine in the field, minimizing costs to the private sector. Simulator training is expected to provide operators/MSPs, safely, with at least 50–60% of the knowledge required to operate a combine harvester before actually driving it. Two Activity partners selling combine harvesters, Abedin Equipment Ltd. and Metal Agri Tech Ltd., are keen to use this concept as part of their sales pitch. CSISA–MEA has identified two IT companies, Battery Low Interactive Ltd. and TechnoMagic Ltd., to develop the simulators and these are now working with the lead firms to design and test them.

Business development activities for rice transplanters

In the reporting period, CSISA–MEA has supported the increase in rice transplanter use by (1) linking MSPs with the companies and dealers selling rice transplanters, (2) linking MSPs who own rice transplanters with farmers seeking their services, (3) technical backstopping to the rice seedling growers especially women growers, and linking them with farmers and rice transplanter MSPs who need rice seedlings, and (4) providing DAE extension staff with training in seedling raising for rice transplanters.

To create demand for mechanical rice transplanter services and to train farmers to raise seedlings for the transplanters, the Activity facilitates a training program for local entrepreneurs, MSPs, and farmers, by both private sector and public sector partners. During the reporting period, the CSISA–MEA team supported Janata Engineering, GSM, Abedin Equipment, Metal Agritech, and Uttaron Engineering to conduct meetings and experience-sharing workshops in the ZOR and ZOI. Abedin Equipment, Metal Agritech, and Uttaron Engineering organized six events in Cox's Bazar, Bandarban, and Chattogram districts, attracting a total of 123 rice seedling entrepreneurs and seven MSPs. In the ZOI, Janata Engineering and GSM organized four training events for 40 rice transplanter MSPs and seedling raising entrepreneurs. The training provided recommendations for the correct age and height of seedlings to use in a rice transplanter, on where to use seedling trays instead of polythene sheeting to raise seedlings, optimal water depth in seedling nurseries, and management of seedlings during heavy rainfall and flooding.

In the ZOR, Activity lead firms Abedin Equipment, Metal Agritech, and Uttaron Engineering organized 11 training sessions for a total of 110 MSPs, covering primary operation, maintenance, and troubleshooting for rice transplanters. To complement this, the Activity, either directly or through Abedin Equipment or Uttaron, organized four training sessions for 65 seedling entrepreneurs and 15 MSPs on seedling raising for mechanized rice transplanters. It also organized 20 training events in rice seedling raising techniques in collaboration with the DAE government extension service, which were attended by a total of 224 seedling entrepreneurs.

Rice transplanter MSPs participated in nine experience-sharing workshops, two in the ZOR and seven in the ZOI, where they met a total of 140 farmers. Lead firm representatives, dealers, DAE extension staff, and mechanics also attended these meetings, which provided all the actors in the value chain with a platform to share their experiences and practical knowledge of the rice transplanter service business. They discussed demand, and rice transplanter technical issues requiring improvement. The MSPs and farmers also negotiated service charges, and the MSPs prepared workplans for the next planting season.

Training rice transplanter MSPs, delivered by Alim Industries in collaboration with the DAE under their Climate Smart Agriculture & Water Management program, with technical support from CSISA–MEA engineers. Tekpara village, Eidgaon *upazila*, Cox's Bazar District, January 14, 2024.
Photo: Md. Abdur Razzak, ADO, Cox's Bazar

On December 11, 2023, the CSISA–MEA Kushtia team in collaboration with DAE organized two linkage meetings at Kumarkhali *upazila* and Gungoli, Chandpur *upazila* to promote rice transplanter MSPs through the DAE-synchronized farming initiative. As a result, MSPs transplanted 20 hectares and earned a total of USD 1,630.

From February 25–27, 2023, BRRI facilitated training for farmers in mechanized rice production. This was led by Dr. Saiful Islam, Project Director of the BRRI-implemented SFMRA project, and was supported by CSISA–MEA. It was attended by the Additional Secretary, Farjana Momtaj, Joint Secretary, Dr. K M Kamrujjaman, and Deputy Secretary, Sayedur Rahman, Ministry of Agriculture. The training featured the use of the BRRI-designed seed tray sower, weeder and insect light traps, how to raise seedlings for transplanting using a rice transplanter, and how to operate a rice transplanter

Facilitating access to finance for MSPs and dealers

Facilitating loans through micro finance institutions

During the reporting period, CSISA–MEA supported three micro-finance institution (MFI) partners, (the Rajbari-based MFI VPKA Foundation, Faridpur-based MFI SDC, and Satkhira-based MFI SUS) to provide loans totaling USD 13,985 to six Jashore MSPs. It also facilitated loans from WAVE Foundation, VPKA, and United Commercial Bank, worth a total of USD 13,985, for seven Faridpur MSPs to purchase combine harvesters, power tillers, irrigation pumps, rice transplanters, PTOS, fodder choppers, and spare parts. All the Activity's MFI partners provide loans specifically targeting the needs of women-managed agricultural machinery service provision businesses.

To support its three partner MFIs to expand their financing program in Faridpur, the Activity facilitated eight meetings between MFI staff, ABLE enterprises, MSPs, and lead firms RK Metal and Janata Engineering, where the MFIs provided information about their financing products, and the producers and services providers provided information about their products, prices and aftersales service. As a result of these meetings, 30 MSPs have applied to the MFIs for loans and the MFIs provided two financial literacy training sessions to a total of 25 MSPs on day-to-day finance basics and business planning.

Facilitating loans through an intermediary financial services provider

In Year 4, CSISA–MEA partnered with Dhaka-based consulting firm LightCastle Partners to act as an intermediary between these FSI actors and MSPs and ABLE enterprises. LightCastle's most successful product was brokering asset-backed financing for MSPs businesses in the ZoR.

In this reporting period, to continue its asset-backed financing mechanism and scale it out, LightCastle developed a profile for 50 MSPs and 50 ABLE enterprises. The profile development process provided valuable insights into the current requirements for business development services, capacity development and financing. LightCastle then identified 40 MSPs (among them 14 female-owned businesses) and 34 ABLE enterprises in the ZOI, and 30 MSPs, two dealers, and eight ABLE enterprises in the ZOR, that it considered could be supported to gain access to financial services and investments and to provide financial record-keeping and investment planning support.

LightCastle has provided the selected enterprises with the following business development services:

- financial toolkits
- one-to-one financial consultation sessions
- financial statements, with support from partner company SMEVai
- a machine services provision calendar for MSPs
- financial support and improved inventory management from LightCastle partners Bank Asia, Industrial Development Leasing Company (IDLC), WeGro, and SMEVai
- training in product photography and digital marketing
- support with establishing Facebook business pages and the use of the "Meta Business Suite"
- marketing banners created with LightCastle support
- legal advice
- e-TIN, VAT and tax return preparation
- advice on how to achieve product diversification
- implementation of workplace safety.

Table 9: Loans facilitated through the partnership with LightCastle Partners for dealers and MSPs

Actor	No. of loan recipients	Loan amount (USD)	Name of financial institute
MSPs	23	70,410	WAVE Foundation, UCBL, VPK Foundation, WeGro, SBL, Buro Bangladesh
Dealers	7	239,046	Lanka Bangla, IDLC, BRAC Bank, BRAC MFI
Total	**30**	**309,456**	

LightCastle partners produced short artless and videos for posting on their web site about agricultural mechanization and the work they have done with CSISA-MEA further publicizing the work of the Activity. See the following links:

https://lightcastlepartners.com/news/training-machine-service-providers-msps-csisa-mea/

https://lightcastlepartners.com/videos/agri-mechanization-innovative-financing-bangladesh-video/

https://lightcastlepartners.com/insights/2023/12/innovative-financing-in-ag-mechanization/

MSPs developed by lead firms with support from CSISA–MEA

The activities described above contributed to the development of 299 new MSPs businesses, bringing the total developed since the start of the Activity to 858. Including the MSP businesses initiated as part of the CSISA–MI Activity, farmers bought machinery services from 1,652 active MSPs during this reporting period.

Table 10: Number of MSPs businesses developed through CSISA-MEA support

Field office	MSPs developed by Activity year					Total
	2019–20	2020–1	2021–2	2022–3	2023–4	
Jashore	34	54	87	162	103	440
Faridpur	94	22	25	67	104	312
Cox's Bazar	0	0	0	14	92	106
Total	**128**	**76**	**112**	**243**	**299**	**858**

This Activity year, new and existing MSPs purchased the machines shown below. The value of the 101 combine harvesters purchased by MSPs represented 82% of the total value of purchases.

Table 11: Number and value (in USD) of machines bought by MSPs supported by CSISA-MEA

Field office	Combine harvester	Rice trans-planter	PTOS	Reaper	Fodder chopper	Reaper binders	Total
Cox's Bazar	30	45	0	6	2	2	85
	449,500	129,094	0	6,115	1,677	6,200	59,586
Bandar-ban	0	3	0	0	4	0	7
		2,100			3,354		5,454
Jashore	35	1	53	8	6	0	103
	586,800	900	23,823	7,662	1,290		620,474
Faridpur	36	36	79	4	0	0	155
	493,500	63,386	76,007	5,506	0	0	638,399
Total	**101**	**85**	**132**	**18**	**12**	**2**	**350**
	1,529,800	**195,480**	**99,830**	**19,283**	**6,321**	**6,200**	**1,856,914**

Note: these sales figures are not the true value of the machines sold, but the value of the machines after government subsidies are deducted from their price.

MSP Business performance survey

In August 2024, CSISA–MEA conducted a survey of 2,608 MSPs across 21 districts to identify challenges and opportunities facing MSPs in Bangladesh. The full report can be accessed through this web link: https://csisa.org/wp-content/uploads/sites/2/2024/10/MSP-Report-CSISAMEA22Aug-1-2.pdf
The study encompassed coastal and non-coastal areas, assessed the status of the service providers, and identified the key issues they face.

The key findings of the report were:

1. **Functional status of MSPs**. Of the 2,608 MSPs interviewed, 54.75% of MSPs businesses were active and 45.25% were inactive. A significant disparity exists between coastal and non-coastal districts, with 62% of MSPs interviewed in non-coastal districts having active machinery service businesses compared to only 31% of MSPs interviewed in coastal districts.
2. **Challenges faced by MSPs**. Key challenges were machine damage, unavailability of spare parts, and operational difficulties. Machine damage is the most significant issue, contributing to the inactivity of the 938 machines owned by the MSPs interviewed. Coastal districts face a higher incidence of spare parts unavailability. Other issues were services sold on credit and strong business competition.
3. **Business viability**. Despite the challenges, 90% of MSPs in non-coastal districts and 83% in coastal districts report their businesses as being viable, though coastal districts face slightly higher financial and operational costs.
4. **Support needs**. MSPs across both areas require stronger linkages with machine suppliers, financial support, and improved access to government subsidies. Training and access to reliable machinery are particularly critical in coastal districts, reflecting a need for tailored interventions.
5. **Popular machines**. The most commonly used machines were the PTOS and the combined harvester. Operational issues, especially with the PTOS and AFPs, highlight the need for better maintenance support and operator training.

The report's recommendations were:

1. **Enhance machine adoption**. Strengthen the value chain by improving access to quality spare parts, technical support, and operator training. Government and private sector initiatives should focus on integrating practical training for youth and women into existing programs.
2. **Support infrastructure**. Develop sustainable local workshops for machine repair and maintenance. Encourage market assessments to ensure the availability of critical spare parts and promote domestic manufacturing where possible.
3. **Tailored support packages**. Address regional disparities by providing specific support based on the unique needs of MSPs in coastal and non-coastal areas. This includes access to finance, stronger customer linkages, and targeted training programs.

MSPs stated that the most useful support they received from CSISA-MEA was in the form of training, linkages with machine suppliers, links to government subsidies, business expansion meetings, farmers field days, contact with mechanics, and marketing campaigns. The most widely used machines, such as combine harvesters, were used between 50–100 days a year, indicating the potential for increasing income from the machines by increasing their use over a wider range of locations and time, or developing multiple functions for the machines. The AFP was recorded as having the highest number of operation days a yar, and reaper machine the lowest. The fodder chopper machine was used over more days in coastal districts, possibly due to greater livestock numbers in coastal areas where salinity problems leaves land fallow and therefore available for grazing during the dry season.

Collaboration with agricultural development programs

Collaboration with a mungbean-exporting company

During March 2024, CSISA–MEA facilitated a demonstration in collaboration with Grameen–Euglena, a mungbean exporting company, of a manually-operated weeding machine produced by ABLE enterprise M/S Maa Metal from Faridpur, and a PTOS to line sow mungbean. It was attended by 35 mungbean growers and a machinery dealer, in Bowphal *upazila*, Patuakhali district. During the meeting, seven farmers each ordered a weeder, and three were sold by M/S Maa Metal.

Training for ABLE enterprises provided by BRRI

With support from CSISA–MEA staff, Dr. Saiful Islam, Project Director of the BRRI-implemented SFMRA project, made two visits to the ZOR to assess the market potential and training needs of ABLE

enterprises. This resulted in the implementation of two training programs on the manufacture of the BRRI-designed engine-driven rice thresher. In learning how to make the rice thresher, participants acquired many basic manufacturing skills and learned the importance of using technical drawings and accurate measurements.

BRRI delivered training, facilitated by CSISA-MEA, for the agricultural machinery manufacturing workforce at M. M. Engineering, Ramu (November 23–30, 2023), and to 16 staff members from four workshops (Bai Bai Engineering Workshop, Ramu; Meheraj bin Miraj Engineering, Lama; Proshad Engineering, Cox's Bazar; Riaz Engineering, Ukhiya) (March 13–17, 2024). As part of the training, participants constructed two rice power threshers.

As part of the training in the manufacture of the BRRI-designed rice thresher, Dr. Saiful Islam, Director of the BRRI-implemented SFMRA project, explains to training participants the use of hand-held tools used in the manufacture of agricultural machinery. Ramu, Cox's Bazar district. November 23, 2023.
Photo: Shihab Shahabuddin, MDO, Cox's Bazar

Collaboration with Kellanova

US multinational company Kellanova has worked for several years with potato growers in northern and south-western Bangladesh to produce potatoes suitable for its potato chips product. Although it had some success with introducing appropriate varieties and forming farmer groups, it needed support to introduce mechanized potato production technology. Working in collaboration with BARI and SEBA Agrotech (a Kellanova partner, based in north-western Bangladesh), CSISA–MEA facilitated meetings with a total of 20 lead farmers from Rangpur, Joypurhat, Gaibanda, and Bogura districts and four meetings with 100 women farmers from two villages in Jashore Sadar Upazila, to present them with options for mechanical potato production, harvesting, and processing.

Women farmers participating in an orientation on mechanized potato farming. Jashore Sadar, March 7, 2024.
Photo: Arifur Rahman, MDO, Jashore

The sessions, led by Dr. Rajiul Hassan Mondol, Senior Scientific Officer, Tuber Crops Research sub-station, BARI, Bogura, included demonstrations of potato planters, weeder-cum-earthing up machines, single-wheel powered sprayers, potato harvesters, and potato graders. After the event, seven farmers committed to buying a total of nine machines, currently being manufactured by the Activity's ABLE enterprises in Bogura.

Communications outreach

To reach a diverse audience, CSISA–MEA utilizes multiple platforms including social media, blogs, and newspapers to showcase its initiatives and successes. The Activity's Year 5 outcomes are presented in detail in the subsequent section; links to some of its published success stories are given below:

- Agrilinks featured a blog post entitled Transforming Change: Women's Diverse Roles in Bangladesh's Agrimachinery Sector, which showcases CSISA–MEA's efforts in promoting gender inclusion.
- The Business Standard, a prominent Bangladeshi daily newspaper, published two articles spotlighting CSISA–MEA's role in advancing agricultural mechanization in Bangladesh. The articles, entitled Agricultural Mechanisation is Revitalising Cox's Bazar and Bandarban and Resilience and Innovation: Bangladesh's Agricultural Engineering Sector Adapts amidst Challenges, highlight the Activity's impact on the country's agricultural landscape.
- The CIMMYT website showcased four success stories related to CSISA–MEA's work in Bangladesh. These articles highlight India–Bangladesh linkages created by the Activity through exposure visits, women's inclusion in light engineering, gender norm shifts in agriculture, and USAID's observations of innovative agricultural practices, respectively. The features include Exposing the potential of agricultural mechanization in India and Bangladesh, Breaking ground and redefining roles in the agri engineering sector: Anjuara Begum, A community leader in Baliakandi inspires women empowerment in agriculture: Promila Rani Mondol, and A journey through Bangladesh's ground-breaking agricultural practices.

- USAID Bangladesh has highlighted various success stories on its social media platforms, including Facebook and Twitter. These stories feature individuals and businesses like Mahafuzur Rahman, SMR Agro Engineering, and Sonia, a CSISA–MEA combine harvester MSP.
- Three blog posts have been published on the CSISA website, and over 30 posts have been shared on CSISA's Twitter, showcasing CSISA–MEA's activities across Bangladesh. The blog posts are Mawa Engineering Workshop: empowering agriculture through innovative machinery, Progressive development: preparing women for employment in agriculture-based light engineering, and Bridging the Gender Gap: Empowering Women in Agriculture through Mechanization.

FEED THE FUTURE This project is part of the U.S. Government's global hunger and food security initiative.

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Transforming Change: Women's Diverse Roles in Bangladesh's Agrimachinery Sector

Asmaul Husna | March 8, 2024

[Promila Rani Mondol is using a rice transplanter to plant rice in the field in Rajbari, Bangladesh; photo: Asmaul Husna]

Women are currently working to help Bangladesh adapt agriculture mechanization in di! erent capacities. Women are employed in many di! erent roles within Bangladesh's agriculture sector, ranging from operating agrimachines to working in foundries and engineering workshops. The coordinated e! orts of programs like the Cereal Systems Initiative for South Asia–Mechanization Extension Activity (CSISA–MEA), funded by USAID and implemented by CIMMYT in partnership with iDE and Georgia Tech, are especially notable for this transformation. The agrimachinery industry has benefited from this initiative's contribution in promoting Gender Equality and Social Inclusion (GESI).

The pioneer of Jashore: Anjuara Begum defies the odds

Anjuara Begum, from Bangladesh's Jashore District, defied societal expectations by becoming a grinding operator at Abdur Rahman Foundry, breaking through gender norms in the engineering sector. Married at the age of 15, she became a single mother within a year following her husband's passing. To support her family, she started working as a cleaner in the foundry. Her interest in traditionally male-dominated roles led her to working in sand molding—a method for shaping metal equipment by pouring molten steel into a sand mold, letting it solidify at room temperature to achieve the desired design—and grinding. With no formal training,...

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A USAID Feed The Future Agrilinks site from March 8, 2024, featuring CSISA–MEA women MSP business owners.

Challenges and lessons learned

Challenges

- *Foreign currency restrictions*. Obtaining foreign currency in Bangladesh is very difficult for many companies. In the case of the ABLE sector, this has constrained its ability to import new manufacturing machinery and the raw materials needed to manufacture machines. Machinery importing companies and dealers have also found it difficult to obtain the foreign currency needed to import the agricultural machines and spare parts that farmers require. These difficulties not only constrain the ability of ABLE enterprises to implement the lessons they have learned from the Activity through training and technical support, but also the ability of the agricultural machinery sector to support and provide farmers with services.
- *Inflation and declining exchange rates*. The rising cost of living driven by increasing global food and fuel prices, and the rising cost of producing food driven by higher energy and fertilizer costs, all constrain the ability of ABLE enterprises and MSPs to offer affordable machines, parts, and services to farmers
- *General election, January 2024*. Although this was largely held without serious civil disturbance, movement was restricted before and after the election, restricting the ability of the Activity to implement its work plan.
- *Change in government, August 2024*. The civil disturbance before and after the sudden change in government in August 2024, and political instability following that change, had a major impact on the ability of Activity staff to implement field work. The new government has also made some policy changes that will have a major impact on agricultural mechanization, the most important of which is the removal of subsidies on the purchase price of agricultural machinery such as combine harvesters and rice transplanters. In the short term this will have a large impact on machinery sales and this will slow the pace of adoption of agricultural mechanization technology. Given time, though, this will result in the development of more sustainable financing schemes such as asset based financing. For instance, four-wheel tractor sales have thrived without any subsidies.

Lessons learned

- *Linkage meetings*. Linking many small ABLE businesses with new markets, through meetings attended by large groups of regionally operating dealers, MSPs and FSIs, is a more effective way of supporting ABLE enterprises to expand their businesses than by linking them with a small number of nationally operating lead firms.
- *Increase impact by focusing on enterprises seeking change*. Concentrating on supporting smaller groups of leading ABLE enterprises through cost-sharing agreements is an efficient way for the Activity to introduce new technology and practices to businesses with the energy and interest to implement them, which are then copied by other enterprises.
- *Supporting collaboration between public and private entities*. The facilitation of government entities (e.g., DAE, BARI, and BRRI) to partner with private sector entities (e.g., ABLE enterprises and MSPs) has accelerated the development and dissemination of new agricultural mechanization technology in a sustainable manner.
- *Importance of credit facilities*. For ABLE enterprises, credit from FSIs to finance operating costs is more difficult to obtain than finance for new investments. MSPs have less collateral than ABLE enterprises and therefore find it more difficult to secure large loans to purchase machinery than small loans to finance business operating expenses. Banks which normally offer lower interest rates (4% to 9%) do not have the field staff to monitor loans to MSPs. MFIs which do have an extensive network of field staff can monitor loans, but only offer loans with very high interest rates (15% to 23%). Developing financing mechanisms for MSPs and other small rural businesses such as asset based financing is required.
- *Utilization of training knowledge.* Workshop staff specialize in specific tasks such as welding or machining on lathes. However, the current exhaustive training covers all tasks and operation of

all the commonly used machinery, meaning that the workforce only uses a small portion of what they learn. Therefore, offering a range of courses through short videos posted on YouTube is one way being tried as a way of supporting ABLE enterprise workers obtain more skill specific training.

- *Introduction of advanced technologies through training and visits.* Investing in orientation or training in advanced technologies may not yield immediate results, but the knowledge and training acquired today will prove invaluable in the future. Visits to facilities with advanced machinery and processes provide ABLE enterprises with aspirations for improving their factories.
- *Future value-added services of MSPs.* The future of mechanization lies in integrating multi-functional, advanced, and efficient machines. Gradual digitization, automation, fleet services, bundled services, and digital platforms are key to business sustainability. Strengthening linkages with commission agents, spare parts shops, machine lead firms/importers, mechanics, dealers, and farmers will be crucial for creating a robust and integrated service model. Online and offline marketing, enhanced service credit systems, improved payment systems, easy access to finance, and comprehensive repair and maintenance services should be prioritized to ensure the long-term success of MSPs.
- *A specific focus on the development of the ZOR*. A focus on the ZOR, a part of Bangladesh where there has been little investment in the engineering industry and agriculture, has resulted in the rapid transformation of small light engineering businesses from only being capable of minor repairs to being able to make complex machines. It has also led to the rapid introduction of technology for the mechanization of laborious tasks such as planting and harvesting rice, and chopping fodder for livestock production. A similar approach could be taken to increase availability of agricultural machinery and spare parts in other less well-served areas, such as the Sylhet region.
- *Women in the agricultural mechanization value chain.* Appropriate training and a supportive environment equip women to work in management, metalworking, and as MSPs. Specifically, the inclusion of GESI training for managers and workers has resulted in them accepting and encouraging women to take key roles in the workshop, in management, and the workforce.

Annex 1: Detailed information about Activity implementing partners

The International Maize and Wheat Improvement Center (also known as *Centro Internacional de Mejoramiento de Maíz y Trigo*, or CIMMYT by its Spanish acronym) is the Activity's prime. In addition to being responsible for the overall administration and financial management of the Activity, responsible for employing field staff with agricultural development and engineering skills. CIMMYT is also responsible for reporting to the donor on the progress of the Activity, lessons learned through its implementation, and its impact. For this it employs a Monitoring, Evaluation and Learning (MEL) team that collects monitoring data, conducts surveys to evaluate Activity progress and conducts internal data quality assessments (iDQAs) to ensure the data reported to USAID are accurate. CIMMYT is also responsible for maintaining and administering field offices (see below for their locations). From these offices, CIMMYT and iDE field staff design, implement and supervise the training and technical support given to lead firms, finance institutions, ABLE enterprises, machinery dealers, research institutions, MSPs and to the farmers. This work is done in partnership with the Government of Bangladesh and the private sector.

International Development Enterprises (iDE) was a partner in the implementation of the CSISA–MI Activity and is a key implementation partner for CSISA–MEA, where its responsibility is to design and implement market-driven interventions in partnership with private sector firms. Within this CSISA–MEA, iDE plays a pivotal role in facilitating partnerships between SMEs and larger firms for process, technology and market improvements, and in leading the financial inclusion component with a range of national and international partners.

Georgia Institute of Technology (Georgia Tech) is CSISA–MEA's core engineering adviser and educational partner. Located in the USA, Georgia Tech provides a technologically focused education to undergraduate and post-graduate students in fields ranging from engineering, computing and sciences to business, design, and the liberal arts. Within CSISA–MEA, Georgia Tech is leading efforts in the mechanization and industrialization activities and in the design and implementation of the apprenticeship program, as well as anchoring US-based industry collaborations.

Annex 2: Summary of SWOC analysis of 42 second-stage ABLE enterprises and areas of request for collaboration

Listed in order of frequency of issue raised or type of collaboration requested

Jashore	Faridpur	Bogura	Cox's Bazar
Areas of collaboration **ABLE enterprises require CSISA–MEA to facilitate support for:**			
1. heat treatment/testing services 2. modern capital machinery purchase 3. linkages with dealers/lead firms 4. drawing & design skills 5. pattern/dice (dies) development 6. product branding	1. pattern/dice (dies) development 2. obtaining modern capital machinery 3. workforce training 4. online video content for marketing 5. promotion/business linkages for developing/marketing climate-smart machinery	1. drawing and design skills/knowledge for targeted new manufacturing prototypes field test, market promotion of targeted machinery	1. skill development in drawing and design, record-keeping, investment planning, digital marketing platforms 2. links to DAE, dealers, and farmers 3. capacity to promote products through social media channels
Strengths **ABLE enterprises have:**			
1. capital machinery 2. existing market networks/market reputation 3. skilled, experience workforce 4. willingness to improve product quality	1. skilled, experience workforce/technical expertise 2. existing market networks 3. suitable workshop location & space 4. huge demand 5. financial strength	1. skilled, experience workforce 2. capacity machinery 3. own workshop/foundry 4. capacity to invest in new products manufacturing 5. ability and willingness to install new machines for manufacture of new products	1. suitable workshop location/space 2. ability and willingness to install new machines for manufacture of new products 3. skilled, experience workforce 4. capital machinery 5. some workforce already trained
Weaknesses **ABLE enterprises lack:**			
1. testing/heat treatment knowledge 2. online marketing skills 3. capacity to meet demand 4. running capital	1. adequate capital machinery 2. online marketing skills 3. staff for market promotion 4. business relationships with dealers and commission agents	1. drawing and design skills for new parts 2. product promotion & branding skills 3. workforce skills for new parts	1. workforce with skills to manufacture new machines 2. skills in product promotion and branding 3. business management skills

Jashore	Faridpur	Bogura	Cox's Bazar
5. digitals tools for controlling quality of output 6. digital inventory 7. capital machinery	5. running capital/link with FSI/financial reserves	4. management capacity	4. skills to make the pattern & dice needed to make prototypes of new machines
There are opportunities as a result of:			
1. increase production by installing modern capital machinery 2. access to markets through online advertising 3. market for spare parts with dealer/lead firm 4. quality improvement through heat treatment/testing 5. market for new agro machinery & spare parts product lines	1. markets in other districts and new dealerships 2. access to bank/MFI finance 3. huge market for spare parts 4. market for new machines 5. availability of people to employ	1. market demand for new machines 2. raw materials available locally 3. low market competition for new machines	1. large market for machines to be manufactured 2. little competition for the machines targeted for manufacture
There are challenges with:			
1. linking with markets in remote districts 2. high price of raw materials 3. obtaining running capital 4. obtaining orders 5. accessing testing facilities 6. low quality of parts for dealers and lead firms	1. poor electrical wiring 2. high workforce drop-out rate 3. high competition in the market 4. political unrest 5. difficulties recovering credit from dealers and customers	1. high raw material prices and variable quality 2. competition from imported low-cost, low quality machines 3. providing after sales services in remote areas 4. copying of products without permission	1. copying of products without permission 2. lack of the machines/services required to manufacture new targeted machines 3. fluctuating raw material prices 4. manufacturing machines at competitive prices 5. providing after sales services in remote areas

Annex 3 JVA scope of work and funds committed

Capacity development of agriculture mechanization actors. The Activity focused on capacity development of different agricultural mechanization actors involved in this sector, including in-house staff capacity development training for lead firms, skill development training of dealers and/or their workforce, skill development training of operators and MSPs, and skill development of local youth entrepreneurs and women entrepreneurs.

Strengthening the agricultural machinery and spare parts supply chain and dealership network. Activities included capacity development training/orientation for ABLEs and dealers in machine and spare parts, sales, marketing and inventory management, dealer development, dealer points branding, linkage meetings with ABLE, dealers, lead firms, and MSPs.

Development of rice transplanter service provision businesses. Under this broader activity line, JVAs outlined activities for promoting rice transplanters (market activation and promotional events), entrepreneurship training on rice seedling raising, and rice transplanter machine operator training and demonstrations.

Raising awareness of new agricultural mechanization technology. Promotional activities under the JVAs were development and promotion of communication materials (e.g., leaflets, brochures, service cards), televisions programmes, online video advertising, awareness campaigns on machine use and safety protocols, promotions through digital platforms (e.g., Facebook, YouTube posts), and machine demonstrations.

Strengthening agricultural machinery aftersales services. Activities planned under this broader activity line included capacity development training of mechanics, capacity development training of commission agents, service campaigns, dedicated dealer/service point development, and guarantee/warranty provision for MSPs.

Access to finance for MSPs. This specifically focused on ensuring access to finance for agricultural mechanization actors. Activities included linkage meetings with banks, NBFIs and MFIs, product and service orientation to the beneficiaries, digital profiling and creditworthiness assessment, record keeping and documentation for credit support, loan disbursement, and stakeholder engagement meetings.

The partnering process with lead firms was as follows:

1. A Request for Expressions of Interest was published on November 5, 2023 and December 5, 2023. Both circulars were open for 20 days via the online portal. The EOI was segmented into three categories:

   Category 1. Strengthening the agricultural machinery and spare parts supply chain, its distribution, uses, servicing, demand creation, and delivering agricultural services to the farmers with enhancing capacity of the actors engaged in agricultural mechanization, especially for MSPs.

   Category 2. Improving access to financial services for ABLE enterprises, dealers, and agricultural MSPs.

   Category 3. Improving the competitiveness and efficiency of domestic agricultural machinery and spare parts manufacturing, developing new/innovative channels including digital marketing platforms for agri machinery and spare parts, delivering business development support services to the ABLE SMEs including branding and marketing made in Bangladesh agricultural machines and spare parts, drawing, design, testing, heat treatment, as well as enhancing commercially viable capacity building solutions for ABLE SMEs and workforces.

2. Eighteen interested firms submitted proposals by email. Five proposals addressed the Category 1 objective, six firms addressed Category 2, three proposals focused only on Category 3, and four firms submitted a proposal focusing on Category 1 and 3 objectives.

Annex 4: CSISA–MEA performance indicators and targets

Indicator reference number/name	Units	FY2020		FY2021		FY2022		FY2023		FY2024		Activity target	Achieved (%)
		target	achieved	target	achieved	target	achieved	target	achieved	target	achieved		
EG.3-2 No. of individuals participating in USG food security programs	no.	25,620	43,011	42,420	41,980	54,061	52,234	60,550	56,494	60,235	57,107	242,886	250,826 (103%)
EG.3.1-15 Value of new private sector investment leveraged by the USG to support food security and nutrition	USD			620,000	672,502	1,300,000	1,263,882	2,300,000	3,528,351	2,150,000	2,109,309	6,370,000	7,574,044 (119%)
EG.3.2-24 No. of individuals in the agriculture system who have applied improved management practices or technologies with USG assistance	no.	25,000	43,011	51,613	41,148	53,391	50,839	58,730	54,724	59,255	56,211	247,989	245,933 (99%)
EG.3.2-25 No. of hectares under improved management practices or technologies with USG assistance	ha.	7,143	12,235	14,683	13,642	17,619	26,188	19,381	23,553	19,554	18,199	78,380	93,817 (120%)
EG.3.2-26 Value of annual sales of farms and firms receiving USG assistance (USD)	USD	260,242	278,980	594,940	1,779,235	2,100,000	2,365,017	2,520,000	3,669,763	2,700,000	2,861,900	8,175,182	10,954,895 (134%)
EG.3.2-27 Value of agriculture-related financing accessed as a result of USG assistance	USD	50,000	9,647	300,000	547,294	600,000	935,295	950,000	1,484,651	1,100,000	1,156,356	3,000,000	4,133,243 (138%)
GNDR-2 Percentage of female participants in USG-assisted programs designed to increase access to productive economic resources	%	11%	22%	11%	14%	4%	33%	6%	42%	14%	19%	9%	26% (283%)
YOUTH-3 Percentage of participants in USG-assisted programs designed to increase access to productive economic resources who are youth (15–29)	%	15%	42%	15%	14%	16%	8%	6%	11%	14%	15%	13%	18% (136%)
Custom Indicator 1 No. of individuals with improved skills following completion of USG-assisted workforce development programs	no.	200	0	400	512	450	755	600	962	300	393	1,950	2,622 (134%)
Custom Indicator-2 No. of individuals with new and/or improved employment following participation in USG-assisted workforce development program	no.	240	0	240	390	342	755	600	848	360	239	1,782	2,232 (125%)

Cereal Systems Initiative for South Asia—Mechanization Extension Activity (CSISA–MEA)