

# Adoption and Adaptation of Pre & Postharvest Rice Farming Technologies: Bangladesh Experiences

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Collaborative Research on Sustainable Intensification



Post-Harvest Loss Reduction

**KANSAS STATE UNIVERSITY**



**ILLINOIS**  
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



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- **Sustainable Scaling and Impact Strategies**
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# Context of Bangladesh Agriculture



## Successes

- Bangladesh is the 4<sup>th</sup> largest rice producer, 3<sup>rd</sup> largest vegetable and inland water fish producer and 5<sup>th</sup> largest aquaculture fish producer in the world.
- Since the independence of Bangladesh, 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).
- Mentionable mechanization has been achieved in tilling, irrigation and threshing, however, planting, harvesting and conservation agriculture activities are lagging far behind.
- Postharvest loss of paddy at farm level is about 14%, amounting to around Tk 3,442 crore (ASMIH-Bangladesh, 2018; PHLIL-Bangladesh, 2021; The Daily Observer, 2020).

## Potential Solutions

- Appropriate scale mechanization in field crops production and reduction of postharvest losses would have been the potential solutions of the challenges.



## Appropriate Scale Mechanization Innovation Hub (ASMIH) - Bangladesh

### Goal

The goal of the ASMIH-Bangladesh is to assess/develop/adapt/implement/promote appropriate-scale agricultural mechanization in the Southern Delta of Bangladesh for sustainable intensification for increasing farm productivity and household income while empowering women and engaging youth.



### Scalable Technologies

- ❖ Rice Transplanter
- ❖ Two/Four-Wheel Tractor based Seed Planters
- ❖ Reaper, Combine Harvester

### Establishment

- ❖ One-stop Single Shade Service Provision (Individual/farmers' group)
- ❖ A Technology Park in collaboration with ACI Motors Ltd.
- ❖ A CA Park in collaboration with BARI
- ❖ SAIYN-Smart Agro-Technology Innovation Youth Network (4H Illinois approach)

### Planned Activities for Polder 29

- ❖ Machinery intervention in transplanting, seed planting and harvesting
- ❖ Capacity building and strengthening agro-entrepreneurship







## Post-Harvest Loss Reduction Innovation Lab (PHLIL)- Bangladesh

### Goal

The PHLIL – Bangladesh component intends to identify and adapt appropriate drying and storage technologies of paddy for farmers (men and women), farmers' groups and agribusiness entrepreneurs to reduce post-harvest loss and improve grain quality with particular emphasis on involvement of women in post-harvest loss reduction activities.



### Scalable Technologies at farmers and commercial scale

- ❖ Dryer
- ❖ Hermetic storage Technologies



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UNIVERSITY



**ADMI**

ADM Institute for  
the Prevention of  
Postharvest Loss



**ACI Motors**

# Conceptual Framework



**Baseline** – Identify promising “on-the-shelf”, “in-the-field elsewhere” and best practices Pre & Postharvest technologies

Value chain assessment using participatory approaches involving key stakeholders

**Assess** – Technical robustness, economic feasibility and end-users acceptance of identified technologies and modification if necessary

Laboratory and on-farm assessment

**Scale-up** – Selected mechanized Pre & Postharvest solutions to wider geographic regions, building capacity of stakeholders

Hands-on Training, demonstration and scaling

**Policy and Sustainability** – Policy advocacy and partnering

Policy dialogue, national workshops, symposiums, private sector partnership

# Adoption of Technologies



## Combine Harvester



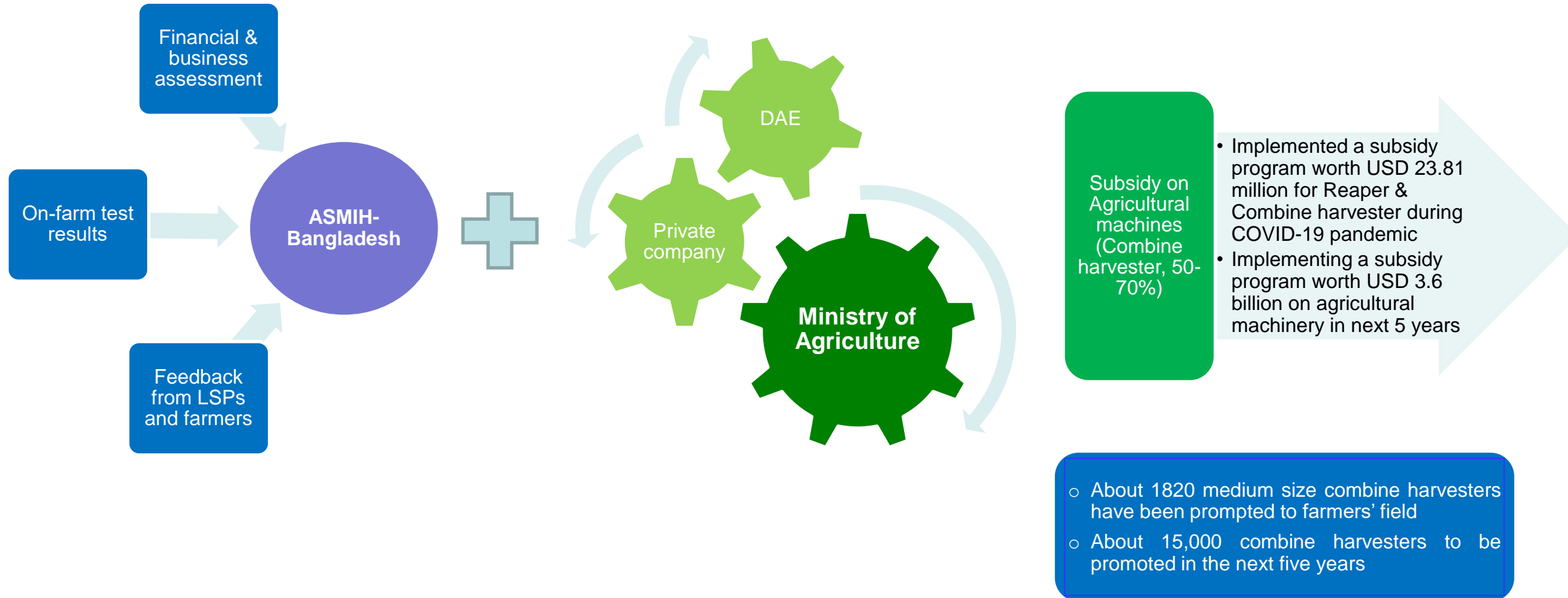
### YANMAR Combine

- ❖ 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

# Adoption of Technologies



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





# Adoption of Technologies



## Rice Transplanter



### 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

Transplanting video:

<https://www.youtube.com/watch?v=JbfiE1UY7iQ&t=68s>

## Reaper



### Reaper

- ❖ Capacity: 0.22 ha/hr
- ❖ Field efficiency: 58%
- ❖ Cost saved:  
36% over manual harvesting
- ❖ Market Price: USD 2118
- ❖ Payback period: less than a year

Harvesting video: <https://www.youtube.com/watch?v=8usfOkFAdzE&t=3s>

# Adoption of Technologies



## Storage of Paddy

### Insect infestation at storage

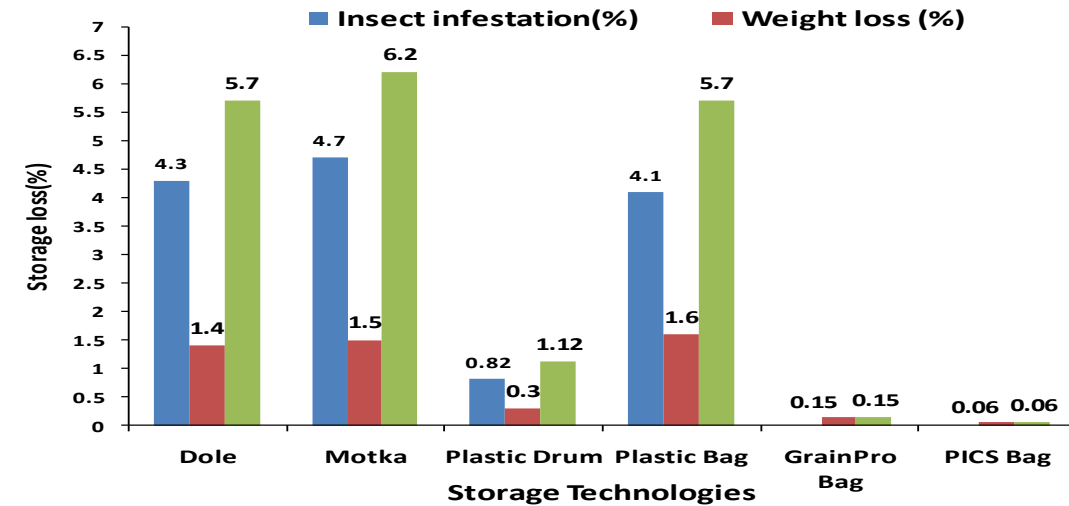
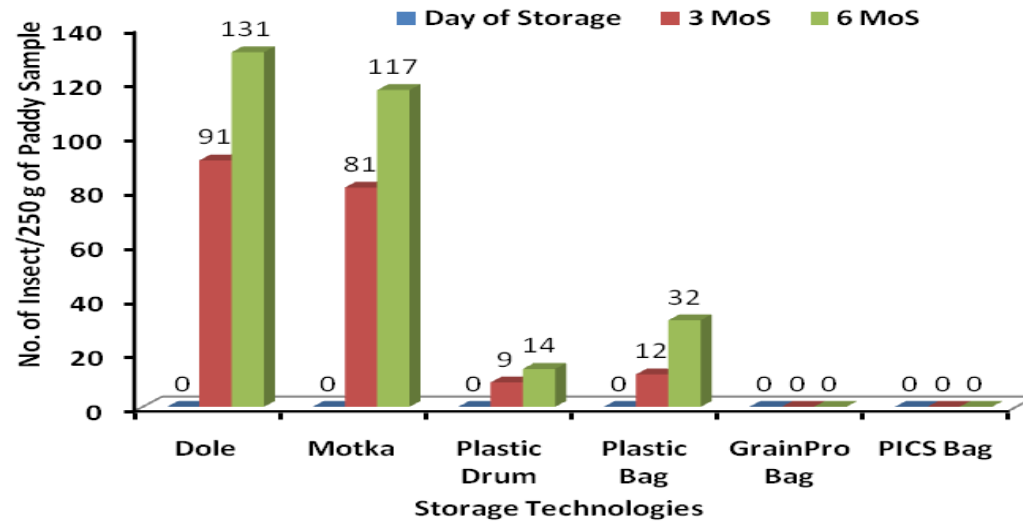
### Storage loss



GrainPro



PICS



### No. of insect infestation/250g

### Storage loss(%)



Rice moth



Lesser meal worm larvae and adult



Rice weevil

Red flour beetle

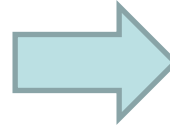
Hermetic storage bags

# Adoption of Technologies

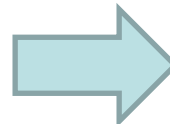


## Ongoing adoption process in 2022

Public Sector  
BADC



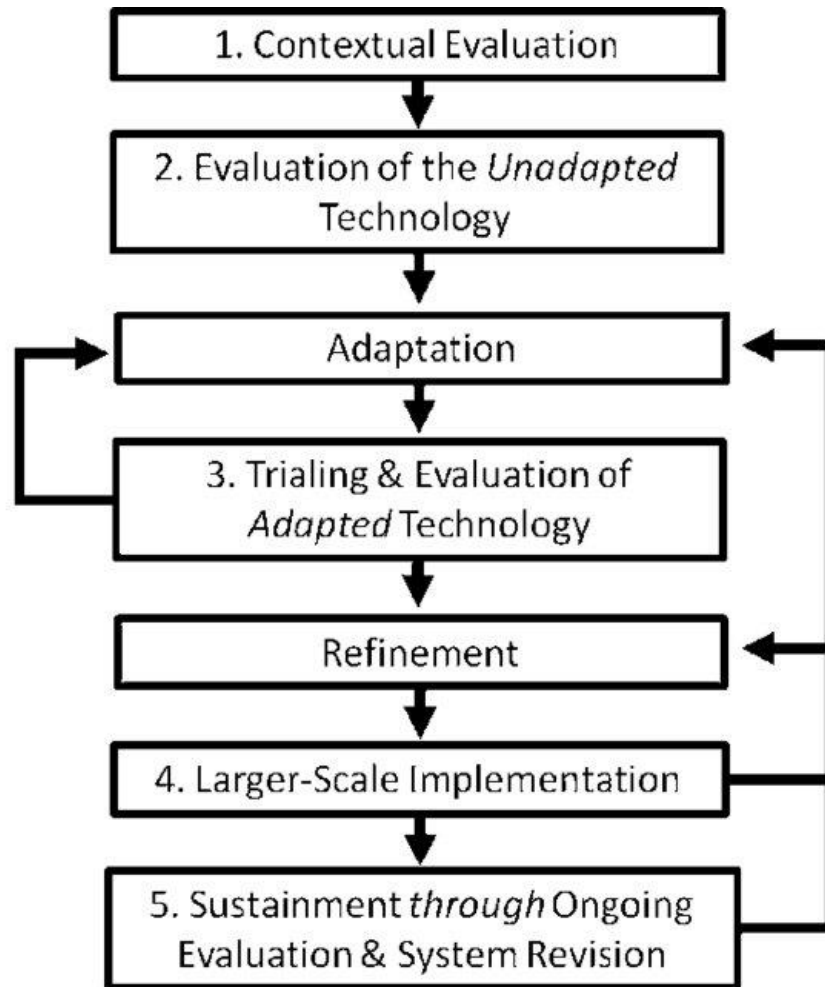
Private Sector  
Rice Mill



**Hermetic Cocoon**



# Adaptation of Technologies



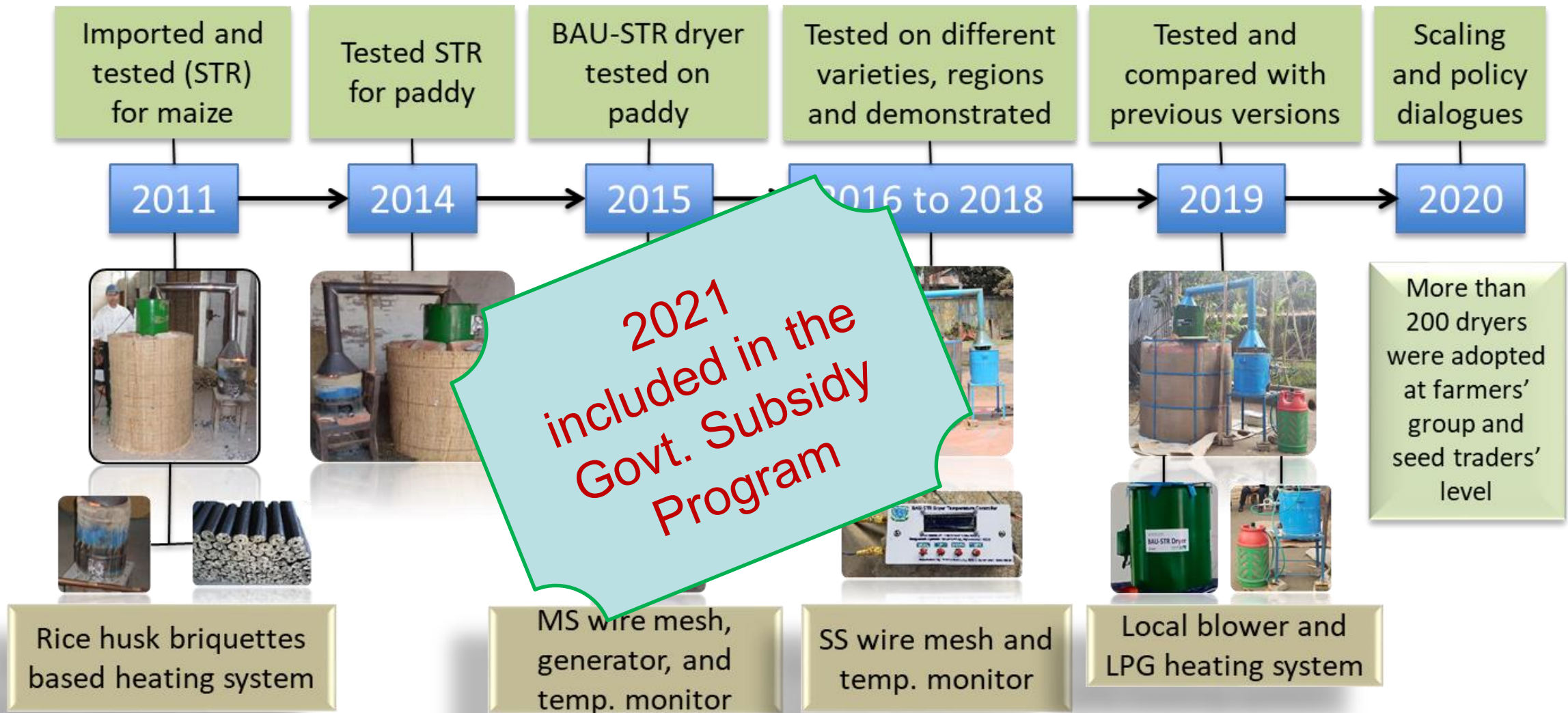
**Contextualized Technology Adaptation Process (CTAP)**  
(Source: Lyon et. al., 2015)



**BAU-STR dryer**



# Adaptation of Technologies



# Adaptation of Technologies



## Sun-drying to Mechanical drying



### BAU-STR Dryer

Capacity: 500 kg/batch

- ❖ Drying time: 4-5 hours/batch
- ❖ Heating options: LPG and Briquette
- ❖ Production Price: USD 850
- ❖ Operating cost
  - 0.93 Tk/kg (LPG based)
  - 0.78 Tk/kg (Briquette based)
  - 2 Tk/kg (Sun drying)
- ❖ Payback period: < 1 year
- ❖ Loss save: about 2% over sun-drying

Source: PHLIL-BD, 2019

SAWBO Videos : <https://www.youtube.com/watch?v=IUt0Ciyd77o> (Bangla)

<https://www.youtube.com/watch?v=4XI5gh-sLo4&t=129s> (English)

<https://www.youtube.com/watch?v=EeJGLEWcd2U&t=34s> (Spanish)

PHLIL-Bangladesh Video : <https://www.youtube.com/watch?v=dCG7CrTILWU> (Bangla with English subtitle)



# Adaptation of Technologies



## CA Machines



### 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



### Strip-till Planter

- ❖ Capacity: 0.12 ha/hr
- ❖ Field efficiency: 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



# Adaptation of Technologies



## Ongoing adaptation process in 2022

**BARI-BAU through ASMIH-Bangladesh Phase II**



**4W Tractor Seeder**

**BAU-Moti Auto Rice Mill through PHLIL-Bangladesh**



**Recirculating dryer both for aromatic and parboiled paddy**



# Sustainable scaling and Impact Strategies



## Technology Park

**Technology Park** at Phulpur, Mymensingh is the collaborative efforts of ASMIH-Bangladesh, ACI Motors Ltd, and Entrepreneur Mr. Nazrul Islam where farmers, students, researchers and policy makers can learn about the appropriate technologies, get the trainings. and lesson about technological practices and benefits from the farmers.



Nazrul Islam with his Yanmar rice transplanter



Nazrul Islam with ASMIH-Bangladesh Team



Hands-on training on Reaper

# Sustainable scaling and Impact Strategies



## Single Shade Service Provision

**Mr. Martin Boiragi**, a service provider at Kolapara of Patuakhali district has purchased a Yanmar Combine harvester from the government subsidy program. He provides one-stop single shade custom-hire service to farmers.

ASMIH-Bangladesh project is providing hands-on training and season long mentoring to service providers.



Hand over of Combine harvester



Single-Shade Service Point



Hands-on training on Reaper



# Sustainable scaling and Impact Strategies



## Conservation Agriculture Park

- Area: 0.8 ha
- A submersible solar pump with 4020 Wp solar panel
- A field lab and visitors' corner
- Buried pipe irrigation system

### Management

- Tillage and residue effect on crop productivity, soil health and profitability in maize-cover crop-rice and mungbean-cover crop-rice cropping patterns
- Unpuddled rice planting for improving soil health and profitability in long term rice-rice-rice cropping pattern (with rice residue management).



Location: BARI Campus, Gazipur  
(23°59'05.0"N 90°24'50.9"E)



# Sustainable scaling and Impact Strategies



## CA Machinery Website

[www.camachinery.org](http://www.camachinery.org)

CA Machinery Bangladesh Mac x

https://www.camachinery.org

Vision & Mission CA Management CA Forum CA Park Machinery Service Research English

Notice Board Advance operators training on CA machinery at Dumura, Khulna on 16 August 2021

Our Recent Activities

Advance training for the operators

Field Day at CA Park

Field Day at Khulna

9:45 PM 11/13/2021

### Application Form

- CA Researcher Forum  
Apply Now
- CA Manufacturer Forum  
Apply Now
- CA User Forum  
Apply Now
- CA Club  
Apply Now
- CA LSP Forum  
Apply Now
- CA Mechanics Forum  
Apply Now

### Join Our Facebook Group



### Like Our Facebook Page



This web-based platform offers information on:

- CA machinery (make, model, price, dealer, marketing company etc.)
- LSPs, operators, mechanics, spare parts etc.
- Engagement to different CA forums.

CA Machinery Bangladesh Mac x

https://www.camachinery.org

Category of Agricultural Machinery

Seeder

Bed Planter

Axial Flow Pump

Combine Harvester

9:47 PM 11/13/2021

CA Machinery Bangladesh Mac x

https://www.camachinery.org

FEED:FUTURE USAID ILLINOIS KANSAS STATE UNIVERSITY

Important Link

Research

Communication

9:48 PM 11/13/2021



# Sustainable scaling and Impact Strategies



## Smart Agro-Technology Innovation Youth Network

S

Smart

A

Agro-Technology

I

Innovation

Y

Youth

N

Network

This network is a knowledge-based learning platform for teenagers and youths where they can explore and boost their interests on smart- and innovative agro-technologies.

*"In collaboration with 4H Illinois"*

- ❖ Bangladesh Agricultural University
- ❖ Hajee Mohammad Danesh Science & Technology University
- ❖ Sylhet Agricultural University
- ❖ Bangabandhu Sheikh Mujibar Rahman Agricultural University
- ❖ Sher-e-Bangla Agricultural University
- ❖ Islamic University of Technology
- ❖ Khulna Agricultural University
- ❖ Jashore University of Science and Technology
- ❖ Young Entrepreneurs

SAIYN has been launched on August 26, 2021

Launching Ceremony in Youtube

[https://www.youtube.com/watch?v=zgmupQu\\_PsU](https://www.youtube.com/watch?v=zgmupQu_PsU)

# Sustainable scaling and Impact Strategies



Facebook page: <https://www.facebook.com/smartagrotechidea>

Website: <https://image.bau.edu.bd/pages/view/NDI=>

**Manage Page**

SAIYN - Smart Agro-Technology Innovation Youth Network

**Business Suite**

- Inbox (4 new comments)
- Planner
- Publishing Tools
- News Feed
- Business Apps

**Home**

**News Feed** (8 new)

**Podcasts**

**Notifications** (6 new)

**Insights**

**Promote**

**SAIYN** - Smart Agro-Technology Innovation Youth Network

@smartagrotechidea · Youth Organization

**Home** Groups Events Videos More

**Promote** Search

Access all your business tools in one place. Create and schedule posts, manage your Inbox, view insights and more in Facebook Business Suite. [Go to Business Suite](#)

**Create Ad** See all

How would you like to grow your business?

**Create post**

- Photo/video
- Get WhatsApp messages

Video will be uploaded via IMAGE YouTube channel

[https://www.youtube.com/channel/UC8JrorjUn0tY56fsvR\\_BUgA](https://www.youtube.com/channel/UC8JrorjUn0tY56fsvR_BUgA)

# Sustainable scaling and Impact Strategies



## Youth Entrepreneur



Khan Md. Sajjatul Nur Niloy  
18 Years old



Sopnonir Agro BD



# Sustainable scaling and Impact Strategies



## Women Entrepreneur



**Khudeza Begum**  
Phulpur, Mymensingh

*--She becomes a model entrepreneur for providing dryer and seed storage services to neighbors*



# US Ambassador's Visit



The ADM Institute for the Prevention of Postharvest Loss

April 25 · 🌐

Ambassador Earl Miller, U.S. Embassy-Dhaka, learned about the development and success of the BAU-STR dryer this week. On Wednesday, the ambassador visited Bhai Bhai Engineering Workshop, one of the collaborating manufacturers of the dryer developed by the Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss-Bangladesh group. Monjurul Alam and Chayan Saha of Bangladesh Agricultural University were on hand to talk about the project. Miller praised the unique example of collaboration between USAID, public and private sectors, and BAU. Miller said he hopes to see further collaboration between the U.S. and Bangladesh in the agricultural sector. Thanks to our collaborating partners for doing great work!



🏠 ফোকাস   📖 শিক্ষা ও গবেষণা   🌱 কৃষি   📰 প্রাথমিক খবর   🗓️ মাস   🗳️ অর্থনীতি   🏠 নতুন প্রকল্প   📊 পরিবেশ ও স্বাস্থ্য   🗳️ দুই ও বাহ্যিক বাস্তু

US Ambassador R. Miller Visited BAU- STR Dryer at Shamgonj Bazar in Netrakona

🕒 প্রকাশিত: ১.৫০ অপরাহ্ন | এপ্রিল ২৫, ২০১৯



April 24, 2019

# Recommendations



- Appropriate scale machines and technologies to be made available through innovation, adaptation or adoption.
- Sustainable long term capacity building of LSPs, mechanics, operators and local workshops on operation, maintenance and business management to be ensured through formal and non-formal education, training and extension organizations.
- Development incentives to be continued for a certain period to single shade service providers, farmers' groups and small service companies.
- After-sales service and spare parts availability to be ensured in cropping seasons and in the farming locality.
- Enable environment for engaging women and youths in mechanized and smart agriculture.
- Climate smart technologies like conservation and precision agriculture technologies to be promoted to sustain natural and physical resources and agricultural eco-system.
- Credit from public and commercial banks to be ensured to agricultural machinery value chain actors (service providers, local machinery producers, marketing companies etc.) for sustaining investment in agriculture.



# Acknowledgement



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Website Link: <https://image.bau.edu.bd/>





Bangladesh Agricultural University

## Innovation in Mechanized Agriculture and Green Energy



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Lab Facilities

Publications

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