Financial management for custom hire service of tractor in Bangladesh

Anisur Rahman*, Most. Latifunnahar, Md Monjurul Alam

(*Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*)

Abstract: The main purpose of the study was to determine the economic parameters and effective schedules for tractor operation. Secondary data from various sources were used in this research. Some essential data were collected from primary sources through survey. Operating costs were calculated and project financial profitability was determined by four major factors on farm financial measurement techniques, namely, benefit-cost ratio (BCR), net present value (NPV), internal rate of return (IRR), and payback period. Considering the economic use, land topography and cropping pattern was developed to effective scheduling for tractor operation. The operating cost of tractor with implement was found to be US$ 9.25 per hectare. For replacement of the existing tractor on expiry of economic life, the entrepreneur has to save an amount of US$ 219 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 tractor is estimated at US$ 11.58 per hectare. Considering 10% interest rate, the NPV of the tractor at existing condition is US$ 18 757. The NPV of tractor indicates that tractor entrepreneurship is considered financially sound and the project is financially viable, with an average IRR of 36.96%. This is because IRR of the tractor was higher than the bank interest rate and it is highly profitable from the viewpoint of individual investors. The Payback period of tractor with implement was determined as 2.03 yrs. The minimum tenure for an economic use of a common tractor used in agriculture is about 6 310 hrs. Above this critical use, the utilization of a tractor is economical for a tractor entrepreneur. Depending on the cropping pattern two major and one minor turn-around periods are available in between cropping seasons for tilling operation. The time available for tilling of land is estimated about 140 days at 12 hours a day in a year. To strengthen the existing capacity of the tractor customer hire service entrepreneurs and develop new entrepreneur, appropriate adoption and dissemination programs must be launched in all over Bangladesh.

Keywords: tractor operating cost, economic parameter, effective scheduling, tractor entrepreneur, Bangladesh

DOI: 10.3965/j.ijabe.20130603.004

Citation: Rahman A, Latifunnahar M, Alam M M. Financial management for custom hire service of tractor in Bangladesh. Int J Agric & Biol Eng, 2013; 6(3): 28－33.

1 Introduction

Bangladesh is predominantly an agricultural country with almost 80% of its total population directly engaged in crop production. For crop production, land tilling is one of the most power intensive operations. Traditional farmers are using animal drawn country plow for centuries in tilling land. This process is very slow and cumbersome in comparison to mechanically powered tilling implements. Almost 95% of land holdings in Bangladesh come below 5 hectares and 80% are less than 2 hectares and often fragmented, thus making the utilization of large mechanical power sources technically ineffective[1]. In pursuit of self-sufficiency in food grains successful execution of multiple cropping, cultivable lands is limited to 9.5 million hectares.

However, with the increase of cropping intensity, the problem of a shorter turn around period between harvesting

Received date: 2013-04-16 **Accepted date:** 2013-07-16

Biographies: Most. Latifunnahar, Graduate Student, Research Interests: Farm machinery, post-harvest technology and renewable energy. Email: dahlia.bau@gmail.com. **Md Monjurul Alam,** PhD, Professor, Research Interests: Agricultural machinery, socio-economics of agricultural machinery, value aided engineering and soil implement mechanics. Email: mmalam.bau @gmail.com.

*** Correspondent author: Anisur Rahman,** Assistant Professor, Research Interests: Farm machinery, machine vision and image processing, automation of agricultural machinery, bio-production engineering, value aided engineering, post-harvest technology and renewable energy. Tel: 8801717605485; Fax: 88091 61510; Email: anis_fpm@bau.edu.bd.

and planting of the subsequent crop or losses due to the timeliness of land preparation is becoming more serious. There are indications of a growing farm power shortage in many districts to the level of 45% in peak demand. On the other hand, cattle population in Bangladesh are declining due to diseases, natural disasters, high price of fodder, low quality of herbs and other factors; thus making the draught power situation worse.

In late 1960s, power tiller and tractor were introduced in Bangladesh agriculture with improved tilling implements. However, they appeared economically unimpressive because of their agrarian structure of the society with various negative factors of production, especially because of the small scale fragmented farms, unequal ownership and absent of consistent governmental policy.

Since early 1980s agriculture situation has begun to change with the increase in cropping intensity, timeliness operations and draught power shortage. The situation demands power intensive mechanical tilling and tractor custom hire service become popular among farmers. In recent years private sectors are importing tractors at a rate of over 3 000 per year and the number has already exceeded 20 000[2].

These tractors are being used for land tilling and local transportation. The wholesalers and retailers of tractor in the country do not have definite capacity building and after sales service programs for the tractor entrepreneurs. During tractor sales, they demonstrate how to operate with very inadequate maintenance instructions to the entrepreneurs. The entrepreneurs are mostly on their own to learn operation, maintenance and financial management of tractors. Therefore, they are always lacking of proper skill for operation, maintenance and financial management of tractor. As a result, the economic life of the tractors become shorter and cause financial loss of entrepreneurs. Considering the problems the study made an attempt to determine the economic parameters and identify effective scheduling for developing a tractor custom hire entrepreneurship.

2 Materials and methods

2.1 Data collection

Secondary data from various sources were used in this study. The main sources of data were from the traders of tractor and machine, journals, published reports and theses. Some essential operational data were collected from primary sources though a survey designed for this purpose.

2.2 Tractor operation cost

Tractor operation cost consists of (a) fixed cost - depreciation, interest on invest, taxes, insurance and housing; (b) variable cost - labour, fuel, oil, repair and maintenance. Three assumptions were considered during calculation of tractor 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 10%.

2.2.1 Fixed cost

Fixed cost is defined as one, which does not change when level of output alters (i.e., it applies to a resource that is fixed in quantity). The straight-line method is the simplest for calculating depreciation and is normally used in budgeting, since the concern is usually only with the average annual cost of machine[3]. Therefore, in calculation of fixed cost, a straight-line depreciation is assumed and the following equation was used for calculating the annual depreciation:

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

where, D = Depreciation, US$/yr; P = Purchase price of tractor, US$; S = Salvage value of tractor, US$; and L = Life of tractor, yr.

The interest on investment in a tractor 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. The following equation was used for calculating the interest on invest:

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

where, i = interest rate, decimal.

2.2.2 Variable cost

The variable cost is one, which changes when the level of output alters. Variable cost depends on hourly labour cost, fuel, oil, repair and maintenance cost and the required working hours for each field operations. The

cost of operator/labour was calculated as the labour rate in US$/hr. The fuel and oil cost was estimated from consumption rate and multiplied by their respective prices.

2.2.3 Operating cost

Annual OC of tractor was divided into fixed cost and variable cost. All calculated fixed cost and variable cost was converted into US$/ha and then summation of fixed and variable cost had given OC in US$/ha. The OC was calculated as follows:

OC, US$/ha = Fixed cost +Variable cost

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 tractor, the funds and their interest have accumulated to an amount that will purchase another tractor. The payment for replacement (PFR) was calculated as follows:

$$PFR = (P - S) \times \frac{i}{(1+i)^L - 1}$$

where, P = Purchase price of tractor, US$; S = Salvage value of tractor, US$; i = Interest rate, decimal; and L = Life of tractor, yr.

2.4 Tractor rent-out charge

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

Rent-out charge (US$/ha) = OC+ PFR + Profit

The profit of the entrepreneur depends on the socio economic condition of the tractor 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 Project appraisal method

For achieving the objectives of the study, the project appraisal technique has been followed to find out the profitability of tractor for owner point of view. Four alternative discounting measures, benefit-cost ratio (BCR), net present value (NPV), internal rate of return (IRR) and payback period are commonly applied for project appraisal[4].

This appraisal is based on four 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 input and outputs are given and constant throughout the project life; and (4) Interest rate of 10% has been assumed for calculating BCR and NPV.

2.5.1 Benefit-cost ratio

Benefit-cost ratio (B/C ratio) may be defined as the ratio of benefits to costs (expressed either in present or annual worth). If the B/C ratio is greater than unity, then it will be economically accepted.

B/C ratio = ∑ Present worth of Benefits (PWB)/
∑ Present worth of costs (PWC)

2.5.2 Net present value

The NPV is a scientific method of calculating the present value of cash flows, both inflows and outflows of an investment proposal, using a discount rate and subtracting the present value of outflows to get the net present value. NPV is calculated by using the following formula:

Net present value = ∑ Present worth of Benefits (PWB) –
∑ Present worth of costs (PWC)

2.5.3 Internal rate of return

The IRR is called Discount Cash Flow (DCF) yield or DCF return on investment or effective rate of interest method or marginal efficiency of capital. The IRR is the value of discount factor when the NPV is zero. The IRR can be computed with the help of this formula:

IRR = Lower discount rate + {Difference between the discount rate × (Present worth of cash flow at lower discount rate/Absolute difference between the present worth of cash flow at the two discount rates)}

2.5.4 Payback period

The payback refers to the time period within which the costs of investment can be covered by revenues. In other words, it is the length of time required for the stream of cash proceeds produced by an investment to equal the initial expenditure incurred. This can be computed by applying the following formula:

Payback period = Investment (total initial, US$)/
Net benefit (US$/yr)

2.6 Scheduling of tractor operation

Tractor mainly used in tilling and transportation purpose. For tilling operation, it takes almost 140 days per year. So for the economic use of tractor, it is needed to use in transportation work. The break-even analysis of tractor operation was used to find out the most

economical hours. According to the land topography, tractor may be used in high, medium and low land depending upon the cropping pattern.

3 Results and discussion

3.1 Operating cost of a tractor

The OC of tractor with implement was found to be 9.25 US$/ha. Fixed cost mainly depends on the purchase price of the tractor with implement. Fixed cost of the tractor was 11% of purchase price of tractor with implement (Table 1).

Table 1 Cost items for estimating the operating cost

Fixed cost	
Depreciation (salvage value =10% of purchase price (P))	$= \frac{P - 0.1P}{20}$ = 0.045 P
Interest on investment (i = 10%)	$= \frac{P + 0.1P}{2} \times 0.1$ = 0.055P
Taxes, insurance and housing (1% of purchase price)	= 0.01P
Total	= 0.11P
Variable cost	
Fuel (US$/hr)	1.94
Lubricant (US$/hr)	0.18
Repair and Maintenance cost (US$/hr)	0.21
Cost of operator (US$/hr)	0.47
Total variable cost (US$/hr)	2.80
Average working hours per year (hr/yr)	1680
Annual use in area (ha/yr)	672
Total	= 7 US$/ha (equal to 2.80×1680/672)

Variable cost of the tractor was 7 US$/ha of the area. Therefore, a tractor entrepreneur can determine the OC (US$/ha) of a common agricultural tractor (35 hp) with the following expression:

Tractor OC = Fixed cost (US$/ha) + Variable cost (US$/ha)

= 11% of purchase price/Annual use of tractor in hectare + 7 US$/ha of the area

= 0.11 × 13820/672 + 7 = 9.25 US$/ha

3.2 Payment for replacement

The entrepreneur has to save 219 US$ per year in a bank account so that the entrepreneur can buy a new tractor when the economic life of old tractor expires.

$$PFR = (P - S) \times i/[(1 + i)^L - 1] = (13\,820 - 1382) \times 0.1/[(1 + 0.1)^{20} - 1] = 219 \text{ US\$ per year}$$

3.3 Tractor rent-out charge

A tractor entrepreneur can determine the rent-out charge of a common agricultural tractor (35 hp) with the following expression:

Rent-out charge = OC (US$/ha) +PFR (US$/ha) + Profit (US$/ha) = 9.25 + 219/672 + 2 = 11.58 US$/ha

3.4 Measuring financial analysis

The financial analysis in this study was computed from the viewpoint of tractor 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 tractor is highly profitable. The result shows that the BCR for tractor is 1.36 that is higher that unity. Considering 10% interest rate, the NPV of the tractor in exiting condition is US$ 18 757. The NPV of tractor indicates that tractor is considered financially sound and the project is said financially viable because IRR (36.96%) of the tractor was greater that the bank interest rate. Payback period is 2.03 yrs. In view of these circumstances, the financial analysis showed that tractor was highly profitable from the viewpoint of individual investors.

3.5 Scheduling of tractor operation

Economic use of a tractor depends on maximum utilization of its capacity within an operating condition. For this, the conditions under which the tractor operates must be identified first, and then options for utilizing the tractor of its fullest capacity would be taken into account. At present, tractors are used mainly for tilling and transportation purposes. A balance scheduling is needed among the activities and the time span for each of them so that economic use of the tractor is ensured. The topography of land, cropping pattern, diversified crop production, etc., also has effect on the demand of tractor in different time and time span. Therefore, to meet the demand of tractor in different time and season in the nearer areas of the entrepreneur, a scheduling of tractor use is necessary for its economic utilization.

3.5.1 Economic use of tractor

Direct comparison between the OC and revenue of tractor operation is shown in Figure 1. The analysis shows that the minimum tenure for an economic use of a

common tractor used in agriculture is about 6 310 hrs. Above this critical use, the utilization of a tractor is economical for a tractor entrepreneur.

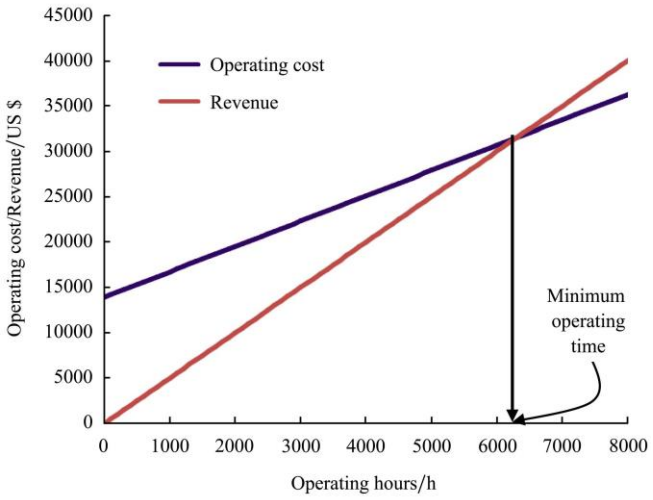

Figure 1 Economic use of tractor operation

Depending on the cropping pattern, two major and one minor turn-around periods are available in between cropping seasons for tilling operation. The time available for land tilling is estimated about 140 days at 12 hrs a day in a year. The tractor custom hire service entrepreneur must have a schedule for utilizing the tractor more than the minimum operating hours estimated for tilling, transportation or other purposes.

3.5.2 Scheduling based on topography, cropping pattern, diversified crop production, etc.

Depending on topography, cultivable land can be classified as high, medium and low in elevation. Cropping pattern and diversified crop production also depend on the topography of land, fertility of land, availability of water resources for irrigation, etc. The same factors also influence the demand of tractor for tilling in different time and season. For example, medium elevation cultivable land demand tilling operation earlier in Boro season after recession of rainwater, followed by low land. For Aman season, low and medium lands demand tilling operation earlier at first rain or with irrigation, followed by high land. Even in monsoon the higher elevation cultivable land demands tilling operation. A tractor custom hire entrepreneur must acknowledge these various demand and schedule tractor operation accordingly to maximize its operation and economic use.

4 Conclusions

1) Estimation of tractor OC is important economic aspects for sustainable tractor custom hire service entrepreneurship. A simple and easy way of estimating OC of tractor (US $/ha) for entrepreneur would be:

Tractor OC (US$/ha) =

= (11% of purchase price/Annual use of tractor in hectare) + 7 US$/ha of the area

2) For replacement of the existing tractor on expiry of economic life, the entrepreneur has to save an amount of US$ 219 per year in a bank account. Based on the OC, annual savings for replacement and a profit margin for the entrepreneur, the rent-out charge of the tractor is estimated as 11.58 US$/ha.

3) Considering 10% interest rate, the NPV of the tractor at exiting conditions is US$ 18 757. The NPV of tractor indicates that tractor entrepreneurship is considered financially sound and the project is said financially viable. The average IRR was 36.96%. In view of these circumstances, the project is financially viable because IRR of the tractor was greater than the bank interest rate and highly profitable from the viewpoint of individual investors. The payback period of tractor with implement was determined as 2.03 yrs.

4) The minimum tenure for an economic use of a common tractor used in agriculture is about 6 310 hours. Above this critical use, the utilization of a tractor is economical for a tractor entrepreneur. Depending on the cropping pattern, two major and one minor turn-around periods are available in between cropping seasons for tilling operation. The time available for land tilling is estimated about 140 days at 12 hrs a day in a year.

5) Considering the socio-economic conditions of the farmers and high initial cost for owning tractor with implement, special agricultural credit should have to be extended to small and marginal farmers and potential entrepreneurs. Public and private sector financial institutions may come forward to extend this credit facility.

[References]

[1] Statistical year book of Bangladesh (BBS). Bangladesh Bureau of Statistics, Statistical Division. Government of the People's Republic of Bangladesh, 2008.

[2] Alam, M. M. *et al*. Booklet on mechanization-its trend and opportunities in the agricultural production system in the SAARC countries. 2010; Farmgate, Dhaka, Bangladesh: SAARC Agriculture Centre.

[3] Barnard C S, Nix J S. Farm planning and control (2nd ed.). 1980; London-New York-Melbourne: Cambridge University Press, Cambridge, United Kingdom.

[4] Gittinger J P. Economic analysis of agricultural projects. 1994; Jhon Hopkins University Press, Baltimore.

[5] White J A, Agee M H, Case K E. Principles of Engineering Economic Analysis (3rd ed.). 1989; London-New York-Melbourne: John Wiley & Sons, Incorporated.