

# Economic parameter of maize sheller for custom hire service in Bangladesh

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**Abstract:** The main purpose of the study was to determine the economic parameters for developing a maize sheller custom hire entrepreneur and effective schedules for maize sheller operation. Secondary data from various sources and some essential data were collected from primary sources through survey were used in this study. Operating costs were calculated and project financial profitability was determined by farm financial measurement techniques namely, benefit-cost ratio (BCR) and break even use. The operating cost of maize sheller for shelling was found US\$ 3.4 per hour or US\$ 1.41 per ton. Based on the operating cost, annual savings for replacement and a profit margin for the entrepreneur, the rent-out charge of the maize sheller is estimated as US\$ 8.15 per hour or US\$ 3.21 per ton. The benefit-cost ratio of maize sheller is found 2.34, which is highly profitable venture for an entrepreneur. The break-even use for maize sheller is estimated as 670 h of operation or 1705 t of maize shelling.

**Keywords:** maize sheller operating cost, economic parameter, maize sheller entrepreneur, Bangladesh

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## 1 Introduction

Bangladesh is predominantly an agricultural country with almost 80% of its total population is directly engaged in crop production (BBS, 2012). Maize is the third most important cereal crop in Bangladesh after rice and wheat, its total cropped area is 0.24millionhaof land yielding 1.6 Mt per year(BBS, 2012).In Bangladesh, over 50% maize shelling is done by non-mechanized, non-standard shelling devices, resulting high percentage (often 7%-8%) of broken kernels causes a lot of wastage. Besides, the broken kernels are susceptible to develop aflatoxin in storage which is potentially dangerous for human as well as animal health. On the other hand, the producers, wholesalers and retailers of maize sheller in the country do not have definite capacity building and

after sales service programs for the maize sheller users. During sales of maize sheller, they demonstrate how to operate with very inadequate maintenance instructions to the entrepreneurs (Alamet al., 1997). The entrepreneurs are mostly on their own to learn operation, maintenance and financial management of maize shellers. For this reasons, the entrepreneur are always lacking of proper skill for operation, maintenance and financial management of maize sheller. As a result, the economical life of the maize sheller become shorter and cause financial loss of entrepreneurs. Therefore, determination of key indicators related to financial management and operation of maize sheller for the development of maize sheller custom-hire service entrepreneurs are of great importance. Considering the problems the study made an attempt to determine the economic parameters for developing a maize sheller custom hire entrepreneurship in Bangladesh.

## 2 Materials and methods

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**2.1 Data collection**

Secondary data from various sources were used in this piece of research. The main sources of data were from the traders of maize shellers and machines, journals, published reports and theses. Some essential operational data were collected from primary sources through a survey designed for this purpose from farmers, custom hire providers of maize sheller and maize sheller owner in Thakurgaon district, Bangladesh.

**2.2 Maize sheller operating cost**

Maize Sheller operation cost consists of (a) fixed cost: depreciation, interest on investment; (b) variable cost: labor, fuel, oil, repair and maintenance cost. Three assumptions were considered during calculation of maize sheller operating cost (OC), which are (1) The cost was calculated using database of a single year; (2) Inflation rates were ignored in the calculation; (3) The interest rate is equal to 11.5%.

**2.2.1 Fixed cost**

Fixed cost is defined as one, which not change when level of output alters (i.e. it applies to a resource that is fixed in quantity). Fixed cost comprises those costs, which have to bear regardless of the machine is used or not. Fixed costs are fixed in total, but decline per hectares, as the annual use of the machine is increased (Barnard and Nix, 1979). In calculation of fixed cost, sinking-fund depreciation is assumed and the following Equation 1 was used (Hunt, 2001):

$$D = \left[ (P - S) \left\{ \frac{(1+i)^L - (1+i)^n}{(1+i)^L - 1} \right\} + S \right] - \left[ (P - S) \left\{ \frac{(1+i)^L - (1+i)^{n+1}}{(1+i)^L - 1} \right\} + S \right] \quad (1)$$

Where, *D*= depreciation, US\$/yr; *P*= purchase price, US\$; *S*=salvage value, US\$; *L*= time between buying and selling, yr; *n*= age of the machine in years at the beginning of the year, yr; *i*=annual interest rate, decimal.

The interest on investment in maize sheller is included in fixed cost estimation. Even if the investment money is not actually borrowed, a charge is made since that money cannot be used for some other interest paying enterprises

(Rahman, 2013). The following Equation 2 was used for the calculation of interest on invest (Hunt, 2001):

$$I = \frac{P+S}{2} \times i \quad (2)$$

Where, *I* = interest on investment, US\$/yr;

**2.2.2 Variable cost**

The variable cost is one, which changes when the level of output alters. Variable costs depend on hourly labor cost, fuel, oil, repair and maintenance cost, hiring cost of engine and the required working hours for each field operations. The cost of operator/labour was calculated as the labour rate in US\$/h. The fuel and oil cost was estimated from consumption rate and multiplied by their respective prices.

**2.2.3 Operating cost**

Operating costs are recurring costs that are necessary to operate and maintain a machine during its useful life (White et al., 1989). Annual operating costs of maize sheller were divided into fixed costs and variable costs. All calculated fixed costs and variable costs were converted into US\$/h and then summation of fixed costs and variable costs had given operating costs in US\$/h on the basis of average field data of maize shellers and engines.

**2.3 Payment for replacement**

Uniform annual payments to a fund are of such a size that by the end of the life of the machine the funds and their interest have accumulated to an amount that will purchase another equivalent machine. By Equation 3, the values for the payment for replacement are (Hunt, 2001):

$$\text{Payment for replacement (PR)} = (P - S) \times \frac{i}{(1+i)^L - 1} \quad (3)$$

**2.4 Maizesheller rent-out charge**

An entrepreneur can estimate the maize sheller rent-out cost from the following expression:

$$\text{Rent-out Charge (US$/h)} = \text{Operating cost} + \text{PR} + \text{Profit}$$

The profit of the entrepreneur depends on the socio economic condition of the maize sheller user as well as country. In this study, the profit of the entrepreneur was

estimated on the basis of middle class family income in Bangladesh.

**2.5 Financial analysis for maize sheller**

For achieving the objectives of the study, project appraisal techniques were followed to find out the profitability of maize sheller for owner point of view. This appraisal is based on three assumptions which are (1) All the devices are purchased with cash; (2) Operation technology is remaining unchanged throughout the project life; (3) Prices of all inputs and outputs are remaining constant throughout the project life.

**2.5.1 Benefit Cost Ratio (B/C)**

Benefit-cost ratio (B/C) may be defined as the ratio of benefits to costs (expressed either in present or annual worth). The method of benefit-cost analysis is simple in principle. It follows the systematic approach used in selecting between economic investments alternatives (Gittinger, 1994). If the B/C ratio is greater than unity, then it will be economically accepted.

$$B/C \text{ ratio} = \frac{\Sigma \text{PresentworthofBenefits(PWB)}}{\Sigma \text{PresentworthofCosts(PWC)}}$$

**2.5.2 Break-even use**

Break-even use of a machine indicates no-profit no-loss situation. Above which the machine use can be considered as net gain (Gittinger, 1994). The break-even use of a maize sheller depends on its capacity of shelling, power requirement, labour requirement and other charges.

$$\text{Break even use for capital recovery} =$$

$$\frac{\text{Total investment}}{\text{Revenue} - \text{Total operating cost}}$$

**3 Results and discussion**

**3.1 Operating cost of a maize sheller**

The present operating cost and capacity of the maize sheller (based on field data) with engine were estimated as US\$3.40 per hour and US\$ 1.41 per ton respectively. Fixed cost and variable cost for only the maize sheller were estimated US\$ 0.24 per hour and US\$3.08per hour respectively based on the average field data collected through personal interview of custom-hire service providers (Table 1).The cost of using engine was estimated as hiring cost of power source and was found as US\$0.08 per hour.

**Table 1 Thumb-rule for estimating operating cost of maize sheller**

<b>Fixed cost</b>	
Depreciation, D (S = 10% of purchase price )	= $(P - 0.1P)/10$ = 0.09P
Interest on investment, I(i=11.5%)	= $(P + 0.1P)/2 \times 0.115$ =0.06325P
Housing (1% of purchase price )	= 0.01P
Total fixed cost (US\$/yr)	= 0.16325P
<b>Thumb rule for fixed cost =16.325 % of purchase price</b>	
<b>Hiring cost of engine(US\$/h)</b>	0.08
<b>Variable cost</b>	
Fuel (US\$/h)	1.53
Lubricant(US\$/h)	0.01
Repair & Maintenance cost(US\$/h)	0.10
Cost of operator(US\$/h)	1.44
Total variable cost(US\$/h)	3.08
<b>Thumb rule for variable cost and hiring cost of engine = US\$3.16per hour</b>	

Therefore, a simple and easy way of estimating operating cost of maize sheller for entrepreneur would be written as follows:

$$\text{Operating cost of maize sheller} = \frac{16.325\% \text{ of purchase price (US\$)}}{\text{Average working hours per year}} + 3.16 \text{ US\$/h}$$

### 3.2 Payment for replacement

Replacement of maize sheller by new one is essential because beyond economic life it is no longer being useful for operating in field. Accident may have damage the maize sheller beyond repair. Performance of a new maize sheller is significantly superior and it makes the old maize sheller obsolete. Anticipated costs for operating the old maize sheller exceed those of a replaced maize sheller. Therefore, a maize sheller entrepreneur has to save money to buy the new one. Uniform annual payments to a fund are of such a size that by the end of the economic life of the machine the funds and their interest have accumulated to an amount that will purchase another equivalent machine. Based on present database and analysis an entrepreneur has to deposit US\$56.61 per year in a bank account so that he can buy a new maize sheller when the economic life of old maize sheller expires for shelling operation.

### 3.3 Rent-out charge of maize sheller

A rational rent out charge must be found out to sustain the entrepreneurship and the rent-out change of a maize sheller was estimated as the sum of operating cost of maize sheller, payment for replacement and profit. Based on the field data and estimation of cost items with appropriate equations and assumptions the rent-out charge was estimated as US\$ 8.15 per hour or US\$ 3.21 per ton of maize shelling.

### 3.4 Measuring of financial analysis

The financial analysis in this study was computed from the viewpoint of maize sheller owner. Discounted measures of project were used for financial analysis since undiscounted measures of project worth is quite unable to be taken into consideration the timing of benefits and costs. The results supported that investment on maize sheller is highly profitable. The result shows that the BCR for maize sheller was found 2.34 which is highly profitable venture for an entrepreneur.

Figure1 shows the economic use of maize sheller for a custom-hire service. The analysis shows that the minimum tenure for an economic use of a common maize sheller used in agriculture is about 670 h or 1705 t of maize shelling. Above this critical use, the utilization of a maize sheller is economical for a maize sheller entrepreneur. The time available for shelling is estimated about 67d @10h a day in a year.

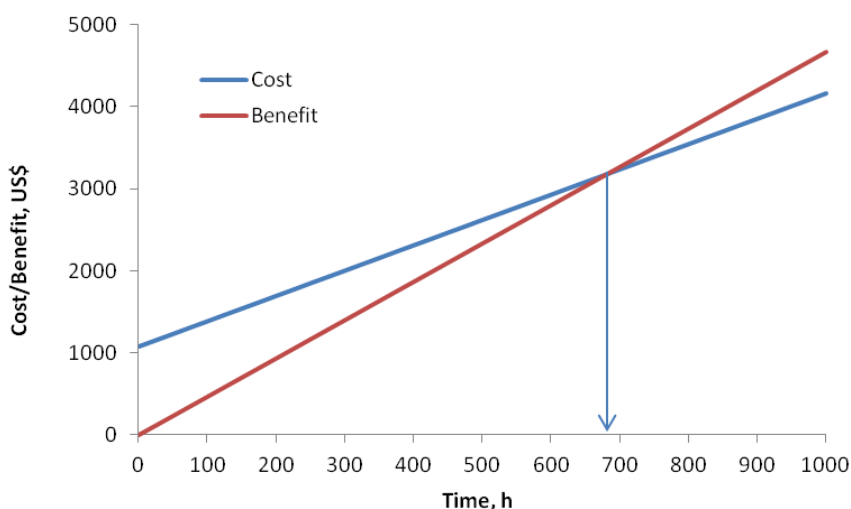


Figure 1 Economic use of maize sheller operation

## 4 Conclusions

Based on the findings and their interpretations the conclusions was drawn that the estimation of maize sheller operating cost is important economic aspects for sustainable maize sheller custom hire entrepreneurship. For replacement of the existing maize sheller on expiry of economic life, the entrepreneur has to save an amount of US\$ 56.61 per year in a bank account. Based on the operating cost, annual savings for replacement and a profit margin for the entrepreneur, the rent-out charge of the maize sheller are estimated as US\$ 8.15 per hour or US\$ 3.21 per ton of maize shelling. The benefit-cost ratio of maize sheller is found 2.34, which is highly profitable venture for an entrepreneur. The break-even use of the maize sheller is estimated as 670 h or 1705 t of maize shelling. Above this minimum operating time, the maize sheller is found economical.

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