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Financial and Economic Analyses of Integrated Rice Processing Technology in an Agrarian Community in Mymensingh District

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Abstract

This study surveyed 100 farmers of Fulbaria upazila of Mymensingh district from four groups namely; Traditional farm-30, Semi-modern-I: farm-30, Semi-modern-II: farm-30, and Modern farm-10 for paddy processing system. Moreover, data on 30-power thresher, one STR-1 dryer and one mechanical reaper operation were investigated to fulfill the objectives of the study. The survey was conducted during January to June 2005 and January to June, 2006 covering two subsequent management both aman and boro season. Partial budgeting technique was applied to estimate the economic benefit to the users and project appraisal technique was adopted to conclude the performance of the three types of devices in terms BCR, NPV and IRR. Two third of the user and owners were 31-57 years of old and 40% of the owner and users had secondary level of education. Eighty percent of the owners were engaged primarily in agriculture and 50% of them occupied in off-farm employment. Semi-modern farms had the large farms compare to traditional farm. About 75% income of the users came from agricultural source while it was 36% for the power thresher owners. A significant portion of the income of owners came from off-farm activities. A net change of rice income Taka 4250 per hectare was observed due to introduction of mechanical reaper for harvesting paddy. The users those who used all the processing technologies earned an additional Taka 8200 per hectare. Those who were already used the power thresher but undertaken mechanical dryer earned an amount of Taka 1889 per hectare. Even those who were already used the power thresher but undertaken mechanical reaper earned an amount of Taka 2520 per hectare. The cost of harvesting, threshing and drying per quintal were respectively Taka 8.89, Taka 23.25 and Taka 35.24. It was observed that NPV of the power thresher and reaper in existing condition were Taka 42441 and 3006 while the mechanical dryer (Taka -1503) indicating the loss of the investment. The average IRR of power thresher and reaper was 89% and 48% while the IRR of mechanical dryer is negative (-2). In view of these circumstances, the financial analysis showed that power thresher and mechanical dryer was highly profitable from the viewpoint of individual investors. A series of problems were identified and suggested for policy guidelines.

Keywords: *Financial and economic analyses, net income change income, partial budgeting, internal return rate return.*

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Introduction

Bangladesh is in the doorstep of attaining food self-sufficiency in the cereal sector, but there is a threat from significant post harvest loss, which accounts about 30% (Akteruzzaman, 2003). Farmers of Bangladesh have given more emphasis on *boro* rice cultivation. The *boro* harvesting time starts from end of April and continues up-to June.

During this time, rainfall occur causing problems in drying of rice. Because of insufficient drying, rice grains are broken during husking in rice huller and if stored, pest infestation occurred reducing the quality of grains and thereby affecting market value (Parvin, 2003). Figure 1 demonstrates how the rice processing technologies help for increasing income to the farmers.

In addition, shortage of drying and threshing space in the homestead has caused insufficient drying of grain and post harvest loss, and invited accidents due to drying and threshing on the road (Pinar, 1987). The main researchable issue, therefore, are insufficient drying, sunshine drying and traditional threshing induced post harvest loss of grains and degrade the quality of rice. Thus the present study is undertaken to estimate the economic return and profitability of investment on power thresher, reaper and dryer in post harvest rice processing of the resource poor farmers and suggests for policy guidelines.

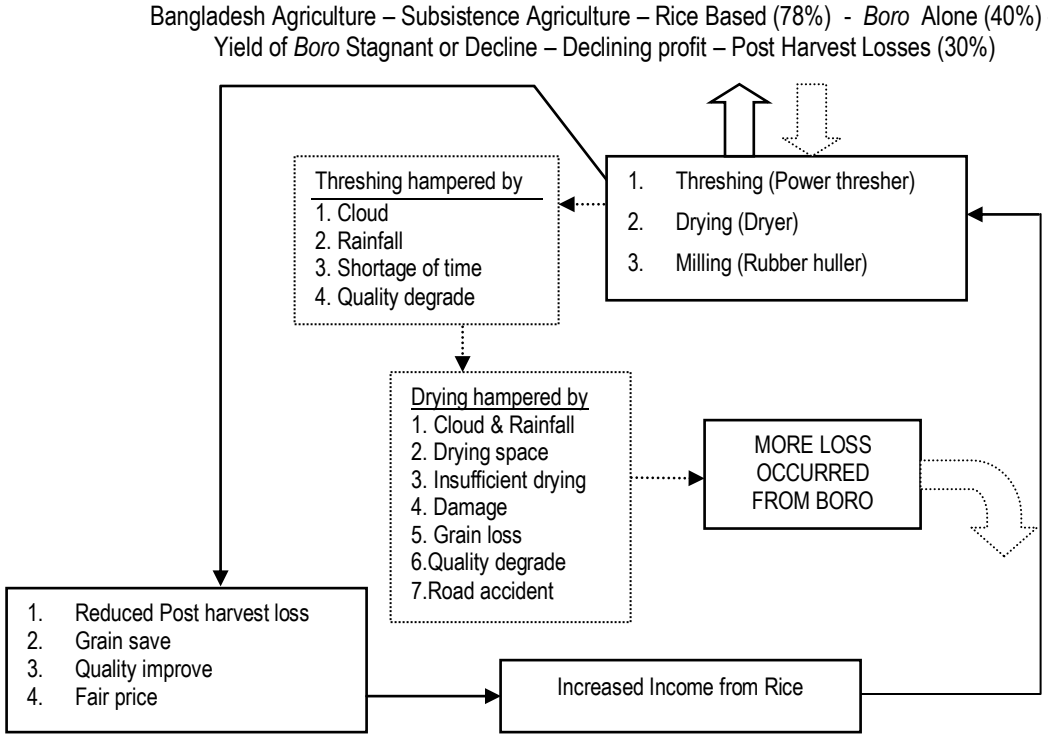

Figure 1. Flow diagram of improved livelihood of the rice farmer (RDRS-REFPI/DFID, 2001)

Methodology

To achieve the objectives, the study has been jointly collaborated with local NGO (ASA). One group members of ASA was selected for this study, where one closed drum power thresher had already been established by the informal group of ASA at Mowati village of Bawoshi union under Barhatra thana of Netrokona district. One STR-1 Dryer distributed free of cost from (Bangladesh Agricultural University Research System) BAURES project on May 2003. The group appointed the operator for operation of the machine. Moisture meter and the necessary spare parts were supplied from the project free of cost (Table 1). The operators worked under close supervision of the project research assistant. The group also shared all the operating cost and charged a fixed amount of rent per unit of output from the user, which was prior, approved from their parent NGO, ASA. The group maintained proper records of accounts of power thresher and dryers on daily basis and corresponding income and expenses.

Table1. Purchase cost and capacity of power thresher, reaper and dryer used in the study area

Specification	Unit	Self-propelled reaper	Closed drum power thresher	STR-1 dryer
Capacity: Per batch	Quintal	-	-	4
Per day	hectare	3	3	2
Harvesting/Threshing/Drying time/batch/ day	Hour	8	8	5
Fuel used	-	Diesel	Diesel	Wood
Fan operated	-	Diesel	Diesel	Electricity
Sample household	No.	10	30	10
Purchase cost	Taka	42,000	25,000	7,000

A total of 30 people including the selected operator and other 10 members of that group of ASA were trained and demonstrated on the operation and management of these devices by the (Bangladesh Agricultural University) BAU and (Rangpur Dinajpur Rural Services) RDRS experts. From the demonstration, the opinion survey was conducted on the performance of the dryer machine in different aspects. To estimate the economic return from the power thresher, mechanical reaper as well as dryer machine, socio-economic information were collected through survey method. A questionnaire was developed and used for collecting data including market price of rice grain. A total of 100 farmers were interviewed (Table 2) covering the three groups namely; those who did not use at all any machineries (Traditional farm -30), those who used both power thresher and reaper (Semi-modern farm I- 30), those who used power thresher and dryer (Semi-modern farm II- 30) and those did use all the machineries (Modern farm-10) for paddy processing system.

Moreover, the technical and physical information, operating costs and returns gained by the 30-power thresher owner, one STR-1 dryer and one self-propelled reaper were investigated. The data collection was conducted during the April to June 2006. The collected data were analyzed to fulfill the objectives of the study. In addition to tabular form of analysis, partial budgeting technique was applied to estimate the economic benefit to the users. The financial analysis was adopted to conclude the performance of the two types of devices in terms of B/C ratio, net present value and internal rate of return (IRR).

Table 2. Distribution of selected households by farm size in the study areas

Type of farm	No. of farm studied						
	Power thresher			Farmer			
	Old	New	Total	Small (Below 1 hectare)	Medium (1.01- 3.00 hectare)	Large (Above 3.00 hectare)	All
Modern*	2 (20.00)	8 (80.00)	10 (100)	4 (40.00)	4 (40.00)	2 (20.00)	10 (100)
Semi-modern I	5 (16.67)	25 (83.33)	30 (100)	6 (60.00)	3 30.00)	1 (10.00)	10 (100)
Semi-modern II	-	-	-	4 (33.33)	6 (50.00)	2 (16.67)	12 (100)
Traditionl	-	-	-	22 (73.33)	6 (20.00)	2 (6.67)	30 (100)
All	5 (16.67)	25 (83.33)	30 (100)	36 (58.06)	19 (30.65)	7 (11.29)	62 (100)

Notes: (-) not applicable.
Figure in the parentheses indicate the average farm size of the respective farm.
** The modern farms also come-out from the semi-modern group.*

Findings and Discussion

Socioeconomic profile of the owners and users of power thresher and dryer

There were not large differences of age, educational level and farm sizes between owners and users of the post-harvest technology practices for threshing and drying but difference was found in case of employment status, income, and income sources. Two third of the user and owners were 31-57 years of old and 40% of the owner and users had secondary level of education (Table 3). Eighty percent of the owners were engaged primarily in agriculture and 50% of them occupied in off-farm employment while about 90% of the users occupied primarily in agriculture. There were no variation of land area between owner and users but varied among the types of farm of which semi-modern and modern farm posses the large farms compare to traditional types of farm. About 75% of the income of the users came from agricultural source while about 30% of the owners from power threshers. A significant portion of the income of the owners came out from off-farm employment such as rental out of the thresher machine.

Table 3. Socioeconomic profile of the selected owners and users of the rice processing devices in the study area

Parameters	Modern	Semi-modern I	Semi-modern II	Traditional
Age between 31-57 years old (%)	60	56	62	58
Literacy level above primary education (%)	53	48	50	47
Occupied primary in agriculture (%)	80	78	90	85
Land under cultivation (ha)	0.73	0.85	0.76	0.62
Land area below 1 hectare (%)	43	48	43	43
Average annual income (Taka)	184,412	125,045	103,299	112,254
Income from agriculture (%)	52.85	71.50	74.87	69.96

Benefit to the power thresher and dryer user: a partial budgeting approach

The Bangladesh economy is mainly based on rice production and the diffusion of modern rice technology especially *boro* production is becoming popular throughout the country. The *boro* paddy is harvested during the rainy weather condition and threshing and drying become an acute problem to the farmers. The timeliness and prices of *boro* paddy affect on the profitability of rice income to the farmers. The power harvester, thresher and dryer are the tools for timeliness process of *boro* paddy, which can positively changes the profitability in rice farming. The partial budgeting analysis was done to calculate the net changes of profitability of rice farming.

Evidence showed that 58% of their threshed paddy in the *boro* season while 42% was found at the *aman* season. The owners of the power thresher received on an average of 3.33% of the threshed paddy in both season. The farmers opined that they received more than 5% of their threshed paddy compare to traditional threshing in *boro* season while more than 3% in case of *aman* season. The farmers also mentioned that there were reductions of grain loss occurred due to using mechanical devices for threshing of paddy. Thus, they could increases rice income by using the mechanical thresher as well as mechanical dryer. The price of *boro* paddy was found 4% higher in the sunny day compare to rainy day. The farmers can receive this incremental price by quick threshing of paddy.

Moreover, the price of paddy at traditional threshing was Taka 675 while it was Taka 730 when mechanically threshed. The higher price of the mechanically threshed paddy was observed due to its cleanness and brightness. The same thing was happened when the paddy had been dried and harvested by mechanically. It was also found that the price of paddy with sun or natural drying was Taka 585 per quintal and found Taka 670 when dried mechanically. On an average more than 6% of the incremental price would be earned by the farmers due to its quality improvement in addition to reduction of grain loss which was accounted about 2%.

It has been observed that the farmers are benefited in all aspects of introduction of the devices for threshing, harvesting and drying of paddy. The level of adoption of the mechanical technologies positively related with the net change of rice income. It has been found that when both mechanical thresher and dryer (traditional to modern) used the net change of rice income (Table 4) was the highest (Taka 8200) followed by traditional to semi-modern-I processing (Table 5) activities (Taka 4250) and traditional to semi-modern-II processing (Table 6) system (Taka 1889).

Table 4. Partial budgeting for traditional farming to Modern farming in rice processing system

Debit	Taka/ hectare	Credit	Taka/ hectare
1. Cost incurred for use Reaper, Thresher and Dryer For using mechanical reaper + thresher • Boro paddy Tk. 1303+900 = 2203 • Drying cost of boro paddy = 2700	4903	3. Cost saved for not use traditional method of harvesting, threshing and drying • For harvesting +threshing Tk. 2800+2600 = 5400 • Sun drying cost of boro paddy =1000	6400
2. Revenue forgone for not use traditional method • For harvesting + threshing of boro paddy = (42.56*585) = Tk. 23727.6 • For Drying paddy = Tk. 586.2 (due to grain loss 2% by sun drying)	25483.8	4. Revenue earned from reaper, thresher and dryer: Tk. (48.04 * 670) = Tk. 32186.8 (Due to grain save, quality improvement and gain fair price for timeliness of threshing)	32186.8
Net change of income	8200		
	38586.8		38586.8

Table 5. Partial budgeting for traditional farming to Semi-modern I farming in rice processing system

Debit	Taka/hectare	Credit	Taka/hectare
1. Cost incurred for using mechanical reaper: Harvesting cost of boro paddy – 1000.6	1000.6	3. Cost saved for not using reaper Manual harvesting cost of boro paddy - 2839	2839
2. Revenue forgone for not using manual reaper = (45.12*620)	27974.4	4. Revenue earned from using mechanical reaper = Tk. (46.04*660)	30386
Net change of income	4250	(Grain saved by 1.5% + incremental price for timeliness)	
	33225		33225

Table 6. Partial budgeting for traditional farming to Semi-modern II farming in rice processing system

Debit	Taka/hectare	Credit	Taka/hectare
1. Cost incurred for using mechanical dryer: Drying cost of boro paddy – 2342.6	2342.6	3. Cost saved for not using sun drying cost of boro paddy -1200	1200
2. Revenue forgone for not using sun drying of boro paddy = (44.12*620) (due to grain loss by sun drying)	27354.4	4. Revenue earned from using mechanical dryer = Tk. (46.04*660)	30386
Net change of income	1889		
	31586		31586

Profitability of the power thresher and dryer owner: a financial analysis

It is evident from financial analysis; the BCR of the power thresher, dryer and reaper were 1.44, 0.85 and 1.20. Considering 5 years period and 12% discount rate, the NPV of the power thresher and reaper in existing condition were Taka 42441 and Tk.3006 while the mechanical dryer negative(-1503) indicating the loss of the investment on mechanical dryer. The positive NPV indicates that power thresher and reaper are considered financially sound and the investment is said financially viable because IRR of the power thresher and reaper was greater than the bank interest rate. The average IRR was 89% and 48%for thresher

and reaper while the IRR of mechanical dryer is negative (Table 7). In view of these circumstances, the financial analysis showed that power thresher and reaper was highly profitable from the viewpoint of individual investors.

Table 7. BCR, NPV at 12% DF and IRR of power thresher, reaper and dryers in the study areas

The devices	BCR at 12% DF	NPV at 12% DF (Tk)	IRR (%)
Power thresher	1.44	42441	89
Mechanical dryer	0.85	-1503	-2
Mechanical reaper	1.20	3006	48

Appropriateness of the mechanical devices for rice post harvest processing

Evidence from the opinion survey (Table 8) showed that most of the participants were below 40 years old. The participants attended the demonstration about 3 km far away and the posses' on an average of secondary level of education. Participants were totally convinced about the operation of thresher but half of them were convinced about dryer machine. Most of the participants would like to buy a dryer machine and they opined that it was very useful for the wet season. Many of them opined that it was possible to produce in local workshop. The participants demanded to buy the dryer machine within the Taka 9000 (max Taka 15000) and would like to pay as rent about Taka 30 (max Taka 50) for drying a quintal of wet paddy. About 75% of them were satisfied about the machine and individually they would like to buy it. Movement of paddy during drying; electricity requirement and heavy sound during operation of the engine were the major problems related to diffusion of dryer technology identified.

Table 8. Opinion regarding machineries in the demonstration

Points	Dryer	Thresher	Reaper
Very Impressive about the performance of devices (%)	46.67	96.67	66.67
Desire to buy a machine (%)	75.00	90.00	90.00
Desire to get the machine as rental service (%)	16.67	10.00	60.00
Necessity of the devices for post harvest rice processing (%)	96.00	93.33	93.33
Possible to make at local workshop (%)	46.67	16.67	16.67
Easy operation and management of the devices (%)	76.67	90.00	40.00
Average amount of money ready to pay for buying the devices (Taka)	8,950 (5,000-15,000)	28,967 (16,000-82,000)	28,967 (25,000-60,000)
Average amount of money ready to pay for rental services (Taka/quintal)	31.50 (12.50-50.00)	24.08 (20.00-32.5)	10.08 (8.00-25.05)

Conclusion

- The users of the mechanical devices were the small farmers, thus, this program may helpful for improving livelihood of the rural poor farmers.
- The use of mechanical devices reduce post harvest losses, timeliness and labor cost thus, the higher demand for mechanical devices were observed in that period and ensure fair price to the farmer.
- The price of rice increased due to timeliness, quality improvement, and seasonality; so, the rice processing devices could help farmers for earning additional income.
- Per quintal harvesting, threshing and drying cost of paddy was Taka 8.89, 23.25 and 35.24, which was much lower than the incremental market price induces for using these rice processing devices.
- The users were more benefited by about Taka 8200 per hectare if they used the devices for rice processing by which they could improve their livelihood.
- In terms of rate of return on investment with existing condition, power thresher and mechanical harvester was found highly profitable but because of sunshine weather dryer was not profitable. If the working period increases due to cloudy weather for increasing return on investment are found that after remodeling the dryer, become more profitable. Finally, the study strongly recommended for rapid extension of the dryer project through government and non-government agencies.

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