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Financial performance evaluation of a semi-automatic rice mill

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ABSTRACT

A study was conducted on Molla semi-auto rice mill at Dakolhati of Sherpur Sadar, Sherpur district, Bangladesh. The objectives of the study were to identify the working process line, the byproduct production and the financial parameters of rice milling and to assess key problems and constraints of the semi-automatic rice mill. The team visited the rice mill and interviewed the key management personnel by carefully designed survey questionnaire for identification of rice milling technologies and assessing financial parameters of the rice mill. The study identified rice drying and milling processes as cleaning of paddy, parboiling of cleaned paddy in parboiling plant, natural drying of parboiled paddy, milling paddy using rubber roll sheller, separation of husk, polishing of rice, separation of rice bran, separation of broken rice, weighing & bagging of rice & byproducts. The products of the semi-automatic rice mill were identified as whole rice, broken rice, husk and bran, and the recovery rates were 64%, 6%, 8% and 22%, respectively. The semi-automatic rice mill processed about 2880 tons of paddy in 250 days. The milling cost per ton of whole rice was estimated as Tk. 3578.82. The unit profit of rice milling was estimated as Tk. 9421.17 per ton of which whole rice and by-products contribution were Tk. 5621.17 and Tk. 3800 per ton of rice milled, respectively. These by-products were used in poultry, dairy fish farm and briquette manufacturing. Another by-product was ash (burnt husk), which was totally wasted. From the cost analysis it was found that the fixed cost depends on the cost of land, building cost, the machinery cost, fixed labor cost and the land user cost. Purchase price of paddy depends upon time. In harvesting season it was low, but the moisture content was high and the production of *auto kura* increase. In semi-automatic rice mills no moisture meter was used. The industry is facing some problems such as inadequate supply of paddy, lack of skilled labor, irregular power supply, inadequate bank credit, high risk of product movement, inadequate storage facility, non-availability of spare parts and non-favorable government policies. Adequate business development services are to be ensured through public and private initiatives to resolve the problems. The estimated financial parameters of the semi-automatic rice mill are found to be impressive and the business seems to be sustainable.

Introduction

Bangladesh is a developing country belonging to the third world. About 84% of the total population of Bangladesh is involved directly or indirectly in agriculture. The future economic development of the country will depend largely on the progress mode in agricultural sector.

Rice is the staple food of about 135 million people of Bangladesh. It provides nearly 48% of rural employment, about two-third of total calorie supply and about one-half of the total protein intakes of an average person in the country. Rice sector contributes one-half of the agricultural GDP and one-sixth of the national income in Bangladesh.

Agriculture is the main source of livelihoods of the rural people which consists of 75.4% of the total population. Major food crops in Bangladesh are rice, wheat and maize. The production of rice, wheat and maize were 28.931 million tons, 0.844145 million tons and 1.346000 million tons respectively in 2008 (BBS, 2008). This indicates that crop sector is dominated by rice. Bangladesh is the most densely populated country in the world with unfavorable land-population ratio and this has resulted in poor food security.

Total rice production in Bangladesh was about 10.59 million tons in the year 1971 when the country's population was only about 70.88 millions. According to “IRRI Rice Demand in Asia is projected to rise 30% in 2010 as the regional economic slowdown forces more people to rely on the staple due to higher cost in diversifying diets” In the year 2010-2011 Bangladesh produced about 34 million tons of

rice from a total rice area of 10.53 million hectors (Statistical hand book, 2011).

About 75.61% of cropped area of Bangladesh is used for rice production, with annual production of 33.33 million tons from 11.41 million hectors of land (BBS, 2013).

Although the lands are limited but the volume of production is gradually increasing due to the introduction of HYV rice, increased cropping intensity, better cultural practice and modern post harvest technology. Hence the increased production needs increased processing technology. The number of rice processing unit in Bangladesh increased in the recent years.

The rice mill under the department of food, GOB are generally classified as husking rice mills, semi-automatic rice mill and automatic rice mill and the numbers are 14239, 457, and 142, respectively with a total fortnight capacity of 6,25,600 tons (DG Food, 2007). In addition there are about 1, 00,000 traditional Engel burg type rice huller in the country.

In this study semi-automatic rice mills were defined as those mills, which performed the rice processing operations by manual and mechanical means simultaneously. For example drying operation was done manually but the boiling and milling were done mechanically.

Milling is a crucial step in post-harvest processing of rice. The basic objective of a rice milling is to remove the husk and the bran layers, and produce an edible white rice kernel that is sufficiently milled and free of impurities. Most rice varieties are composed of roughly 22% rice husk, 8% bran layers, and 70% starchy endosperm, also referred to as the total milled rice. Total milled rice contains whole grains and broken. The by-products in rice milling are rice husk, rice bran and broken rice. Broken rice is marketed in almost two-third price of the whole rice. The bran is used for producing edible oil and cakes are used in poultry and fish feed mills. The husk is mainly used in firing boiler for making steam for parboiling and heat for drying rice in automatic rice mills. The husk is also used in making briquette as renewable energy.

In rice mills the losses during the milling process are caused by poor technical performance of milling machinery, resulting in poor milling yields. Engel burg type steel hullers have been eliminated from different countries as it breaks the grain in the milling process and yields only 53% milled rice. In Bangladesh, the Engel burg type steel rice hullers are still predominant in rice milling. At present, about 60% milling is done by Engel burg steel huller in Bangladesh and at least 2% rice is lost due to use of Engel burg steel hullers (Ali, 2002). The use of rubber-roll hullers produces good quality rice and rice by-products that can be sold at higher prices. In Bangladesh the use of rubber-roll hullers during the milling process is increasing day by day.

The demand of fresh and fine quality rice is increasing day by day. As a result, the rice produced from husking mills is losing its demand in the market. It is reported that the numbers of automatic and semi-automatic rice mills are increasing rapidly with the rate of closure of the husking mills. It has been possible because of higher capacity and technological advantages of semi-automatic rice mills over husking rice mills. In this case, it is very essential to investigate under what financial and technological changes bring these benefits in favor of semi-automatic rice mills. Therefore, this study undertakes to investigate under what financial circumstances these changes have been taking place.

The specific objectives of the study are as follows:

1. To identify the rice milling process in a semi-automatic rice mill;
2. To estimate the financial parameters of the semi-automatic rice mill;
3. To identify and assess the key problems and opportunities of the semi-automatic rice mill; and
4. To estimate the amount of by-products of the semi-automatic rice mill and its better utilization.

Materials and Methods

A semi automatic rice mill was selected purposively for the study and the rice mills were visited for the purpose collection of relevant information. A semi structured questionnaire was prepared according to the objectives of the study with active consultation with key informants, expert from the relevant fields and secondary information. Furthermore, a check list was developed for key informants. The draft questionnaire and the check list were pre-tested and necessary corrections, modification and alternations were made accordingly.

Semi-automatic rice mill

There are broadly three types of rice mills in the country: fully automatic mill, semi-automatic mill and hauler mill. Semi-automatic rice mills perform mechanically all operations without drying. In the case of the semiautomatic mill, parboiled paddy is dried manually by spreading and stirring on the floor under the sun and the dried paddy is fed into the mill. The processes involve storing of paddy, cleaning of paddy, parboiling of paddy, natural drying of paddy, milling with rubber-roll huller, rubber polishing, paddy separating, stone separating, black rice sorting, cracked and discolored grain sorting, sieving for broken rice, aerating, bagging and weighing. Semi-automatic rice mills produce good quality properly graded rice; husk and bran are obtained separately and have better use in Briquetting of rice husk and edible oil extraction from bran.

Selection of rice mill

The Molla semi-automatic rice mill of Dakolhati of Sadar, Sherpur district, Bangladesh was selected purposively for the study. Effective data was collected though the prepared questionnaire.

Sampling units

The sampling units were key Informants, the proprietor, manager and senior mechanic of the selected rice milling industry.

Data collection

Data were collected by direct interview with the owner of mill or the manager and technical persons working in mill.

Survey questionnaire

A semi-structured questionnaire was prepared for this purpose and data-keeping notebook was maintained to collect and record the information. A set of semi-structured questionnaire was developed by Bhuiyan, 2012 to assess the selected rice mill financial performance.

Cost determination and analysis

In this study financial parameters of rice processing in a semi-automatic rice mill were determined based on financial analyses considering the fixed and variable costs involve in milled rice processing.

Fixed Cost

The fixed costs in rice milling include:
i) Annual depreciation cost of machinery.
ii) Yearly interest on investment for machinery.
iii) Tax on machinery.
iv) Yearly insurance cost of machinery.
vi) Yearly fixed cost for housing or shelter.

(i) Depreciation cost of machinery

Depreciation measures the amount by which the value of a machine decreases with the passage of time whether used or not. The value of actual depreciation depends on length of the useful life of machine and method used for calculation. There are various methods for calculating depreciation. In calculation of fixed cost, sinking fund method of depreciation was assumed and the following equations were used:

(a) Annual depreciation, $D = V_n - V_{n+1}$..... (1)

$$V_n = (P - S)[\frac{(1+i)^l - (1+i)^n}{(1+i)^l - 1}] + S$$

$$V_{n+1} = (P - S)[\frac{(1+i)^l - (1+i)^{n+1}}{(1+i)^l - 1}] + S$$

Where, S = depreciation, Tk/yr.
P= Purchase price of machine, Tk.
S = Salvage value of machine, Tk.
L= life of the machine, year.
In this study, salvage value was assumed as 10% of the purchase price.

(ii) Interest on Investment of Machinery
The interest on investment is usually included in operational cost; since money is used to buy a machine and cannot be used for other productive enterprises. Using the following formula, Interest on investment was determined:

(b) Interest on investment, $I = (\frac{P + S}{2})i$..... (2)
Where, P= Purchase price, S = Salvage, I = Interest rate

(iii) Taxes
The cost of taxes was considered as 1.4% purchase price of the machine and equipment.
(c) Taxes, T = 1.4% of p..... (3)

(iv) Insurance
The cost of insurance was considered 0.25% of purchase price of the machine and equipment.
(d) Insurance, Ins. = 0.25% of P.....
(4)
Where,
Ins. = Insurance rate, Tk/yr;
P = Purchase price of machine and equipment involved, Tk.
(v) Opportunity Cost of Land
The amount of money of the rice miller has to pay for the land or the value he might get from the investment of the rice mill area.

(A)Total Fixed Cost of Machinery = (a+b+c+d) ..... (5)
(B) Opportunity Cost of Land (amount if leased) = Tk/yr..... (6)
(C) Opportunity Cost of Building (amount if leased) = Tk/yr..... (7)

Variable Cost
Variable costs per year in rice milling include:
i). Labor cost
ii). Repair and maintenance cost
iii). Cost of electricity
iv). Tax
v). Management cost (Stuff salary)
(vi). Cost of Fuel for Parboiling

(i) Labor cost

Labor costs include the cost of the labors that are not permanently employed and paid on monthly or daily basis. In semi-automatic rice mill, large number of temporary workers is employed on contact basis for parboiling, drying, cleaning, milling, polishing, bagging and storage operations.

(a) Labor Cost (Tk/year), L= Taka/day × No of labor required in a year……(8)

(ii) Repair and maintenance cost

Repair costs are the expenditure, for parts and labor for (i) installing replacement parts after failure, and (ii) reconditioning of renewable parts as a result of wear. Maintenance cost (adjusting for wear and tear, greasing, etc) and cost of labor required for maintenance, installing and replacement parts were items included as R&M cost. Repair and maintenance costs were calculated according to the information given by the miller.

(b) Repair and Maintenance Cost per year, R&M = Tk./yr……..(9)

(iii) Electricity cost

The electricity cost was determined by asking the monthly electricity bill by the miller.
(c) Electricity Cost (Tk./yr) = Tk./ month ×12 ……..(10)

(iv) Tax
Normally the large mill owners pay their income tax per year. Tax is imposed to the rice mill owner on the basis of electricity cost.
(d) Tax as a Cost= Tk/yr…… (11)

(v) Management cost

In small mill, staff salary is negligible because mill owners themselves operate and maintain the mill. Sometime they use labor for operation. Current value of the salaries for the stuffs was collected by the survey.
(e) Stuff Salary as Management Cost = Tk/yr…… (12)\

(vi) Cost of fuel for parboiling

The cost of fuel for parboiling was considered, in calculating operating cost.
(f) Cost of Fuel for Parboiling = Tk/yr…… (13)
Total Variable Cost = (a + b+ c+ d+ e+f) ..... (14)

Total annual operating cost

Total annual operating cost was estimated as the sum of the yearly total fixed cost and total variable cost.
AOC (Tk/yr) = Fixed cost (TK/yr) + variable cost (Tk/yr)..... (15)

Where,
AOC = Total annual Operating, Tk/yr.

Revenue

Revenues are calculated by multiplying the volume sold (Q) with the selling price (P) and subsequently, by adding additional sources of income, such as revenues of selling the production waste of a product.

Revenues = (Q*P) + other sources of income…… (16)

Net income

Net income or profit was calculated by deducting total costs (both fixed and variable cost) from revenues.

Net Income = revenues – fixed cost – variable cost……. (17)

Net margin (currency**)**

A margin on a product is the net income per product. This was calculated by dividing the net income of the manufacturer by the total volume of product sold (Q).
Margin = Net income / Q…….. (18)

Net Profit margin (percentage**)**

Net profit margin per unit is usually expressed as a percentage.
In this case,
Net profit margin = Unit profit/ unit price …… (19)

Return on investment

Calculating the return on investment (ROI) for each actor in the value chain shows how attractive the activity is relative to other potential uses of capital. The ROI was estimated using the following equation:
ROI = Net Income /Total cost…….. (20)

The Calculation of revenue, net income, net margin, net profit margin, return on investment follows Bhuiyan, 2012.

Benefit cost ratio (BCR)

Benefit cost ratio is the quotient of income to operating cost.

When BCR>1; i.e. income>; there is profit.

When BCR<1; i.e. income<cost; there is a loss.

When BCR=1; i.e. income= cost; no profit no loss situation.

Break-even analysis

For the break-even analysis let the machine to be operated x ton/yr
At break-even point revenue= total cost.
Q=FC/(IU-CU)
Where, FC=Fixed cost (Tk./yr)
IU=Income per unit (Tk./ton)
CU= Cost per unit (Tk./ton)

Results and Discussion

The study was undertaken to identify processing line and to estimate financial parameters of a selected semi-automatic rice mill. This chapter also includes key problems and opportunities of the semi- automatic rice mill.

Processing line of the selected semi-automatic rice mill

Rice milling is the process which helps in removal of hulls and barns from paddy grains to produce polished rice. Milling is a crucial step in post-production of rice. The basic objective of a rice milling system is to remove the husk and the bran layers, and produce an edible, white rice kernel that is sufficiently milled and free of impurities. Depending on the requirements of the customer, the rice should have a minimum of broken kernels.

Rice milling processes

The mechanical process of modern rice milling includes: Paddy arrives at mill gate, unloaded and stored, paddy soaked in water tank, stirred and unfilled grains removed, soaked paddy transferred to parboiling pan, water vapor from boiler parboils the paddy, natural drying of parboiled paddy manually.

Pre-cleaning- removing all impurities and unfilled grains from the paddy. Husking- removing the husk from the paddy. Husk aspiration- separating the husk from the brown rice un-husked paddy. Paddy separation- separating the un-husked paddy from the brown rice. De-stoning- separating small stones from the brown rice. Whitening- removing all or part of the bran layer and germ from the brown rice. Polishing- improving the appearance of milled rice by removing remaining bran particles and by polishing the exterior of the milled rice. Sifting- separating small impurities or chips from the milled rice. Length grading- separating small and large broken from the head rice. Blending- mix head rice with predetermined amount of broken, as required by the customers. Weighing and bagging- preparing milled rice for transport to the customers.

The operational flow diagram of a semi-automatic rice mill is shown in Figure 2

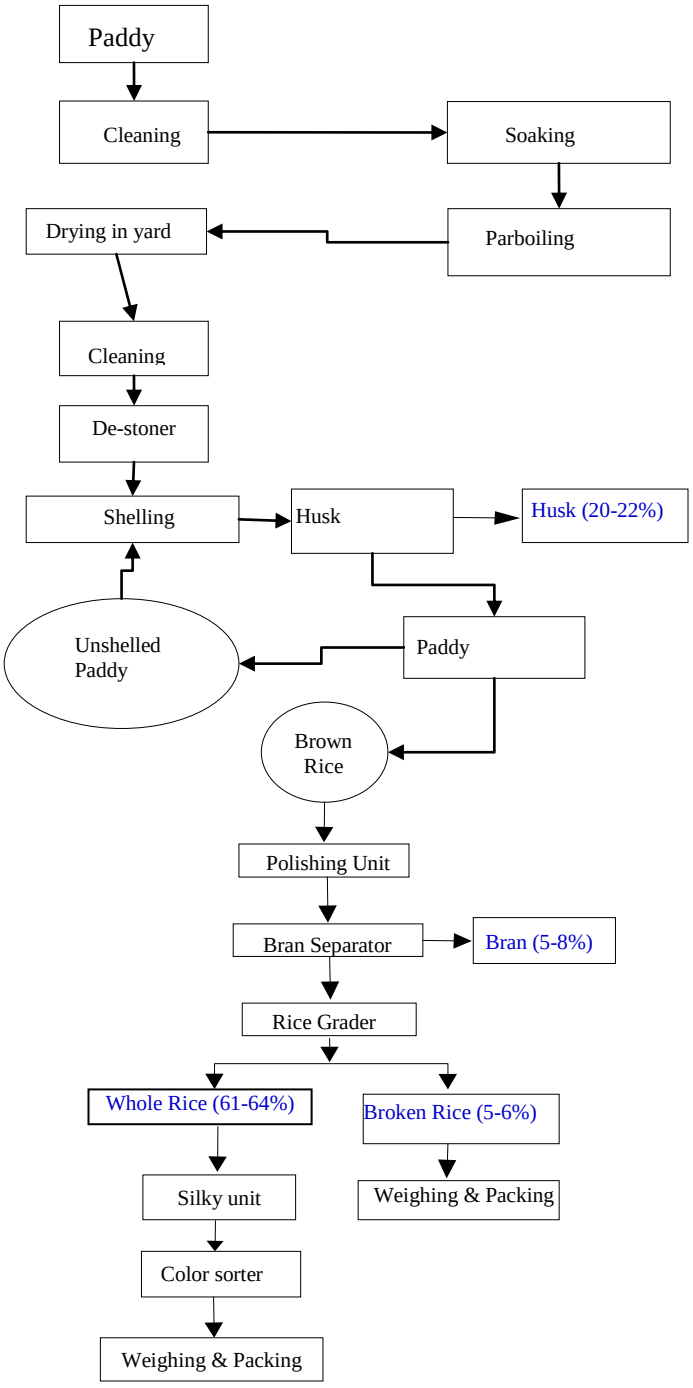

Fig.2: The operational flow diagram of a semi-automatic rice mill

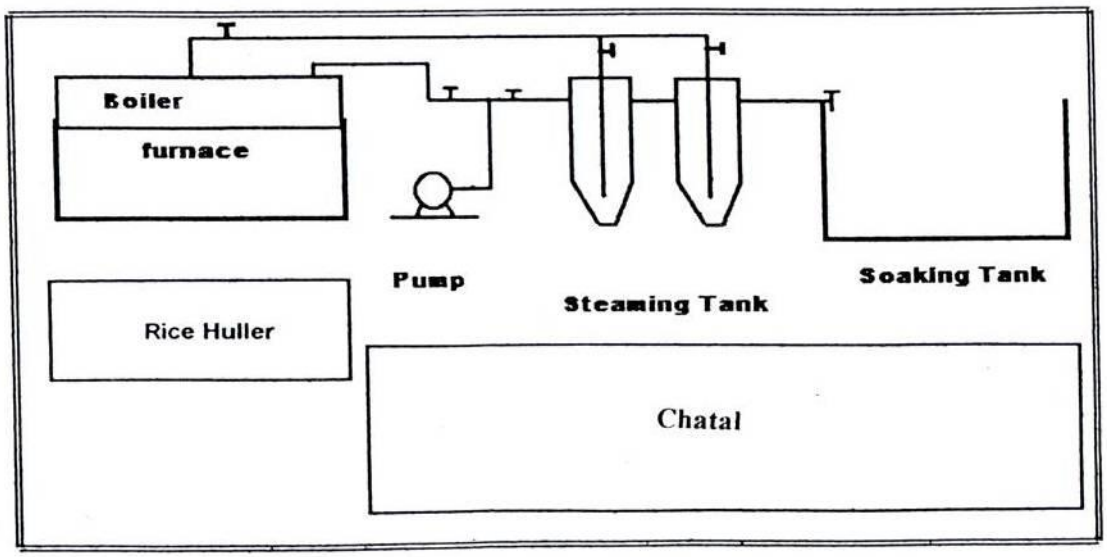

Fig 3: Components and layout of a semi-auto rice mill

Paddy storing and cleaning

Every mill has some contract buyers (Aratdars) who buy paddy from the market and bring these to the mill gate. Once the paddy is arrived, a group of contract laborers, usually males, unload the paddy and carry these in the warehouse. Then stored paddy is cleaned before going to the stage of soaking.

Soaking of paddy

Later on, the paddy is soaked in the water tank and stirred the paddy a few times to remove the floating unfilled grains.

Parboiling of cleaned paddy in parboiling plant

The process helps in improving the nutritional quality by gelatinization of starch inside the rice grain. Parboiling is done by steam which comes from the boiler. It improves the milling recovery percent during de-shelling and polishing/whitening operation, husking, removing husk from paddy.

Fig.4: Parboiling plant of Molla semi-automatic rice mill

Natural drying of parboiled paddy

It is the most important process before milling. After the parboiling is complete, another group of contract laborers, usually females, spread the parboiled paddy under the sun on the drying floor and repeatedly stir the paddy to either cool down or sundry. It takes about 2-3 days to completely sundry the paddy.

Cleaning and De-stoning

When the paddy is properly dried then it is again cleaned in a cleaner. After cleaning of dried paddy then flown in to the de-stoner which separate small stones from paddy.

Milling of parboiled & dried paddy using sheller type milling machines

Rubber-Roll Husker

Husking or de-hulling is a process for removing the rice hull from the rough rice. The rubber roll husker is by far the most important technology used today for husking rough rice. Rough rice is fed via a hopper and supplied to the two rubber rolls. One roller rotates clockwise, and the other counters clockwise at a faster speed. This provides a shearing action that strips off the husk while paddy drops between the rollers (Fig. 2). The rubber on the rollers is flexible and does not crush the grain.

Paddy and brown rice separator and de-stoner

The de-stoner is an important component of the rice mill, particularly when rice is harvested mechanically, or when rough rice is dried on open pavements. The grain gathers a lot of stones during handling, which must be removed. The de-stoner is a simple vibrating deck and air blower that suspends the grain from the stones. The stones are thrown off in one end and the brown rice in the other end.

Polishing

It helps to improve the appearance of milled rice by removing the remaining bran particles and by polishing the exterior of the milled kernel. Cone polisher does the polishing job by rubbing the grains between rotating cone-shaped stones. Further, fine polishing is done by polisher commonly named as silky machine. It polishes and cleans the grains by water jets.

Separation of rice bran & broken rice

It is done by using vibrating sieves. The broken grains are separated by moving through the finer sieves and whole grains are retained on the sieves.

Weighing and packing section

When the separation of highly sorted rice from harvested paddy, then rice is weighed and packaged in order to reach the customer in good condition.

Financial parameter of semi-automatic rice mill

In a semi-automatic rice mill the financial parameters include fixed cost, variable cost and opportunity cost of running cost. The fixed cost items are fixed cost of machinery, opportunity cost of land, opportunity cost of building, office stuff cost. The variable cost items are daily worker, electricity, generator, repair & maintenance, income tax. In the selected semi-automatic rice mill the fixed costs of machinery, opportunity cost of land, opportunity cost of building, office stuff cost were estimated as Tk.959993,Tk. 110000, Tk. 1600000 and Tk. 672000, respectively. The variable costs for daily worker, electricity, generator, repair & maintenance, income tax were estimated as 3562500, Tk. 2600000, Tk. 120000, Tk.300000 and Tk. 805830 respectively. The opportunity cost of running capital was estimated as Tk. 1920000 and the total operating cost was estimated as Tk. 15150323.

Table 1: Cost items in a semi-automatic rice mill

Fixed cost items	**Taka per year**
Fixed cost of machinery	959993
Opportunity cost of building	1600000
Opportunity cost of land	110000
Cost of permanent staffs	672000
Variable cost items	
Cost of daily labor	3562500
Cost of electricity	2600000
Repair and maintenance	300000
Cost of electricity generation (generator)	120000
Income Tax	805830
Opportunity cost of running capital	1920000
Total operating cost	15150323

In the last year the selected semi-automatic rice mill processed 4500 ton of paddy. The price per ton paddy was Tk. 18000 and per ton of rice was Tk. 31000. The recovery of whole rice was 64%, therefore the production of annual milled rice was 2880ton.The operating cost per ton of milled rice was estimated as Tk. 5621. The profit per ton of rice processing was found Tk. 7739, of which profit from rice was Tk. 4249 and from byproduct was Tk. 3490. Benefit cost ratio was estimated as 1.47 (Table -2 and Appendix-II). There were two kinds of labor identified in the rice mill, the daily labor and the staff. The labor cost per ton of rice milling was found Tk. 491 and staff cost was Tk. 149 (Table 2).

Table 2: Milling cost, benefit cost ratio and employment in the semi-automatic rice mill

Milling cost Tk./ton of rice	Profit Tk./ton of rice			BCR	Whole rice recovery%	Employment	
	Rice milling	By products (husk, bran, broken rice)	Total			Labor Tk./ton of paddy	Staff cost Tk./ton of rice
5261	4249	3490	7739	1.47	64	491	149

By-products that produced during milling are mainly rice husk, broken rice and rice bran. These are used in poultry, dairy, fish farm and briquette manufacturing. Another by-product was ash (burnt husk), which was totally wasted. It has no use by the millers and they have no new idea. The production of by-product fluctuates with the variety of the paddy and moisture content of the paddy. The demand of these by-products is increasing day by day in Bangladesh.

The selected semi-automatic rice mill produces some byproduct these are broken rice, husk, and bran. The amount of the broken rice, husk, and bran were found 6%, 22% and 8%, respectively. The total amount of broken rice, husk and bran produced last year in the selected automatic rice mill were 270, 990, 360 tons and sold as Tk. 23000, Tk. 4500, and Tk. 14000 per ton, respectively. Therefore, the incomes from broken rice, husk, and bran in last year were Tk. 6210000, Tk. 4455000, and Tk.5040000, respectively (Table-3 and Appendix-II.

Table 3: Income from by-products

Items	Recovery %	Amount ton/yr	Selling price/ ton	Tk/yr	Total income /yr
Broken rice	6%	270	23000	6210000	
Husk	22%	990	4500	4455000	15705000
Bran	8%	360	14000	5040000	

Every mill hires a manager to oversee the mill activities and to keep records. The manager is also a contract laborer and paid on work basis. The rate of payment differs among mills. Typically the semiautomatic mills pay Tk 10 per sack of paddy (80 kg per sack) and the hauler mills pay Tk 11 per sack of clean rice (75 kg per sack) produced. These rates have been used in our cost calculations. The instruments and facilities used to perform the tasks are supplied by the mills costs of which are included in the overhead costs of the mill.
The semi-automatic rice mill is equipped with modern technologies and requires minimum number of labor for operation. Labor and staff requirement per ton of rice milling of the automatic rice mill were found 14.6 and 2.2 hours, respectively (Table 4).

Table 4: Labor and staff cost per ton of rice milled

Type of rice mill	Labor, man-hr/ton	Staff, man-hr/ton
Semi-automatic	14.6	2.2

Table 5: Financial parameters of the semi-automatic rice mill

Fixed cost Tk/yr	Variable cost Tk/yr	Operating cost Tk/yr	Revenues Tk/yr	Net income Tk/yr	Unit profit Tk/ton	Return on investment	Net profit margin
3341993	9308830	15150323	104985000	91754677	7739	6.05	24.9%

The important financial parameters of the selected semi-automatic rice mill such as total fixed cost, total variable cost, and total operating cost of milling were estimated as Tk.3341993, Tk.9308830 and Tk.15150323, respectively. Moreover, total revenues, net income and unit profit per ton of rice milling were estimated as Tk. 104985000, Tk. 91754677 and Tk. 7739, respectively. The return on investment and net profit margin percentage were found as 6.05 and 24.9%, respectively (Table-5).

Break-even analysis

From calculation break-even processing per year is 130.

Problems and opportunities of the semi-automatic rice mill

The semi-automatic rice mill is equipped maximum operation with modern equipment however the industry faced some problems (Table 6). The problems identified were inadequate supply of paddy, lack of skilled labor, irregular power supply, inadequate bank credit, high risk of product movement in adequate storage facility, non-availability of spare parts and inadequate government policies.

Table 6: Problems and opportunities of the semi-automatic rice mill

Priority areas	Constraints	Business Development Services	Service Providers
Input supply	Inadequate supply of paddy	Provisions for establishment and easy access to farmers assembly market	Ministry of local govt., ministry of industries
Skilled development	Inadequate operation, R&M skill at rice mill level Inadequate management skill(business management, accounting and marketing)	Provision for training on operation, R&M of rice mill operates and technicians	PTI,VTI Apprenticeship at rice mills(embedded)
		Provision for training on management, accounting and marketing skill to management personnel	Private training institutes, private enterprises (rice mills) can provide training beside its production line.
Infrastructural services	Irregular power supply Inadequate storage facility	Provision for non-interrupted power supply Provision for adequate credit facilities for storage facilities	PDB, PBS Public and private sector financial institutions
Business environment	High risk for product movement due eroding law and order situation	Provisions for enforcement of law and order	Public law enforcement agencies

Conclusion

The study identified rice milling process as cleaning of paddy using paddy cleaner & de-stoner, parboiling of cleaned paddy in parboiling plant, natural drying of parboiled paddy, milling paddy using rubber roll sheller, separation of husk, polishing of rice, separation of rice bran, separation of broken rice, weighing & bagging of rice & byproducts. However, modern technologies like fine polisher (silky machine) and color shorter are absent in the processing line that could add value to the quality of whole rice produced.
The products of the Semi-automatic rice mill were identified as whole rice, broken rice, husk and bran, and the recovery rates were 64%, 6%, 22% and 8%, respectively.

The semi-automatic rice mill processed about 4500 tons of paddy in 250 days. The capacity of the rice mill is observed to be under-utilized and the profitability of the rice mill might have been increased with better capacity utilization. The milling cost per ton of whole rice was estimated as Tk. 5261, which is slightly higher in compared to established rice milling cost of automatic rice mill in the country.

Net profit margin of rice milling was estimated as Tk. 7739 per ton of which whole rice and byproducts contribution were Tk. 4249 and Tk. 3490 per ton of rice milled, respectively.

The cost of labor and staff per ton of rice milled were estimated as Tk. 791 and Tk. 149, respectively. The labor and staff requirement were also estimated as 24.3 man-hr/ton and 2.2 man-hr/ton, respectively.

The return-on-investment (ROI) and percentage of profit margin of the semi-automatic rice mill were estimated is 6.05 and 24.9%, respectively.

The estimated financial parameters of the semi-automatic rice mill are found impressive and the business seems to be sustainable.

The industries facing some problems such as inadequate supply of paddy, lack of skilled labor, irregular power supply, inadequate bank credit, high risk of product The industries facing some problems such as inadequate supply of paddy, lack of skilled labor, irregular power supply, inadequate bank credit, high risk of product movement, inadequate storage facility, non-availability of spare parts and inadequate government policies. Adequate business development services are to be ensured through public and private initiatives to resolve the problems.

Recommendations

Depending on the present market demand fine polisher and color shorter machines would be installed in the rice milling line that would increase the profitability of the industry.

The semi-automatic rice mill management must take initiative to increase the capacity utilization of the process line by increasing the days of operation up to 300-330 days in a year.

Appropriate govt. authorizes must enact policy options for non-interrupted supply of electricity to producers and sellers.

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