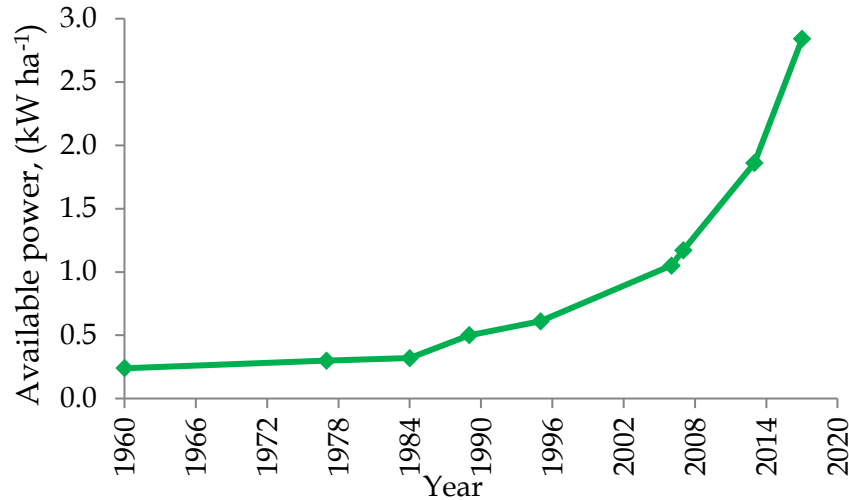


## Research and Development of Combine Harvester under Public Private Partnership Approach-An Experience Sharing



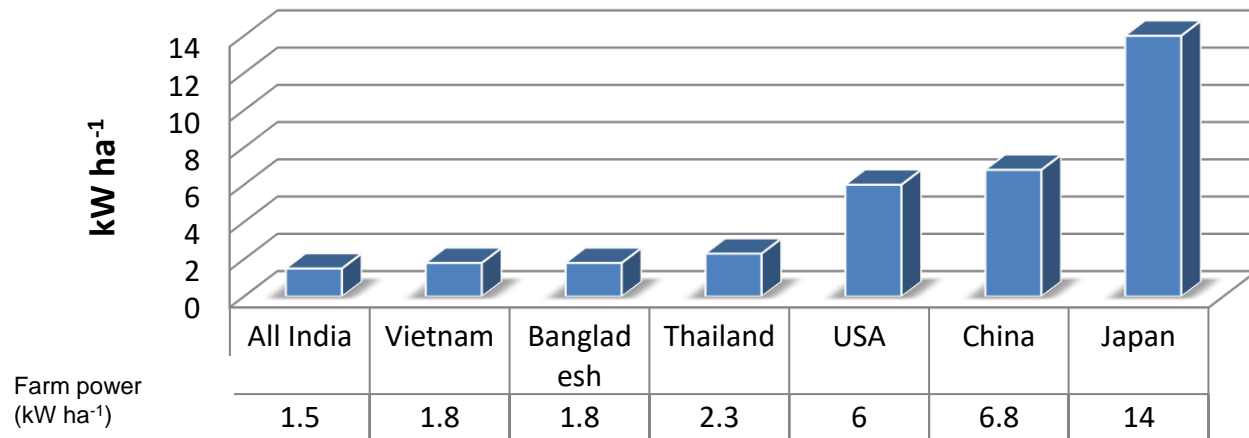
**Bangladesh Rice Research Institute**

# Farm Power Availability



- 1960-1984, Farm power increase 1.2%.
- After 2008, Farm power sharply increased to 10%

## Total Farm power in different countries



# Research and development



Seed sower



Transplanter



Seeder



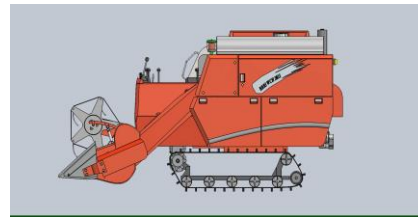
Fertilizer Applicator



Weeder



Reaper



Combine Harvester



Thresher



Winnower



Dryer



# Comparative analysis

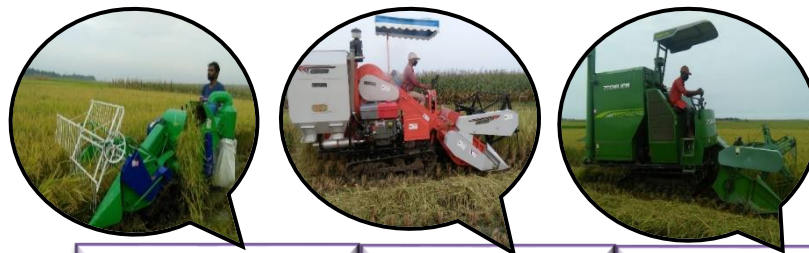


	Mini Combine Harvester	Saifang	Zoomlion	
Model	4LZ-0.6	4LZ-1.5	4LZT-4.0ZD	
Price, Tk	5 lakhs	10 lakhs	22 lakhs	
Engine type	Single cylinder	Single cylinder	Four-cylinder	
Engine power, kW	6.6kW	24kW	65kW	
Normal-sized track load	Yes	Yes	No	
Rubber track (Crawler)	255×80×30	320×90×40	500×90×53	
Ground pressure, kN/m <sup>2</sup>	5	20	24	
Cutting width, mm	1000	1500	2000	
Forward speed, km/h	0.63-0.90	1.40-1.90	1.23-3.20	

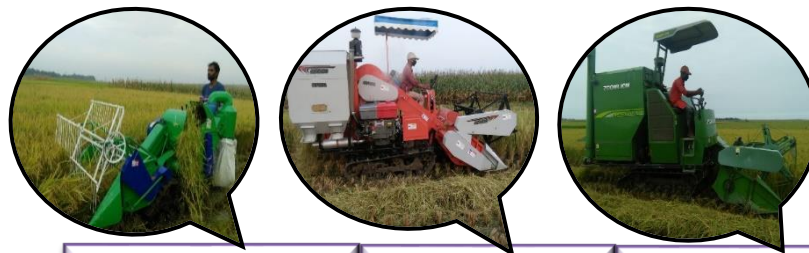


Model	Mini Combine Harvester	Saifang 4LZ-1.5	Zoomlion 4LZT-4.0ZD
Fuel consumption, L/hr	0.8-1.2	2.04	4.8
Total harvesting loss, %	1.12-1.40 %	2.13%	1.60-1.91%
Minimum suitable Plot area, m <sup>2</sup>	400	500	800
Harvesting capacity, bigha/hr	0.20-0.35	0.65-1.00	2.00-4.00





	Mini Combine Harvester	Saifang	Zoomlion	
Model		4LZ-1.5	4LZT-4.0ZD	
Machine status	<ul style="list-style-type: none"> <li>• Overfeeding clogged the conveying unit</li> <li>• The gear mechanism is not the operator's friendly</li> </ul>	<ul style="list-style-type: none"> <li>• Overfeeding clogged the conveying unit</li> <li>• The gear mechanism is not the operator's friendly.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to overcome the clogging</li> <li>• Gear changing mechanism is operator's friendly</li> </ul>	
Parts failure frequency	Frequently	More	Occasionally	



	Mini Combine Harvester	Saifang 4LZ-1.5	Zoomlion 4LZT-4.0ZD	
Model				
Operator's comment	<ul style="list-style-type: none"> <li>High vibration and noise</li> <li>Faced no difficulty with transferring machine.</li> </ul>	<ul style="list-style-type: none"> <li>Over high speed makes too much vibration on the front</li> </ul>	<ul style="list-style-type: none"> <li>Operators' felt comfort</li> <li>Problem in uplifting on higher ground due to larger size.</li> </ul>	
Farmer's comment	Harvesting capacity-low	Harvesting capacity-low	Harvesting capacity-high	
Overall comments	Harvester in small sizes of lands where bigger sizes are inaccessible. <b>Not business viable</b>	Farmers showed satisfaction <b>Not business viable</b>	Farmers showed satisfaction <b>Business viable</b>	

# Background

- There are **several types of combine harvesters available at the field levels which** are imported from China, Japan, Korea, and other countries of the world.
- The adoption of the combine harvester depends on the factors like size of the land, types of the crops and the purchasing power of the user.
- Considered of engine power, ground pressure, cutting width, harvesting capacity, harvesting loss, plot area and land condition, ease of operation, plot size, land condition, and business viability of the imported combine harvester



- A prototype of full feed combine harvester was fabricated in the FMPHT divisional research workshop and Janata Engineering Workshop, Chuadanga with the help of other local agricultural machinery manufacturers.

- The prototype was fabricated using locally available raw materials except crawler, gear box and engine.
- Rubber track/crawler and engine were imported from China with the help of local agricultural machinery importer.
- Gear box was modified some modification.

# Design Consideration

- Locally available raw materials should be used to minimize the fabrication cost
- Easy to repair and maintenance using local spare parts
- It should have single delivery chute to avoid grain crack or regular troubles
- Overall dimension of the machine should be less than 2000 mm to transport from one place to another

- Delivery unit without cutting blade
- Grain tank with minimum half ton capacity
- Ground clearance greater than 300mm
- Traction load less than 24 kN per square meter
- Four cylinder engine to avoid excessive vibration and noise
- Weight of the harvester is about 3000 kg
- Traction area more than 1376 square meter
- Power transmission should be mechanical with HST
- Harvesting capacity minimum 1 acre with minimum loss (1%).

January 2021



Base Frame

February 2021



Engine cover

March 2021



Vibration test

April 2021



Threshing drum

May 2021



Conveyer box



Threshing unit

# The colors used (Duco paint)

- Kangaroo Paprika (Code No. 9523)
- Kangaroo of White (Code No. 9600)
- Marine color
- Nahar's black
- Nahar's white
- Nahar's surface
- Nahar's yellow











# Contribution

Serial No.	Manufacturer's name	Services
1	Janata Engineering Workshop, Sarojganj, Chuadanga	The spline gear of the shaft of the recycle threshing augur, the main gearbox is cut. Straw conveying box, dashboard, threshing, sieve  All types of fabrication are done
2	Alim Industries Ltd., Sylhet	Engine, gear, box, all types of wheels, threshing agar, grain discharge agar, hydraulic valve, hydraulic cylinder, and hydraulic cable.  Electrical device board, grain tank, reel, stock separator
3	Alam Engineering Workshop, Wari, Dhaka	Fuel tank, all types of V&C pulleys, sprockets, chains, all types of B&C belts, bevel gear, MS welding material. Bevel gear of threshing sub gearbox.
4	The Metal Industries Ltd., Jirani, Savar	Crawler
5	Ekata Iron, Majampur, Kushtia	All kinds of cutting and folding
6	Monno Agro and General Machinery Ltd., Dhamrai, Manikganj	MS Material Tempering

Serial No.	Manufacturer's name	Services
7	Bismillah Workshop, Majampur, Kushtia.	Crawler guard
8	Pavel Iron Traders, Dholai Khal, Dhaka.	All types of MS shafts, plates, pipes, and square boxes.
9	Messrs. Jahanara Steel, English Road, Dhaka.	All types of MS, GI, and SS seats.
10	Nahar Enterprise, Nawabpur, Dhaka.	All kinds of machine tools, lathe tools and milling machine tools.
11	Babul Enterprise, Chuadanga Sadar, Chuadanga.	All kinds of colors

# Specification of BRRI Whole Feed Combine Harvester (Especially for haor areas)

Sl no.	Name	Parameter
1	Name	Whole feed combine harvester
2	Model	BRRI WCH2021
3	Dimension, mm (L*W*H)	5200*1800*2600
4	Threshing drum (L, $\Phi$ )	2000mm, $\Phi$ 620
5	Cutting width, mm	1500
6	Engine power, hp	87 (85-90)
7	Rubber track (Crawler)	400*90*51
8	Fuel tank, L	60
9	Grain tank, kg	600
10	Power transmission	Mechanical + HST
11	Total weight, kg	3000
12	Ground clearance, mm	300
13	Traction load, kN/m <sup>2</sup>	20.7
14	Traction Area, m <sup>2</sup>	1.376 for two crawler
15	Sensor indicator	Grain tank, fuel tank, straw delivery
16	Harvesting capacity, bigha	3-4
17	Forward speed, km/h	3-4
18	Fuel consumption, L/hr	3.5-4
19	Unthreshed grain, %	Less than 1%
20	Total harvesting loss, %	Less than 1%
21	Price, Tk	12-13 lakh



# Commercialization

- Need assembly line
- Well equipped workshop
- Modern workshop machines
- Initially ensure the market

# Conclusion

- It is quite possible to design, development and manufacture whole feed combine harvester aimed at solving farmers' problem of harvesting and transportation in Bangladesh.
- It has been fabricated considering the small and muddy lands of the farmers.
- All attempts were taken to ensure the cost of production was significantly reduced and the combine harvester is readily accessible to small scale traders and farmers of the country.

- It is more efficient to harvest paddy from fragmented farmland in Bangladesh and has comparative advantage over imported combine harvester.
- The combine harvester developed by BRRI would be able to meet the domestic demand for agricultural machinery, reduce import dependence and export it abroad with more policy support and financial support from the government.
- It would be a tremendous success in Bangladesh to fabricate the machine using the capabilities of local agricultural machinery manufacturers and the design and technology of BRRI scientists.

Thank you