Cost analysis of operating a medium sized rice processing mill in Bhutan

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ABSTRACT

The study aimed to ascertain the cost of operating a medium sized rice mill in the country. The fixed cost and variable cost were calculated for operating the rice mill. An empirical formula was derived to forecast the revenue generated while running the operation. The moisture content of paddy during purchase may not greatly influence the profit margin as the loss is not significant when the quantity is huge. The rice milling recovery at 67% indicated satisfactory performance of the mill; remaining 33% consisted of husk, bran and the broken grains. Hence it is important to ascertain alternative use of the by-products which also add up to the profit. There is a significant difference between the cost of milling with subsidy from the government, or investment in rice mill and infrastructure and also with rental charge on these facilities. Still it is a good business to own and run a rice mill.

Keywords: *Cost of operating; rice mill; milling recovery*

1. Introduction

The government is promoting medium sized rice processing machines in rice growing Dzongkhags in the country under the Accelerating Bhutan Socio Economic Development programme. The objective behind the initiative is to have good processed and packaged rice for sale in the domestic market. The government is also equally implementing programmes such as increasing irrigation network and farm mechanization programme which will lead to more area under cultivation and thus increasing the paddy production in the country. With high yielding varieties, the scope for increased production is high which is intended to reduce import of rice in the country.

The rice processing machine however needs investment which includes both infrastructure and the installation of the plant. It also requires paddy storage, the drying area and the milled rice storage. The storage houses also require controlled temperature to protect it from insect infestation and reduce mould formation, which however is not included in the government initiative at present. The government has invested in the construction of the infrastructure and purchase, installation of the rice mill at different places. The proposal is to hand over the operation to Food Corporation of Bhutan initially and then hand over to the private sector. Hence this study will ascertain the cost analysis of operating such rice mills.

2. Materials and Methods

The cost of construction and installation of the rice milling machine was Nu 1.9 m and cost of rice mill was 2.04 m (DoA tender document). The fixed cost and variable cost have been calculated (Kinga 2013) as described below. The fixed cost includes depreciation cost**,**

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interest on investment and insurance cost. The variable cost includes electricity cost**,** labour wages and repair and maintenance cost**.**

i) Depreciation cost: According to Kepner et al (2005), the annual depreciation was calculated as

$$D = \frac{(P - S)}{L}$$

Where D= Yearly depreciation; P= Purchase price of the machine (Nu), S= is the salvage value or the selling price of the machine after its useful use (Nu) and assumed as 10 % of the machine price; L= useful life of the rice mill between buying and selling (10 years for farm machinery).

ii) Interest on investment: In Bhutan, the maximum interest generated through fixed deposit is 4%. According to the Kepner et al (2005) and Khairo et al (2009) the annual interest on the investment was calculated as follows:

$$I = \frac{(P + S)}{2} \times \frac{i}{100}$$

where, I= Rate of interest in %, i= Annual interest rate for buying a rice mil

iii) Insurance and taxes: It is amount spent on insurance every year as this rice mill.

$$In = \frac{1.1P}{2} \times \frac{in}{100}$$

Where, In = Rate of insurance and taxes, %; in= Annual insurance and taxes rate (2% per annum for agricultural use).

Calculation of variable cost of the rice mill

i) Electricity Cost
It is calculated as the total KW x number of operating days x the rate (BPC)

ii) Repair and maintenance cost
According to Kepner et al (2005) it was taken 2.5% of the purchase price. However for Bhutanese terrain, it was proposed 8% as the repair needed is frequent.
RM = 8% x purchase price of farm machinery (Nu)

iii) Operator and labour wages

Labour cost = Nu 7000 /head/month x 12 months x 4 person

Mathematical analysis

i) Cost of operation is the cost involved in the operation of the rice mill

$$CoO = \frac{Total\ Annual\ Cost\ (\frac{Nu}{year})}{Capacity\ of\ the\ machine\ (\frac{acre}{year})}$$

where total annual cost includes both fixed cost and variable cost. The capacity of the machines is its performed capacity in acre/year

The cost of milling has been calculated based on three categories:

a. The initial investment as zero as the both the construction and purchase are done by the government

b. The initial investment calculated on rental basis at 10%, 20& and 30% respectively
c. The initial investment included as if it is operated by private without any government support.

The rice milling recovery was considered at 67% from the paddy as 20-22% includes the husk and remaining included in the polishing. The cost of purchased paddy is taken at Nu 30/kg and the selling of the rice in the market is assumed at Nu 70/ kg as surveyed from the farmers. The moisture content of the paddy at purchase time is assumed at 22%.

The change in weight because of the variation in the moisture content is calculated through this equation (Kinga 2012)

$$Water(X) = W - W \times \left\{\frac{100-MC_i}{100-MC_f}\right\}$$

Where W is the weight of the rough rice in gram, MC_i is the initial moisture content in decimal, X is the amount of water to be added to removed in gram, and MC_f is the final moisture content in decimal.

3. Results and Discussion

3.1. Paddy weight variation with change in moisture content

The weight of the paddy is directly influenced by the moisture content of the paddy. The moisture content during the purchase is assumed to be at 20%, whereas at harvest it normally ranges from 22-24%. At the milling time, it is important that the moisture content is in the range of 11-13% to ensure less breakage during the milling process. This change in moisture content from 22% or 18% to 13% reduces the overall weight of the paddy which is a loss as shown in Figure 1.

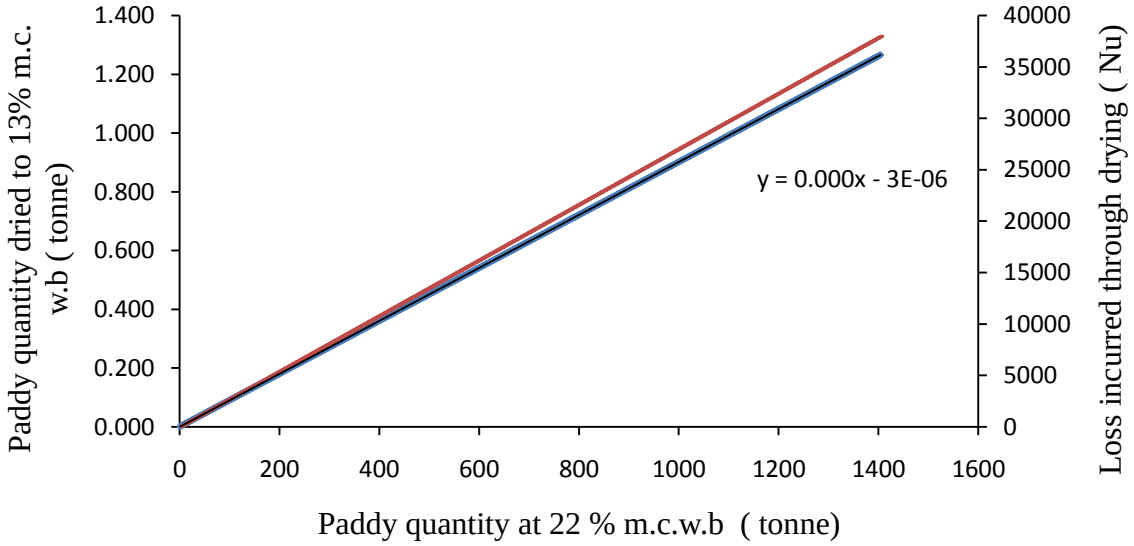

Figure 1. Paddy weight variation through drying and cost incurred

Even at 22% moisture content when the paddy is purchased from the farmers' fields, the loss incurred in paddy weight after drying to 13% for milling was 1.2 ton when quantity of paddy

purchased is around 1400 tonnes. The loss amount incurred was Nu 36000 for this quantity which may be negligible. Hence, concern on the moisture content during purchase of paddy should not be a prominent issue.

3.2. Rice milling recovery

During the milling process, the paddy has to be converted into rice. The rice milling recovery is assumed to be 67%. The remaining consists of the husk and the bran. Figure 2 shows the amount of milled rice and paddy during the milling process.

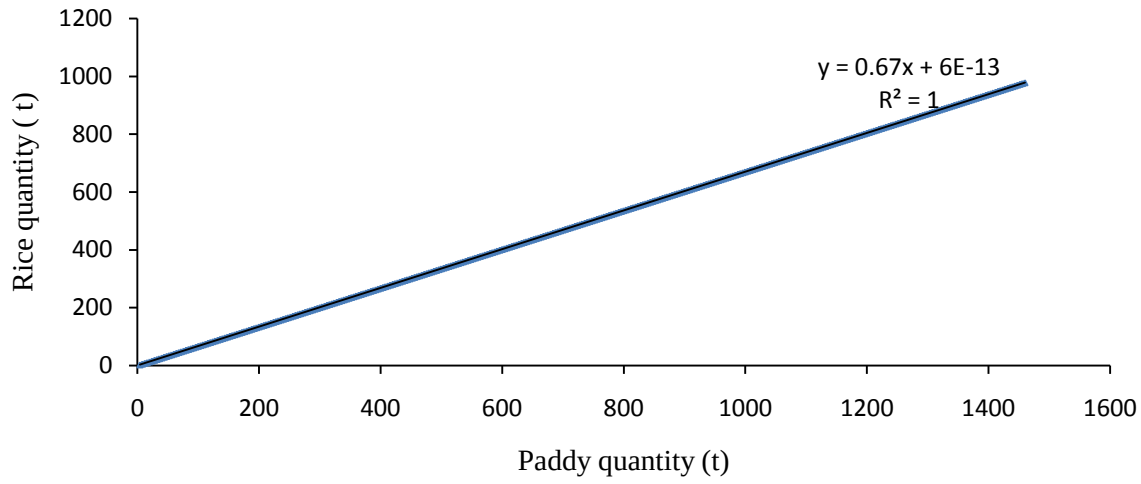

Figure 2. Rice and paddy quantity relationship

However this trend is assumed under the condition that the moisture content of the paddy is around 13% which is required for milling. It gives a very clear picture and indication of how much rice can be collected once the milling operation is completed. The quantity of rice collected is always lower than the initial paddy quantity as the remaining loss consists of husk, bran, brokens etc. The rice collected was 630 tonnes for every 1000 tonnes of paddy milled.

3.3. Cost analysis between paddy purchase and rice sold

Figure 3 shows the relationship between the quantity of paddy processed and revenue generated from the sale of rice. More the rice processed wider will the difference between the two lines in the graph which is better for the firm.

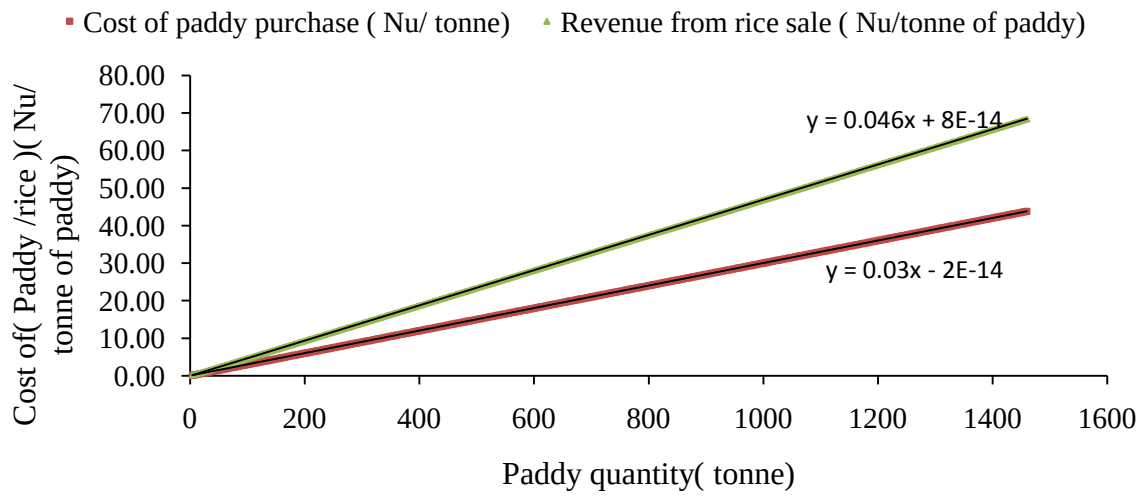

Figure 3. The prevailing paddy cost and rice price (Nu/tonne)

The difference is the amount that includes loss/profit, the milling cost, transportation, packaging and selling of rice. When 500 tonnes of paddy is purchased, it will cost Nu 15 m and this amount when processed and sold will fetch Nu 23.45 m. When 1000 tonnes of paddy is purchased it will cost Nu 30 m and when processed and sold will fetch Nu. 46.9 m. This is at the prevailing rates of the farmers. This shows that when the paddy quantity is increased, the revenue made will also increase as indicated in Figure 3.

3.4. Cost of milling

The cost of milling paddy into rice is the major operation with other operations also equally important in the entire operation. The cost of milling per tonne with this level of investment on plant and infrastructure is shown in Figure 4. It also includes if rental is charged at 10-30% to the mill users when investment is from the government.

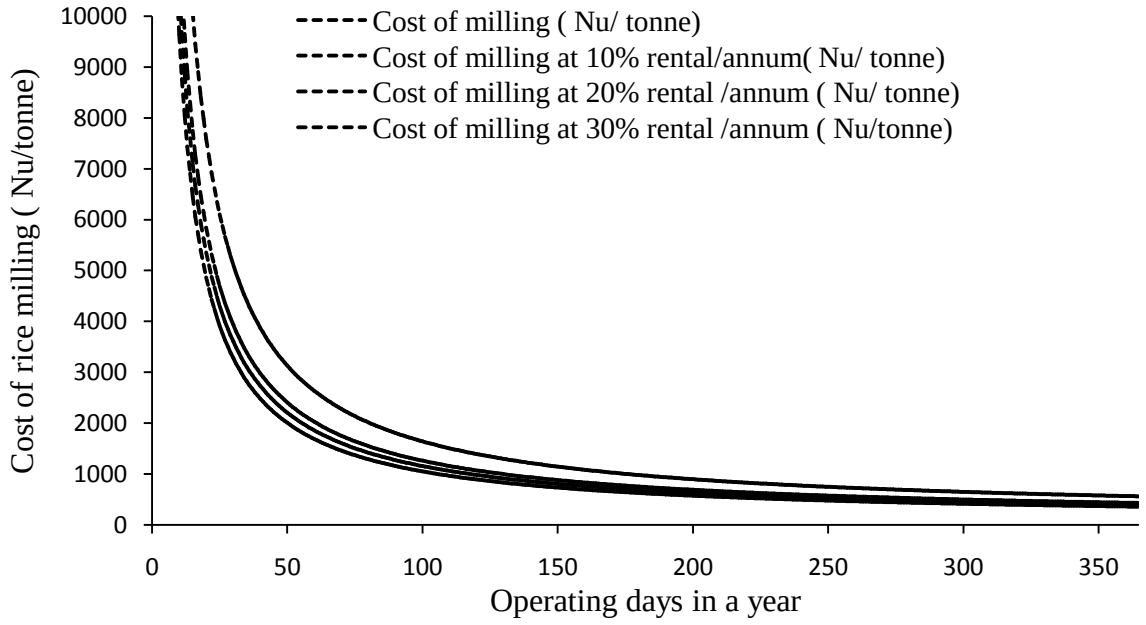

Figure 4: The cost of milling (Nu/ton) with operating days

It is clearly shown that if milling cost/ton is to be brought to Nu. 1000/ton, then the operating days should be 105 days with investment, 118 days with 10% rental per annum, 130 days with 20% rental per annum and 176 days with 30% rental per annum for using the mill and the infrastructure.

However, if the cost of milling is to be brought to and less than Nu 2/kg, then the operating days should be 50 days, 55days, 61 days and 80 days respectively with respect to the rental charge percentages. It can be clearly seen that with increasing operating days, the cost of milling can be reduced further which is good for the business as shown in Figure 5.

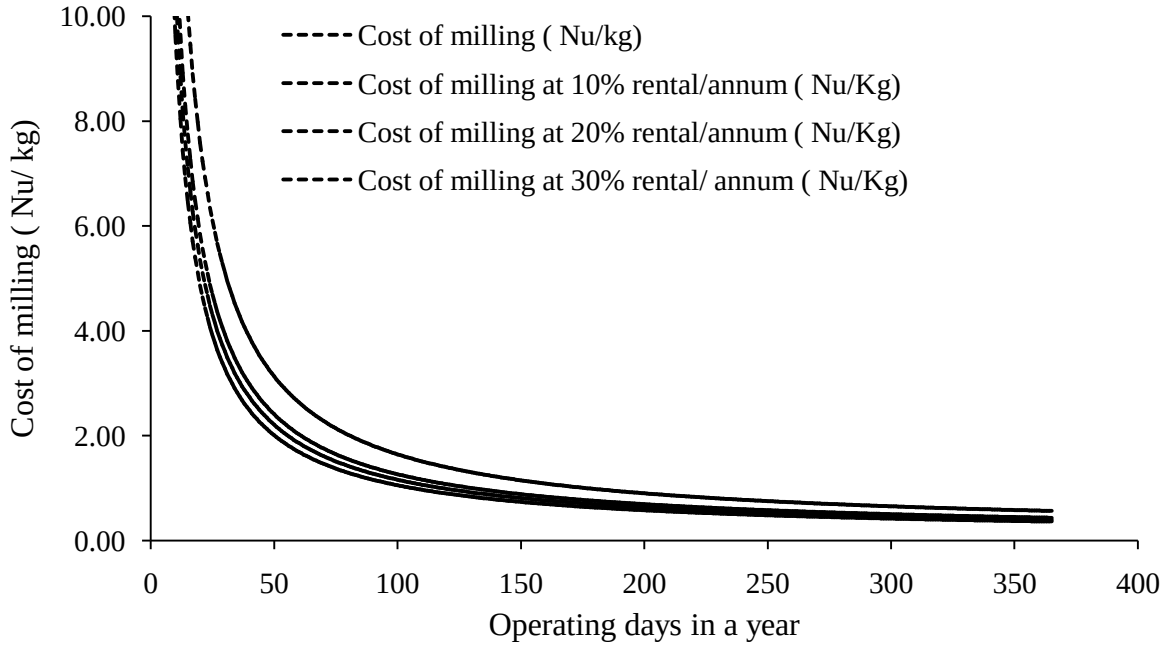

Figure 5. The cost of milling (Nu/kg) with operating days

In case the government decides to let the FCB or any firm operate it without any rental charge or investment on the plant and the infrastructure as subsidy, the cost of milling will be further reduced as shown in Figure 6.

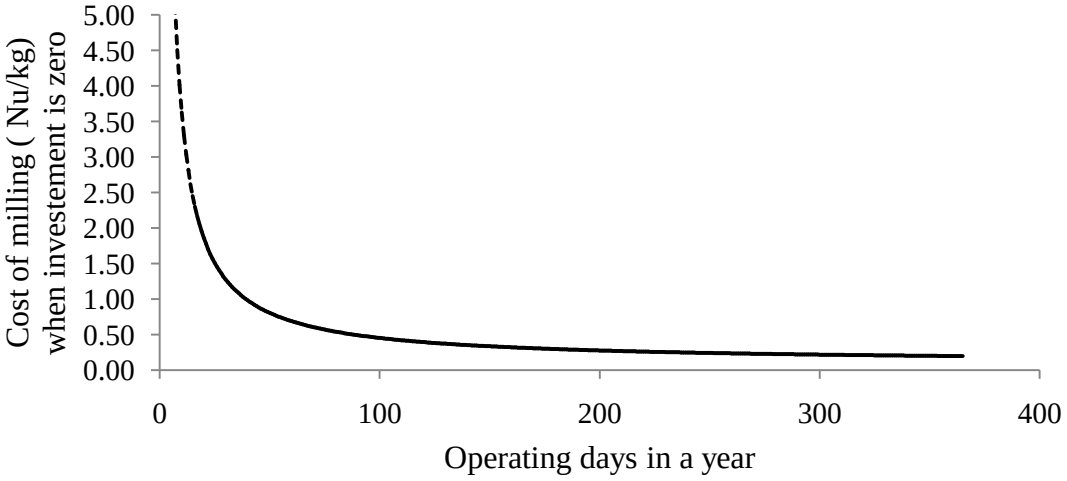

Figure 6: The cost of milling with subsidy with both rice mill and infrastructure

It can be seen that the cost of milling is further lowered. The milling cost will be only Nu 0.5 per kg if the mill is operated in full capacity for 88 days or about 3 months.

3.5. Revenue Generation

An empirical formula can be used to forecast the revenue generated from all the figures and assumptions stated above:

$$Revenue\ generated\ (M) = (0.07 \times 0.67X - \{[0.03\ \times X] + [0.002 \times X]\})$$

Where X is the paddy quantity (ton)

4. Conclusion and Recommendation

Some interesting observations through this study and analysis of the data are summarized. The moisture content of the paddy during purchase may not greatly influence the profit margin as the loss amount is not so significant when the paddy quantity is huge. However, the drying process may prolong and add up to unnecessary expenditure. The rice milling recovery at 67% indicates that the remaining 33% which consists of husk, bran and the broken as loss. Hence it is important to ascertain alternative use of these by products which also could fetch money. If the quantity of paddy purchased is higher, the revenue made is also higher when processed and rice is sold. Hence it will always be profitable if the paddy quantity is increased when other factors like spoilage and optimum storage conditions are addressed. There is a difference between the cost of milling with subsidy from the government, or investment in rice mill and infrastructure and also with rental charge on these facilities. Still it is a good business to own and run a rice mill.

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