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Profitability of mechanical thresher and dryer in rice processing system in Bangladesh: A financial analysis

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Abstract

This study surveyed 30-power thresher and one STR-1 dryer operation during the April to June 2003 in some villages of Barhatta Upazila in Netrakona district. Project appraisal technique was adopted to compare the performance of the two types of devices in terms of benefit cost ratio, net present value and internal rate of return (IRR). The costs of threshing and drying per quintal were respectively Tk 25.36 and Tk 30.03. The cost of firing wood, diesel and labour costs constitutes the major share of the total drying cost while the labour and diesel cost constituted the major share of the threshing cost of paddy. IRR of the dryer machine was found -2 percent and for thresher, it was 89.12 percent. The dryer was used only 10 working days during the rainy season of 2003. If it is considered 30 working days due to increase in rainy weather, the IRR will be 72 percent. Rainy weather is very important factor for using the dryer. Finally, the study strongly recommended for rapid extension of thresher and dryer technologies through government and non-government agencies for improving livelihood of the resource poor farmers.

Keywords: Mechanical dryer, Drying and Threshing cost, Benefit cost ratio, Net present value and Internal rate of return

Introduction

Bangladesh is an agro-based country. Its economy mainly depends on rural agricultural production. More than 78% of the people of this country live in rural area and their main occupation is agriculture (BBS, 2001). In the crop sector rice, wheat, and maize are main cereal crops. Although Bangladesh is in the door step of attaining food self sufficiency in the cereal sector, there is a threat from significant post harvest loss which accounts for not less than 30% (Akteruzzaman, 2003). Rice occupied about 78% of the total cropped area and remainder 22% of total cropped areas are non-rice crops, which include wheat, sugarcane, oilseeds, pulses, etc. (BRRI,2001). Farmers of Bangladesh have given more emphasis on *Boro* rice cultivation. The *Boro* harvesting time starts from April and continues up to June. During this season rice processing mainly threshing and drying of rice is very difficult for the farmers of Bangladesh.

A study (RDRS-REFPI/DFID 2001) was conducted by Rangpur Dinajpur Rural Services (RDRS) and Bangladesh Agricultural University/ Research and Extension in Farm Power Issue (BAU/REFPI) in Kurigram and Lalmonirhat districts during November 2000 on Farm Power Need Assessment (FPNA) using Participation Reflection and Action (PRA) technique. The study reveals that the insufficient drying due to cloudy weather in *Boro* season was followed by threshing and tillage machines. The analysis indicates that shortage of sunshine due to cloudy weather and shortage of drying and threshing space have caused insufficient of drying gain and post harvest loss. Because of insufficient drying, rice grains are broken during husking by rice huller and if stored, pest infestation occurred reducing the quality of seed/grains and thereby affecting market value. In addition, shortage of drying space in the homestead has caused insufficient drying of grain and post harvest loss, and invited

accidents due to drying on the road. The main researchable issue, therefore, insufficient drying and sun drying induced post harvest loss of grains and degraded quality of rice decrease in rice income to the resource poor farmers. Introduction of modern and scientific power operated threshing and drying machine minimized the enormous post-harvest losses and ensured quality rice. During the rainy season, the price of paddy decreases and rice price increases. In this situation, farmers can improve the rice income through threshing and drying paddy using thresher and dryer and sell them in the market as husked rice. It was found that the paddy threshing and drying are hampered by cloudy and rainy weather as well as for drying space which causes insufficient drying of paddy, damage grain, quality degrades and it can be a cause of the road accident. As a result, the rice farmer becomes more losers and the same cycle is running in the rice economy without the mechanical thresher and dryer. It is hypothesis that the introduction of mechanical dryer and thresher may ensure reduction of post harvest loss, grain saved, quality improvement and get fair price which resulted increase income from rice consequently induced thresher and dryer technology in the rice economy of Bangladesh. This study is a modest effort to examine the financial profitability of using mechanical thresher and dryer for rice processing system.

Methodology

To achieve the objectives, the project has been jointly collaborated with a NGO named as Association for Social Advancement (ASA). One group of member of ASA was selected for this project, where one close drum power thresher had already been established by the informal group of ASA at Mowati village of Bawoshi union under Barhatta Upazila of Netrakona district. One STR-1 dryer distributed to the informal group of ASA free of cost from the 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 this project free of cost. 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.

The project appraisal technique has been followed to find out the profitability of power thresher and STR-1 mechanical dryer from owner point of view. The following three major discounting measures are applied for project appraisal (Gittinger, 1994). These measures are:

a. Benefit Cost Ratio (BCR),
b. Net Present Value(NPV),
c. Internal Rate of Return (IRR).

Results and Discussion

Three discount measures such as BCR, NPV, and IRR have been employed in this study to assess the profitability of investing in power thresher and dryer for threshing and drying paddy from the viewpoint of individual investors. The sensitivity analysis was also worked out to examine the sustainability of the project.

Capital Cost

The term cost generally refers to outlay of fund for operation of mechanical thresher and dryer cost item are classified into two major groups. One is capital cost and other is operation and maintenance cost, this together is equal to gross costs. The capital cost consists of the average purchase cost of power thresher and STR-1 dryer. Mechanical thresher was available in the study area. The thresher owners bought these threshers from Vai Vai workshop, local workshop, BRRI, BARI, etc. The average price of power thresher with engine was Tk 29152 (Table 1). The dryer has been using in the study area for last year. It is quite new technology in Bangladesh agriculture. These were made RDRS work shop and an SRR-1 dryer was used in the study area.

Table 1. Investment cost and capacity of a mechanical thresher and dryer

Specification/capacity	Unit	Power thresher	STR-dryer
Investment cost	Taka	29152	7000
Capacity			
• Per batch	quintal	-	5
• Per hour	quintal	6	-
Working time	Hour/batch	-	6
Fuel use	-	Diesel & Mobil	Charcoal/firewood
Fan operated by	-	-	Electricity

Source: Field Survey, 2003

Operation and Maintenance Cost of Power Thresher and Dryer

The operation and maintenance cost consists of cost of diesel, cost of mobil, electricity cost, cost of charcoal/fire wood, and causal labour cost. All the cost was calculated during the period of threshing and drying operation in 2003. Table 2 demonstrated that the total operation and maintenance cost of thresher and dryer were Tk 15287 and Tk 1036 per season. The diesel cost was the most important cost for power thresher. It was taken into consideration according to the actual amount paid by the farmers for purchasing diesel. They bought it from local market. It was found that on an average, the cost of required diesel for threshing *Boro* and *Aman* paddy under power thresher was Tk 4321 and it accounted for about 28.27 % of total operation and maintenance cost of power thresher. Mobil is also necessary for power threshers but not for a dryer. The average cost of mobil was found Tk 1842 and these accounted for about 12.05 % of operation and maintenance cost of power thresher. Cost of mechanic charge is very low because operation of power thresher is very simple. Some time they needed to purchase spare parts. The average cost of spare parts and mechanic charge were found Tk 1024 and Tk 360, respectively, these accounted for about 6.70 % and 0.24 % of operation, and maintenance cost of power thresher. For both thresher and dryer, labor cost is an important cost item. At least four labors are needed at the time of operation of the devices. The average labor cost of threshing was found Tk 7740 per year that constituted 50.63 % of total operation and maintenance cost and the labor cost of dryer was Tk 317.40 per quintal, which was 30.64 % of total operation, and maintenance cost of dryer. In the study area, the dryer owner paid a large amount of money for buying charcoal/firewood. It was found that the charcoal/firewood cost for drying paddy was Tk 422.63 per year. It was about 40.79 % of the operation and maintenance cost of STR-1 dryer. Electricity cost was a major cost of STR-1 dryer in the study area. The average electricity cost was Tk 296.01 which accounted about 28.57 % of operation and maintenance cost of the dryer (Table 2).

Table 2. Annual Operations and Maintenance Cost of a Mechanical Thresher and Dryer

Cost items	Power thresher		Mechanical dryer	
	Average cost (Tk)	Percentage of total cost	Average cost (Tk)	Percentage of total cost
Diesel	4321	28.27	-	-
Mobil	1842	12.05	-	-
Spare parts	1024	6.70	-	-
Mechanics charge	360	0.24	-	-
Labor cost	7740	50.63	317.40	30.64
Charcoal/firewood	-	-	422.63	40.79
Electricity	-	-	296.01	28.57
Total	15287	100.00	1036.04	100.00

Source: Field Survey (2003).

Measuring Gross Benefits

The formula used for calculating gross benefit of thresher is the quantity of threshed paddy in quintal multiplied by charge collected per quintal for threshing of *Aman* and *Boro* paddy. In the same way the gross benefit is the quantity of dried paddy is quintal of paddy dried multiplied by the charge collected per quintal of drying paddy. Gross benefit for power thresher and mechanical dryer was Tk 37700 and Tk 2242.5 respectively.

Measuring Financial Analysis

A project can be evaluated from economic point of view or the society and/or from the viewpoint of the individual. In the former case, the total return is determined by applying economic analysis and in the later case the return to the equity that an individual entity contributes is determined by applying financial analysis.

The financial analysis in this study was computed from the viewpoint of owner of mechanical thresher and dryer. Discounted measures of project were used for financial analysis since un-discounted measures of project worth is quite unable to take into consideration the timing of benefits and costs.

This appraisal however, is based on the following assumptions:

(a) All the devices are purchased with cash.
(b) The project life has been 5 years of the devices.
(c) Production technology was remaining unchanged throughout the project life.
(d) Prices of all inputs and outputs are given and constant throughout the project life.
(e) Discounting factor of 12 percent has been assumed for calculating BCR, NPV, and the salvage values were assumed 10 %.

Result of Financial Analysis

Before proceeding to the results, it is worthwhile to recapitulate some salient features of the selected discounting measures (i.e. BCR, NPV and IRR). The BCR is a relative measure, which is used to compare benefits per unit of cost. The NPV criterion, on the other hand, is an absolute; not a relative measure may have a smaller NPV than a large marginally acceptable project. As long as both have a positive NPV, this is not really a problem for the selection of a project. The IRR is not affected by the rate of discount, while the NPV may change as a result of using a different discount rates (Miah and Hardaker, 1988). The summary results of financial analysis of power thresher and mechanical dryers are presented in Table 3.

The result presented in Table 3 supported that investment on power thresher is highly profitable. On the other hand, investment on mechanical dryer is unprofitable in the existing condition. The result shows that the BCR for power thresher is 1.44 that is higher than unity but the BCR of mechanical dryer is 0.85.

Table 3. BCR, NPV at 12% DF and IRR of power thresher and mechanical dryers

The devices	BCR at 12% DF	NPV at 12% DF (Tk)	IRR (%)
Power thresher	1.44	42441.28	89
Mechanical dryer	0.85	-1503.75	-2

Considering 5 years time period and 12 % discount rate, the NPV of the power thresher in existing condition were Taka 42441.28 while the mechanical dryer negative indicating the loss of the investment on mechanical dryer. The positive NPV indicates that power thresher is considered financially sound and the project is said financially viable because IRR of the power thresher was greater than the opportunity cost of capital. The average IRR was 89 % while the IRR of mechanical dryer is negative. In view of these circumstances, the financial analysis showed that power thresher was highly profitable from the viewpoint of individual investors.

Sensitivity Analysis of Power Thresher

The appraisal of financial analysis, as presented in Table 3, has been done based on certain assumptions. It was assumed that the operation and maintenance cost of thresher will increase by 10 % for any uncertain cause but the other things remain constant during the life cycle. It will also assume benefits of owners of equipment will decrease by 10 % because of available machine. The result of sensitivity analysis shows how the investment decision changes with the changes in the value of any variable in the discounted cash flow analysis. If the operation and maintenance cost increased by 10 %, the profitability of power thresher owner even did not affect too much. One cannot perfectly predict future technology or actions of the government, any of them can quite easily falsity the assumptions upon which the appraisal is based. Sensitivity analysis can be done considering any of the above factors, as well as combination of the factors. In our country, the prices of cost items are increasing day by day. Summary results of the sensitivity analysis are presented in Table 4.

A great deal will inevitably depend upon the judgment of those making the decision. Here the vital factors such as opportunity cost and benefit of the machines are considered in this study for the sensitivity analysis. The aim of this section is to analyze what happens to profitability under the changed circumstances.

It is evident from financial analysis, the BCR of the power thresher decreased to 1.36 and NPV decreased to Taka 36929.58 and IRR observed 76 % due to 10 % increase in operation and maintenance cost (Table 4). The BCR, NPV and IRR of power thresher were respectively 1.30 Tk 28851.28 and 59 % if benefit of owners equipment decreased by 10% (Table 4). It reveals from the above findings that power thresher is highly profitable in existing situation. Even the operation and maintenance cost of the thresher increased by 10 % and/or benefit of the thresher owner decreased by 10 %, mechanical thresher is still profitable.

Table 4. Results of Sensitivity Analyses of Power Thresher

Measures	Unit	Operation and maintenance costs increased by 10%	Benefit decreased by 10 %
BCR	-	1.36	1.30
NPV	Taka	36929.58	28851.28
IRR	%	76	59

Sensitivity Analysis of Mechanical dryer

The results of financial analysis for dryer as presented in Table 3, have been done based on certain assumptions as stated earlier. It is assumed that the batch of drying by mechanical dryer will be increased by two times and three times due to bad weather. The profitability of dryers may be sensitive to weather, which affect on gross benefits of the firms. Miah and Hardaker (1988) also argued that the problem of uncertainty was another knotty problem to which there was no tidy solution.

Gittinger (1994) has pointed out that there are four kinds of uncertainties mainly price, delay in implementation, cost over run and yields in which sensitivity analysis can be applied in agricultural project analysis. Sensitivity analysis can be done considering any of the above factors, as well as combination of the factors. Summary results of the sensitive analysis are presented in Table 5. Here drying period of the dryer would increase to 20 days due to cloudy weather. This will effect on gross cost and gross benefits as the quantity of drying paddy increased by machines. The aim of this section is to analyze what happens to profitability under the changed circumstances.

It is evident from financial analysis, the BCR of the dryer increased to 1.21 and NPV increased to Tk 2845.27 and IRR observed 40.80 % (Table 5). In case of the dryer, if the drying period increased to 30 days then the BCR, NPV and IRR increased to 1.31, 5328.84 and 72 % (Table 5).

It reveals that STR-1 dryer will be highly profitable in the cloudy weather. Thus, the study recommended that STR-1 dryer could be suggested for the household level. The results of sensitivity analyses also clearly indicate that amount of drying paddy have a strong influence on the profitability of dryer operation.

Table 5. Results of sensitivity analysis of the mechanical dryer

Measures	Unit	Double batch from existing situation	Triple batch from existing situation
BCR	-	1.21	1.31
NPV	Taka	2845.27	5328.84
IRR	%	48	72

Conclusions

Drying and threshing of paddy becomes more problematic by the farmers during *Boro* harvesting season due to continuous rainfall. So mechanical threshing and artificial drying is very necessary during peak season not only to be lessen burden of farmers but also to prevent the grain deterioration, which will greatly affect the income of farmers. Therefore, close drum power thresher and STR-1 dryer machine are the reasonable alternative methods of traditional threshing and sun drying, respectively.

The drying and threshing cost was calculated considering the operating cost of the dryer and thresher, which was borne by the owner of the devices. It was found that the cost of threshing and drying per quintal were Tk 25.36 and Tk 30.03, respectively. The cost of firing wood, cost of diesel and labor costs constitutes the major share of the total drying cost while the labor and diesel constituted the major share of the threshing cost of paddy. The project appraisal techniques were applied to calculate the rate of return to investment on thresher and dryer. IRR of the dryer machine was found -2% and for threshing it was 89 %. Here the dryer was used only 10 working days during the study period. The weather was fine in this year so the farmer did not need to undertake the mechanical dryer services. If it is considered 20 and 30 working days, in this case the IRR will be 48% and 72% respectively which was more profitable. In case of thresher if the operation and maintenance cost increased by 10% and gross returns decreased by 10%, the IRR will be 76% and 59% respectively. It is clearly indicated that mechanical thresher is profitable though the dryer could not instantly indicate any profit to the owners' point of view.

Based on the above findings the following conclusions could be drawn-

(i) A large quantity of *Boro* paddy harvested and sold during the peak period of wet season and mechanical threshing reduce the post harvest loss, timeliness and labor cost. Thus, the higher demand for mechanical thresher and dryer observed in that period and ensured fair price to the farmer.

(ii) The price of rice increased by 10% in subsequent rainy day while the price of paddy decreased by 8% in the same time; so, the dryer could help farmers for earning additional income taking it as a business motive.

(iii) The price of paddy as well as rice increased about 30% after 3 months harvesting, thus, mechanical thresher and dryer should ensure the quality of paddy and rice for getting higher price to the farmers.

(iv) The thresher cost of one quintal was about Taka 25.38 and the drying cost of one quintal was about Taka 30.03, which was much lower than the incremental market price induces threshing and drying of paddy by using the devices.

(v) In terms of rate of return on investment with existing condition, power thresher was found highly profitable but because of sunshine weather dryer was not profitable. If the working period increases due to cloudy weather, the return on investment is found much higher than the opportunity cost of capital. Result of sensitivity analysis found that if the operation and maintenance cost increased by 10 % and benefit of owners' equipment decreased by 10 %, the profitability of thresher is still much higher than the opportunity cost of capital.

(vi) The study strongly recommended for rapid extension of the dryer project through government and non-government agencies.

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