

Appropriate Scale Mechanization Innovation Hub (ASMIH)- Bangladesh: A Sustainable Approach

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Outline of the Presentation



- Context of Bangladesh agriculture
- Project objective and activity framework
- Key activities and achievements
- Sustainable impact strategies
- Urgent policy intervention

Context of Bangladesh Agriculture



Successes

- Bangladesh is the 4th largest rice producer, 3rd largest vegetable and inland water fish producer and 5th largest aquaculture fish producer in the world.
- Since independence, the production of paddy has increased over three folds (55.4 million tones in 2019; GIEWS-FAO, 2020) compared to double the population growth and attains self-sufficiency in paddy production.

Challenges

- Agricultural land is decreasing by 0.5% per year (FAO, 2014).
- On-farm labor employment was about 43% of rural labor force in 2017 and expected to be reduced to about 36% by 2020 and 20% by 2030 (FAOSTAT, 2017).
- There is potential yield gap between research and on-farm production.
- Harvesting and processing loss of paddy at farm level is about 14% of which harvesting loss is about 6%, (ASMIH, 2018).

Potential Solutions

- Appropriate scale mechanization of field crops would have been one of the potential solutions of the challenges.

Objective and Areas of Intervention



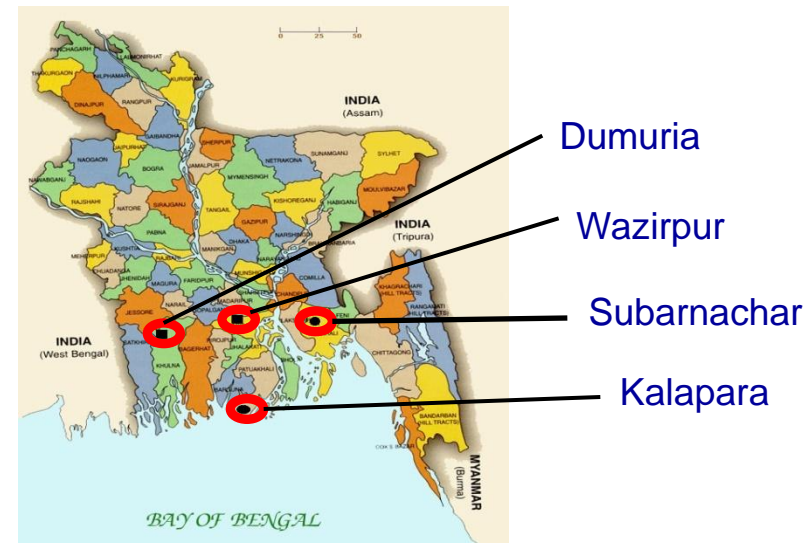
ASMIH-Bangladesh: October 2015 to September 2020

Overall Objective

To promote appropriate scale agricultural mechanization for sustainable intensification focusing on smallholder farmers' on-farm operations and to improve land and labor productivity in a sustainable manner, considering the social, economic and environmental impacts with special focus on the role of women.

Areas of Intervention

- ❖ Transplanting
- ❖ Harvesting
- ❖ Conservation agriculture



Activity Framework: A Sustainable Approach



Hub formation and Survey – Establish Hub, identify specific areas of mechanization, assessment and benchmarking; identify stakeholders and their capacity building

Engage partners and EPOs, Perform SWOT analysis, site visits and farm household survey

Year- 1

Assess – Technical & economic feasibility, robustness and end-users acceptance of identified technologies

Farmers' fields in different areas of southern delta

Year-2

“Scale-up”– Selected mechanized solutions to other areas of southern delta

Training, demonstration, piloting and service provider development

Year- 3

Policy and Sustainability of Hub – Advocacy and Seeking fund

Policy dialogue, workshops, symposiums, seek sources for funding

Year- 4

Rice Transplanting



Seedling Preparation



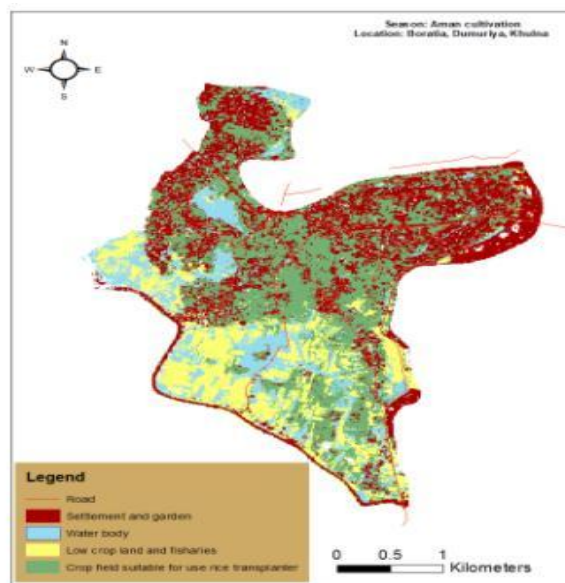
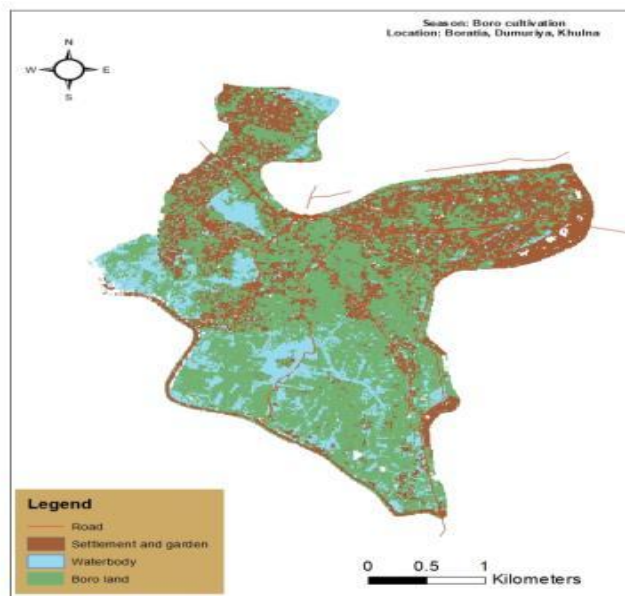
- Standardized methods of seedling raising
- Identified models of Rice Transplanter
- Developed Local Service Providers
- Developed women entrepreneurs in seedling raising business



Rice Transplanter

- ❖ Capacity: 0.17 ha/hr
- ❖ Field capacity: 72%
- ❖ Cost Saved over manual transplanting:
 - 30% with tray seedling
 - 48% with polythene mat seedling
- ❖ Market Price: USD 4700
- ❖ Payback period: 2 years

GIS mapping and Estimating Number of Transplanter



Assumptions

Capacity – 0.17 ha/hr

Working hour in a day – 8 hrs

Working days in season – 20 days

Boro

- Low land and fish farms (GHER) turned into rice land
- STW based irrigation available

Aman

- Poor drainage
- Low land turned into fish farm

Description	Boro season			Aman season		
	Area	Percent of area (%)	No. of Transplaner required	Area	Percent of area (%)	No. of Transplanter required
Settlement	313.23	30.77	20	313.23	30.77	14
Water Body	153.57	15.08		153.57	15.08	
Low crop land and fisheries	-	-		180.67	17.75	
Crop land (suitable)	551.26	54.15		370.59	36.40	
Total	1018.06	100		1018.06	100	

Rice Harvesting



- Labor intensive and costly
- High harvesting loss
- Time consuming



- Low capacity
- Need threshing and cleaning
- Cannot harvest shattered crop



- Low capacity
- Low power & less robust
- High repair & maintenance cost
- Cannot harvest shattered crop

Best Solution



- Combine can harvest 100% shattered paddy
- Operate in wet and 15 - 20 cm standing water
- Detect clogging using six sensors
- Easy operation, adjustment and maintenance

Rice Harvesting



Reaper

- ❖ Capacity: 0.22 ha/hr
- ❖ Field efficiency: 65%
- ❖ Cost saved: 36% over manual harvesting
- ❖ Market Price: USD 2118
- ❖ Payback period: less than a year

Mini-Combine

- ❖ Capacity: 0.10 ha/hr
- ❖ Field efficiency: 55%
- ❖ Cost saved: 51% over manual harvesting
- ❖ Market Price: USD 8529
- ❖ Payback period: 2 years

YANMAR Combine

- ❖ Capacity: 0.45 ha/hr
- ❖ Cost saved over manual harvesting:
 - Cost saved: 60.98%
 - Loss saved: 4.74%
 - Labor saved: 70%
- ❖ Market Price: USD 33333
- ❖ Payback period: less than 3 years

Rice Harvesting (BAU Reaper)



BAU-reaper has been modified and replicated at Mahbub Engineering Workshop, Jamalpur

Season	Location	Model	Forward speed, km/hr	Fuel Consumption l/ha	Effective field Capacity ha/hr	Field Efficiency %
<i>Boro-2019</i>	<i>Jamalpur</i>	Diesel engine operated reaper	2.66	2.73	0.243	76.18
<i>Aman-2019</i>	<i>Jamalpur</i>	Battery operated reaper	2.83	-	0.203	79.6



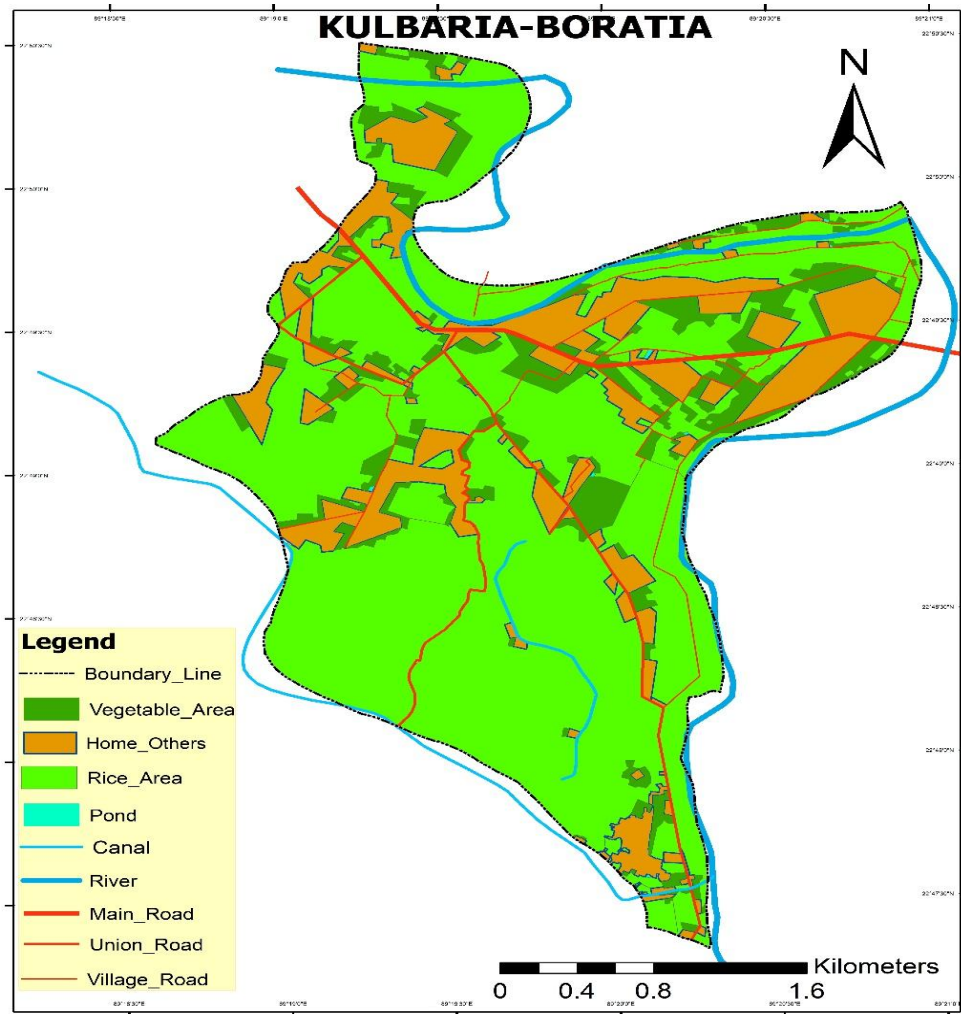
Diesel engine operated reaper



Battery operated reaper



GIS mapping and Estimating Number of Harvester



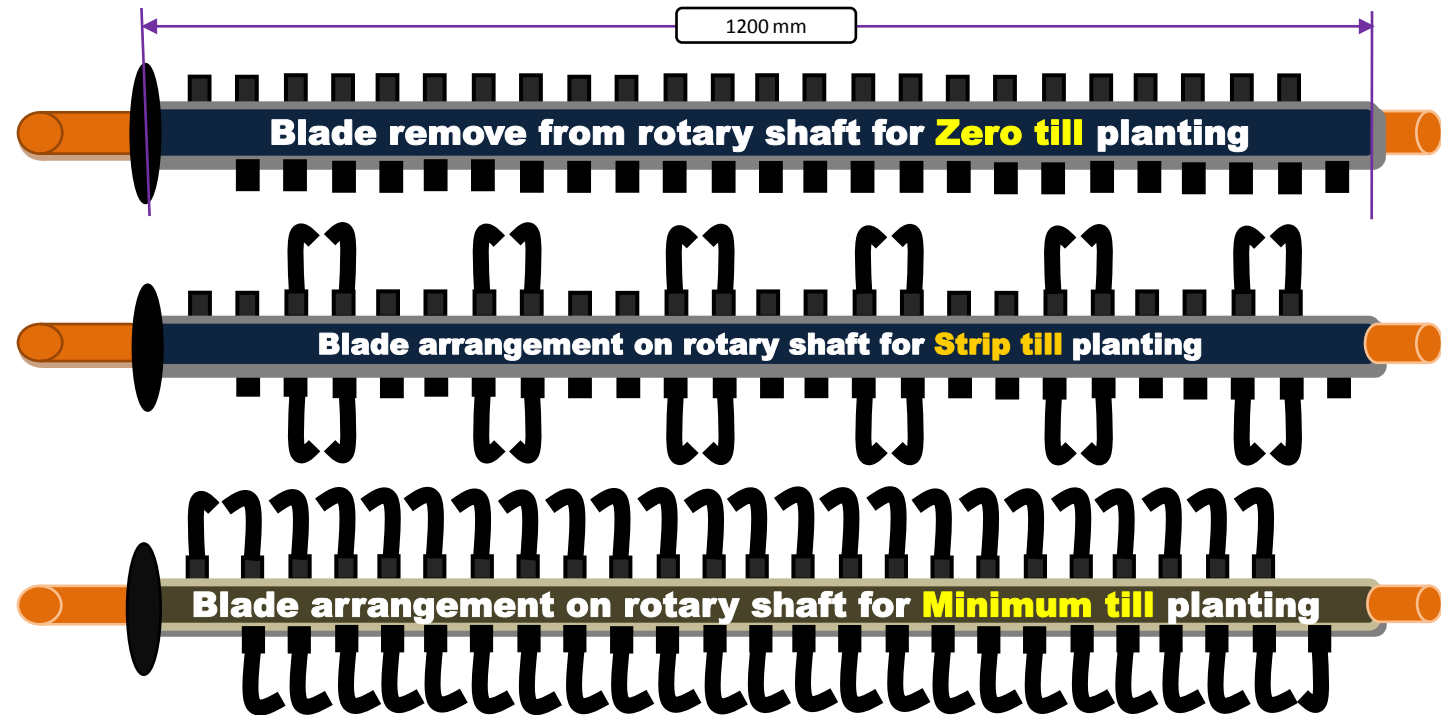
Land use	Area (ha)	Area (%)
Crop land (Paddy) (<i>Aman</i> & <i>Boro</i> , equal area)	702.37	70.71
Vegetable production	110.13	11.09
Water body (pond)	0.47	0.05
Settlement (Home & others)	180.33	18.15
Total	993.29	100.00

Based on 100% mechanical harvesting

- Number of reaper required **13** nos.
- Number of Mini-combine required **27** nos.
- Number of Combine required **7** nos.

GIS map of Kulbaria-Boratia, Dumuria, Khulna, 2019

Conservation Agriculture Seed Planter



- Three conservation tilling (zero, strip, reduced tillage) can be performed
- Tilling, seeding and covering of seed can be done simultaneously
- Suitable for multi-crop seeding i.e. wheat, maize, oilseeds, pulses, jute, sesame, etc.

Conservation Agriculture Seed Planter



Zero-till Planter

- ❖ Capacity: 0.1 ha/hr
- ❖ Field efficiency: 70%
- ❖ Cost saved: 65% over conv. planting
- ❖ Market Price: USD 470

Source: ASMIH-BD, 2019



Stripe-till Planter

- ❖ Capacity: 0.12 ha/hr
- ❖ Field capacity: 74%
- ❖ Cost saved: 50% over conv. planting
- ❖ Market Price: USD 553

Source: ASMIH-BD, 2019



Bed Planter

- ❖ Capacity: 0.12 ha/hr
- ❖ Field efficiency: 72%
- ❖ Cost saved: 53% over conv. planting
- ❖ Market Price: USD 470

Source: ASMIH-BD, 2019

Capacity Building Strategy



Capacity Building Materials Developed

- Training manuals on Transplanting, Harvesting and CA planter
- Business modules on Transplanting, Harvesting and CA planter
- Leaflets on Transplanting, Harvesting and CA planter
- Gender based technology profiles on Transplanting, Harvesting and CA planter
- Videos on Transplanting, Harvesting and CA planter in Bangla with English sub-title
 - Harvesting video: <https://www.youtube.com/watch?v=8usfOkFAdzE&t=3s>
 - Transplanting video: <https://www.youtube.com/watch?v=JbfiE1UY7iQ&t=68s>
 - Seed Planter video: <https://www.youtube.com/watch?v=Fui94AdAlzE&t=2s>

Publication	Number
Journal Publication	12
MS thesis	4
Conference abstracts/papers	23
Presentation	22
Media/Blog article	3

Capacity building	No	Participant
Long term training Completed On-going	10	4 (MS) 3 (PhD), 3 (MS) ongoing
Training and demonstration	118	2024 (M), 476 (F)
Machinery fair	3	440(M), 232(F)
Workshop/Symposium	3	291 (M), 25 (F)

Training & Business modules and Technology Profiles



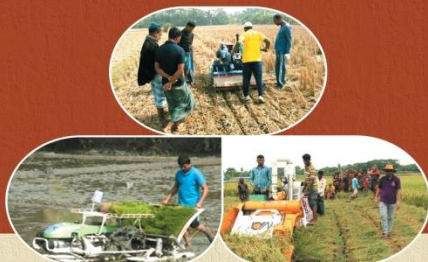
Training Manuals on Rice Transplanter, Harvester, Seed Planter and Irrigation Machinery



Appropriate Scale Mechanization Innovation Hub (ASMIH)-Bangladesh
Department of Farm Power and Machinery
Bangladesh Agricultural University
Mymensingh-2202
Bangladesh



Business Modules on Rice Transplanter, Harvester, Reaper and Seed Planter



ধানের চারা রোপণ যন্ত্রের (রাইস ট্রান্সপ্লান্টার) প্রশিক্ষণ নির্দেশিকা



রিপার ও মিনি-কম্বাইন হারভেস্টার-এর প্রশিক্ষণ নির্দেশিকা



বীজবপন ও সেচ যন্ত্রের প্রশিক্ষণ নির্দেশিকা



GENDER TECHNOLOGY ASSESSMENT Appropriate Scale Mechanization Consortium

BANGLADESH: SEED PLANTER



GENDER TECHNOLOGY ASSESSMENT Appropriate Scale Mechanization Consortium

BANGLADESH: RICE TRANSPLANTER



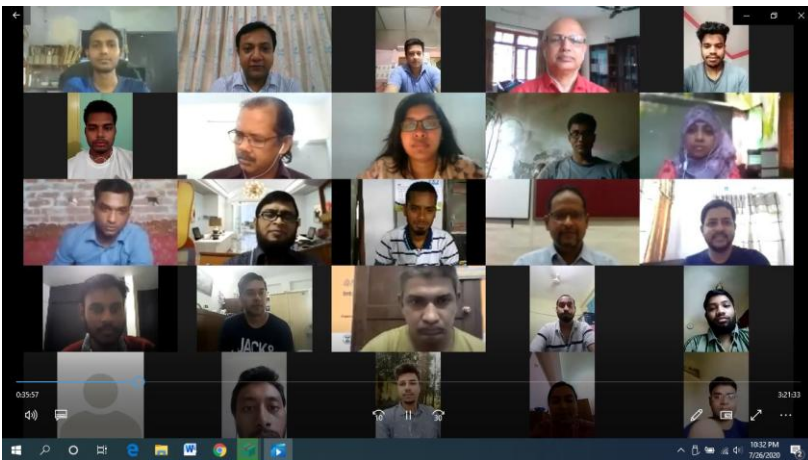
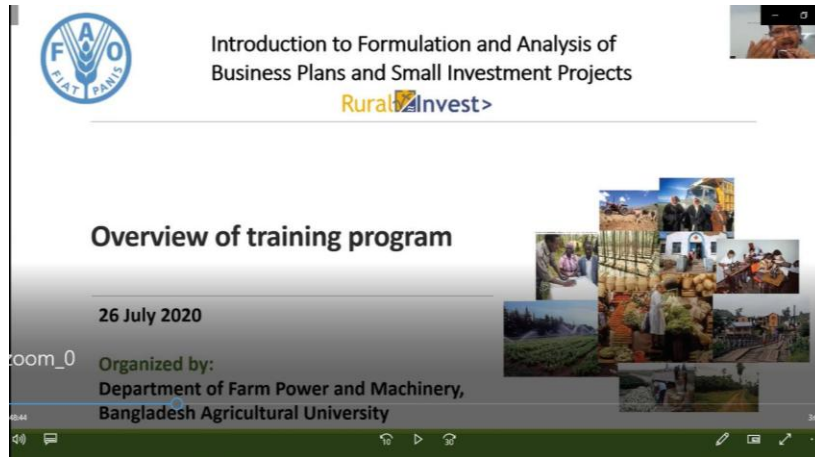
GENDER TECHNOLOGY ASSESSMENT Appropriate Scale Mechanization Consortium

BANGLADESH: HARVESTING TECHNOLOGY

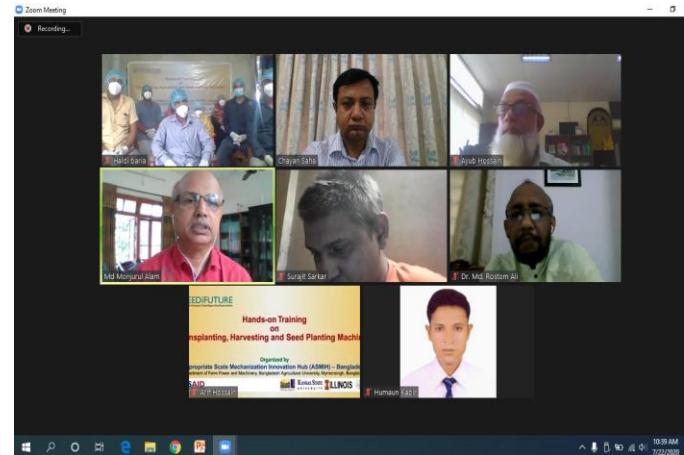
Copping with COVID-19 Pandemic



Training on RuralInvest Toolkit –July 26, 2020



Hands-on Training of Operators and Mechanics -July 2020 (Khulna, Patuakhali, Barishal)



Helping Farmers during COVID-19 Pandemic, May 2020



https://postharvestinstitute.illinois.edu/admi-pandemic-response/?fbclid=IwAR0g2JgxyUGOwChr3OR3hJgM5Tf8dUVjve4oxk4p6dw-Y_9mGSKQ6stVBIs

Ag. Engg. Course Update, July 2020



Sustainable Impact Strategy



Mapping of Collaborating Partners

Research

- Bangladesh Agricultural Research Institute (BARI)



- Implementing Conservation Agriculture research as core partner

Public Sector

- Department of Agricultural Extension (DAE)



- Collaborating in on-farm project activity implementation
- Implementing govt. subsidy program on agricultural mechanization

Private Sector

- ACI Motors Ltd. (National level machinery company, Dhaka)
- The Metal Pvt. Ltd. (Dhaka)



- Provided machines for testing and field demonstration
- Nationwide marketing of agricultural machines
- Mobilizing resources for research and development

- Mahbub Engineering (Jamalpur)



- Collaborating in Design and Modification of BAU-Reaper
- Marketing of modified engine and battery powered BAU-Reapers

Sustainable Impact Strategy



Entrepreneurship Development and Long-term Mentoring



Mizanur Rahman, Dumuria, Khulna

Transplanter

- Khulna - 2
- Barishal - 1
- Noakhali - 1
- Patuakhali - 3

Mini-combine

- Khulna - 2
- Barishal - 1

Reaper

- Khulna - 3
- Noakhali - 5
- Barishal - 4
- Patuakhali - 4

Seed planter

- Four locations - 19

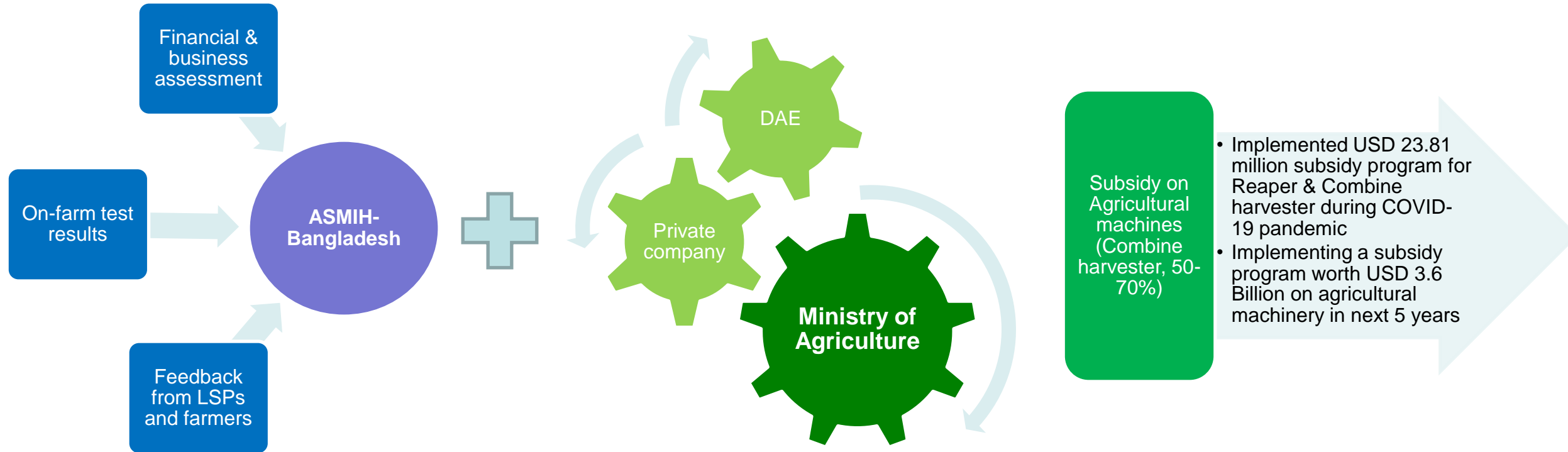


Kamal Uddin, Shubarnachar, Noakhali

Sustainable Impact Strategy



Policy Advocacy: Shifting focus from Mini-combine to Combine harvester



Urgent Policy Intervention



- Capacity building of Local Service Providers (LSPs), operators, mechanics and local workshops on operation, maintenance and business management of agricultural machinery.
- Season long mentoring of Local Service Providers of agricultural machinery.
- Introducing and strengthening agricultural mechanization diploma and courses at Poly-technique Institutes, Technical School and Colleges (TSC) and Technical Training Centers (TTC).
- Prompt and effective after-sales services to be made mandatory to the machinery marketing companies.
- Nationwide GIS mapping for identifying machine intervention and service mobilization strategies.
- Clear instruction to public and private sector commercial banks for disbursing at least 15% of agricultural credits to agricultural machinery.
- Immediate recruitment of Agricultural Engineers in the Department of Agricultural Extension (DAE) for effective and successful implementation of agricultural mechanization strategy of the government of Bangladesh.

Acknowledgement



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