Analysis of Government Supported Farm Machinery Custom Hiring Services in Bhutan

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ABSTRACT

Custom hiring services have been institutionalized with the creation of the Farm Machinery Corporation Limited. It is being implemented nation-wide to accelerate mechanized farming. The charges levied on the farmers are highly subsidized. This study was undertaken to assess the hiring costs, commercial viability of the operation and rationalize the rates and subsidy components. The cost of operation of farm machinery under government programme is divided into two sub costs (I) Fixed Cost and (II) Variable Cost, and government endorsed parameters were used for the custom rates calculation for different machine through regression analysis. An analysis of breakeven point on present endorsed hiring rate was done to ascertain the economic trend of this activity. Government subsidy on each machine operation is also shown. The analyses provide a positive outlook for the machine owners and corporations to take up the hiring scheme based on nationally endorsed parameters. The custom hiring analysis also gives a good guide on the custom hiring rates to be charged based on the operating days.There is more profit especially on tractors and mini combine harvesters compared to other machines. This is a favourable business opportunity. However, there is also an opportunity to reduce the custom rates to bring down the overall cost of farming using machine and reduce burden on government subsidy. It will also encourage private sector participation in the programme.

Keywords: *Farm machinery, Custom hiring rate, Break-even point, Subsidy*

1. Introduction

Agriculture is the primary sector in Bhutan with 58% of the population depending on it for their livelihood (MoLHR, 2016). To a large extent, farming is performed manually and through animal draft power. Higher forms of mechanization are limited due to rugged terrain. Due to increasing farm labour constraints, major efforts are being initiated by the government to promote farm mechanization activities in the country. One prominent intervention has been the supply of labour-saving agricultural machines mainly to individual farmers at subsidized prices including after-sales services. Although the supply of the machines brought tremendous benefits to the farming communities, the financial burden on the government increased substantially. Besides, the system of individual ownership did not result in optimum use of the machines. Machines therefore,

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remained extremely underutilized while the demand kept increasing rapidly. There is also the low-income groups of farmers who combined with low land holdings, can neither afford nor economically justify the investment in machines individually. On the other hand, the encouragement of private community group ownerships has not resulted in adequate rate of adoption (AMC, 2019).

In order to provide services to as many farmers as possible while simultaneously enhancing efficient utilization, farm machinery hiring services were initiated. Although the initiative had been taken up by the Agriculture Machinery Centre (AMC) many years ago, major up-scaling of the activities started from 2016 with the establishment of the Farm Machinery Corporation Limited (FMCL). It is also anticipated that the private sector hiring services will pick up gradually, thereby reducing the need for continued state support. The corporate hiring services currently being at the promotional stage, the rates applied constitute substantial subsidies, which the government provides to the corporation.

There is huge demand for farm machinery such as power tillers and tractors for primary and secondary tillage operations. Considerable demands still exist with preference for individual ownership although the land holdings do not justify it and that most do not provide hire services. This trend needs to be discouraged through awareness on the economic cost analysis and hiring system. Chahal and Malhi (2005) studied the societies of Ludhiana and Moga and found that the annual use of implements like disc-harrow, seed drill and bund former in the societies was 10 times more than that of farmers owned. The machine owners need to be educated that hiring out their machines is a profitable business and is also more economical than owning them if their individual land holdings are small. Chaudhary (2006) reports that average total running cost of tractor by individual ownership was Rupees 574.69 per hour whereas the cooperative societies cost was 39% lower than the total cost per hour of tractor. Verma (1985) conducted a study on farm size and economic efficiency in Punjab. The study showed that large farms gained much more in terms of economic efficiency as compared to the medium and small farms which gained only 43.04% and 17.02%. This was because large-scale farmers had better machinery while small farmers could not afford it. So there is good scope for custom hiring of machinery for small farmers. There is a stipulated time available for each operation in each season which makes it all the more imperative to calculate machine requirements and economically study the cost of operation.

Presently, hiring in Bhutan is not at the commercial scale and the informal hiring practiced is purely based on the convenience of the machine owners, and hiring rates are informal without any basis. Hence, it has become important to come up with a study on the hiring rates to be recommended to the farmers.

This study is to review the present government hiring rates using the break-even analysis and assess the true margin, and come up with recommendations for the future on the required government subsidies.

2. Material and Methods

The costs of operations of farm machinery are divided into two sub costs (I) Fixed Cost and (II) Variable Cost, where fixed cost is independent of operational use while variable cost varies proportionately with the coverage area or the machine use. The main components of the fixed and variable costs are given below.

1) Annual Fixed Costs
    i)   Depreciation cost
    ii)   Interest on investment
    iii)   Insurance cost
    iv)   Shelter cost for the machine
    v)   Registration cost
2) Annual Variable Cost
    i)   Fuel cost
    ii)   Lubrication cost
    iii)   Labour wages
    iv)   Repair and maintenance cost

2.1 Calculation of the Fixed Cost of farm machinery

i)   Depreciation cost

According to Kepner et al. (2005), the annual depreciation was calculated as

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

Where
D: Yearly depreciation, the annual decrease in the value of the machine
P: Purchase price of the machine
S: Salvage value or the selling price of the machine after its useful life and normally adopted as 10 % of the machine price
L: Useful life of the machine

ii)   Interest on investment: It is normally the interest amount that can be generated from a fixed deposit. In Bhutan, the maximum interest generated through fixed deposit is 7.5% (BoBL, 2019).

According to Kepner et al. (2005) and Khairo et al. (2009) the annual interest on the investment is calculated as follows:

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

where, I=Interest amount, i= Annual interest rate for buying a machinery

iii) Shelter: This is the cost associated with having a shed used primarily to house the machinery. Shelter cost is calculated at 1.5% of the purchase price of the machinery

$$Sc = \frac{1.1P}{2} \times \frac{is}{100}$$

Where Sc=Shelter cost, is = Hiring cost of the shelter (1.5% per annum for the agricultural use).

iv) Insurance and taxes: It is the amount spent on insurance every year as these machines need to be insured as they are movable machines and are prone to eventualities like accidents.

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

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

V) Registration cost: It is calculated as Nu 1000 per year as the renewal and registration cost for farm machinery in Bhutan.

2.2 Calculation of variable cost of the farm machinery

i) Fuel Cost
For simplicity, fuel cost was calculated as:
Fuel cost (Nu h^{-1}) = fuel price (Nu L^{-1}) x Fuel consumption (L h^{-1})

ii) Lubrication oil cost
Average lubrication cost = 1.5% of fuel cost (Nu h^{-1})

iii) Repair and maintenance cost
According to Kepner et al. (2005) it is taken 2.5% of the purchase price. However, for Bhutanese terrain, 20 % is proposed as the repair needed is frequent.
RM = 20 % x Purchase price of farm machinery (Nu)

iv) Operator and labour wages
The labour cost. It is assumed as Nu 700 /day
Labour cost = Number of days x Labour charge (Nu d^{-1})

2.3 Analysis

Cost of operation is the cost involved in the operation of the machine in the field

$$CoO = \frac{TotalAnnualCost\ (\frac{Nu}{year})}{Capacity\,of\,the\,machine\ (\frac{acre}{year})}$$

Where total annual cost includes both fixed cost and variable cost. The capacity of the machine refers to its capacity in a year.

v)   Overhead cost: It includes the cost involved in arranging the operation from office, power, office rent, telephone calls, the machines transportation cost to the field and off the field, etc. It is adopted as 15% of the cost of operation of the machine. The value adopted is normally 10% overhead and a contingency of 5% of the operation cost per day is incorporated.

vi)   Profit Margin: The profit margin is adopted at 10 % of the cost of operation, which is the difference between the cost and the rate charged.

vii)   Hiring rate: It is inclusive of the cost of operation, overhead cost involved and the profit margin. This is the rate chargeable for a quantity of service based on days, hours or area covered, provided to the client receiving the service.

viii) Break-even point analysis: Break-even point (BEP) is the point at which the total hiring cost is equal to the total costs. It is also frequently calculated in terms of area coverage

ix) $$BEP = \frac{(Fixed cost)(\frac{Nu}{year})}{\left[(Hiring cost)-(Variable cost)(\frac{Nu}{(h)(acre)(year)})\right]}$$

x) The hiring charges in Nu/h and break even in hours can be calculated. This can be done

$$Custom\ rate\left(\frac{Nu}{h}\right) = \frac{Nu/acre}{acre/h}$$

Where Nu/acre is the custom rate in acre and acre/h is the field capacity of the farm machinery. The nationally approved parameters based on the actual field results and experiences had been adopted for calculation as shown in Table 1.

Table 1. Hiring cost parameters for custom hiring analysis

Description	Power tiller	Tractor above 34hp	Tractor 34hp	Tractor 18hp	Paddy reaper	Combine harvester	Paddy Transplanter	Water pump	Mini Tiller
Initial Cost	302,839	1,300,000	1,000,000	800,000	130,000	1,300,000	150,000	252,927	257,000.00
Life of machine in years	10	10	10	10	6	10	6	10	10
Operating hours/day	8	8	8	8	8	8	8	8	8
Operating days /year	70	70	70	70	20	50	20	30	50
Operating hrs/year	560	560	560	560	160	400	160	240	400
Capacity (acre/h)	0.1	0.3	0.25	0.18	0.3	0.3	0.3	0.25	0.06
capacity of the machine per year (acre/year)	56	168	140	100.8	48	120	48	60	24

The parameters were endorsed by the Ministry of Agriculture and Forests' (MoAF) price fixation committee (AMC, 2019) based on the past years' operating costs and expenses of the hiring operation as shown below.

Table 2. Revised and approved parameters for operating cost

Description	Revised criteria	Remarks
Repair/ year	20% of the from initial cost	Spare parts and transportation are expensive
Fuel cost (Nu/L)	60	The cost of diesel fuel as of today
Lubrication cost	1.5% of fuel cost	Its a standard requirement to change
Operator charge (Nu/day)	700	Operator wages. Still the labour cost in western region is more expensive
Transportation during hiring	10% of operation cost	Should be met from hiring
Overhead cost	10% of operation cost	Previous is very high
Contingency cost	5% of the operation cost	Accidents, natural calamities affects are included
Profit Margin	10% of operation cost	Hiring should be sustainable and continued
Total variable cost % range	55%	

Based on above parameters, a regression analysis was conducted for all farm machinery and graphs plotted to come up with trends of the hiring rates based on the operation duration.

3. Results and Discussion

3.1 Custom hiring rates for different machines

The operating cost of different farm machines shown in graphs provide the hiring cost/day based on the operating days in a year. The empirical formula through regression had been generated. However, agricultural work is seasonal and during the season everyone require machines at the same time. This substantially limits the duration of the use of the machines in a year. More machines are needed at the same times due to the seasonal nature of agricultural work.
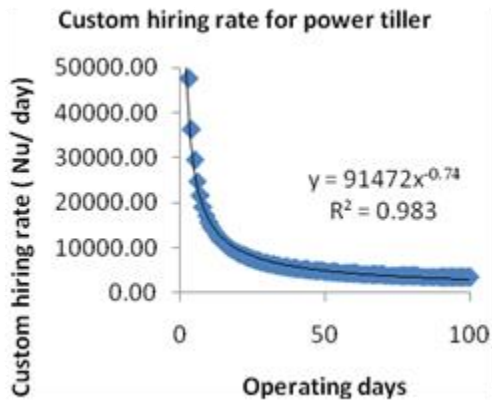
Figure 1. Custom rate for power tiller

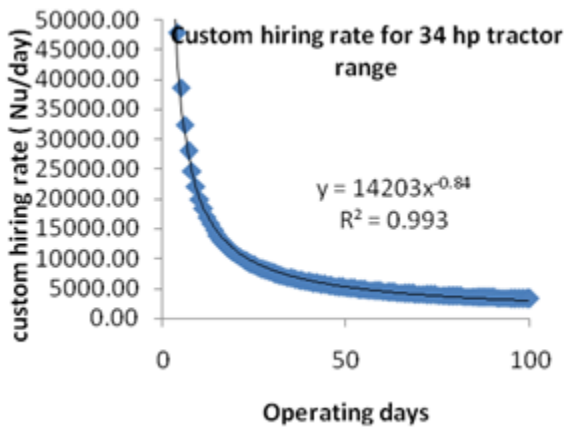Figure 2. Custom hiring rate for 18 hp tractor

Figure 3. Custom rate for 34 hp tractor

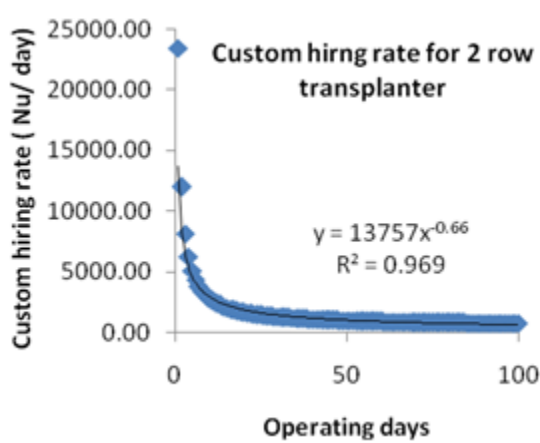Figure 4. Custom rate for 34hp and above

Figure 5. Custom rate for transplanter

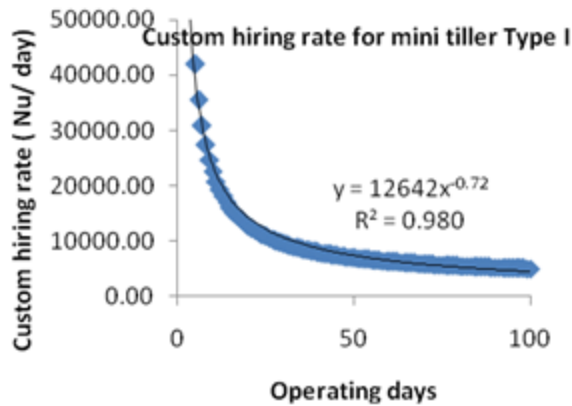Figure 6. Custom rate for mini combine harvester

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Figure 7. Custom rate for mini tiller I
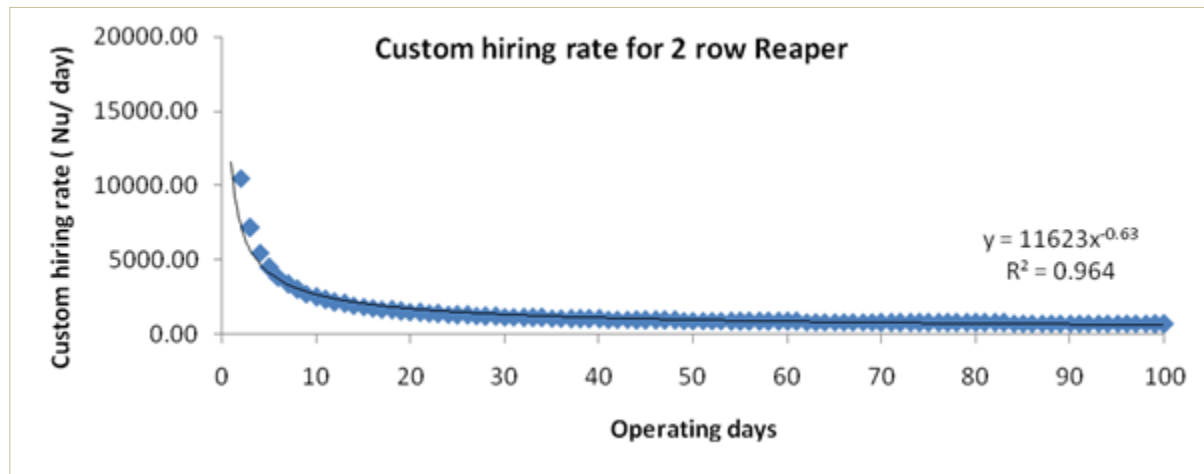

Figure 8. Custom rate for mini tiller II

Figure 9. Custom rate for 2 row reapers

3.2. Determination of economic feasibility of farm machinery

After calculating the BEP, it is observed that most of the farm machines under the hiring scheme have BEP less than their annual operating days and uses i.e. the net annual usage of machinery after the BEP is positive (where the net annual usage = adopted annual operating days/ year – BEP of machinery). If the net annual usage is positive, the hiring of that machine is positive.

At present hiring rates endorsed by government for the Farm Machinery Corporation Limited (FMCL) is positive and can make profit as shown in Table 3. The graph of annual profit or loss is plotted as shown in Figure 10. From it, it is observed that tractors and combine harvesters make maximum profits annually at the present endorsed parameters. A tractor alone makes a profit of

around Nu. 0.5 m in a year. Other machines are all making profit, which is good for the hiring scheme as shown.

Table 3. Breakeven point analysis of farm machines

| Parameters	Power tiller	Tractor above 34hp	Tractor 34hp	Tractor 18hp	Paddy reaper	Combine harvester	Paddy Transplanter	Water pump	Mini Tiller
Initial Cost (Nu)	302,839	1,300,000	1,000,000	800,000	130,000	1,300,000	150,000	252,927	257,000
Operating days /year	70	70	70	70	20	50	20	30	50
Actual operation cost/day (Nu)	3376	12044	9018	7000	4427	13179	4900	3301	3862
Breakeven Point (days/year)	22.6	27.9	28.4	29.0	9.2	20.3	9.4	14.1	15.8
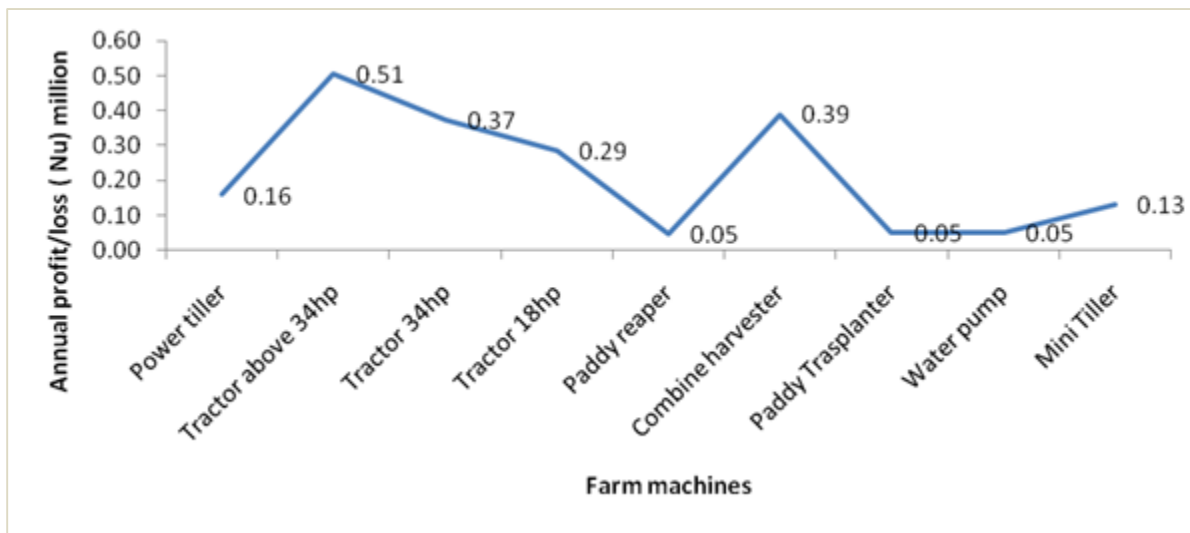
Figure10. Annual profit/loss of various common machines

Private hiring services also prevail very effectively although net amount of the charges on the farmers are double of the FMCL's rates. There is the potential for reducing the custom hiring rates specifically for these machines by reducing the subsidy components to encourage the private sector participation eventually. The income generation situation further improves for machines like tractors, in case the number of working days per year includes those for non-agricultural purposes.

3.3 Subsidy support from government

Table 4: Subsidy component from government side for hiring

Description	Power tiller	Tractor above 34hp	Tractor 34hp	Tractor 18hp	Paddy reaper	Combine harvester	Paddy Transplant	Water pump	Mini Tiller
Custom hiring rate to farmers	1500.00	3800.00	2900.00	2300.00	2200.00	4400.00	1300.00	2500.00	1300.00
Custom hiring rate	3376.00	12044.00	9018.00	7000.00	4427.00	13179.00	4900.00	3301.00	3862.00
Subsidy from Government (%)	55.57	68.45	67.84	67.14	50.31	66.61	73.47	24.26	66.34

The government is promoting this hiring system in a very concerted effort which can be clearly visible through the subsidy percentage. For major machines, the subsidy is more than 55% which is indeed very good in one hand and also high considering the private hire services are also availed by farmers without subsidies.

4. Conclusion

The analyses give a positive outlook for machine owners and FMCL to take up hiring scheme as it is still very profitable based on the nationally endorsed parameters. The custom hiring rates also provide a useful guide on the custom hiring rates to be charged based on the operating days.

With the present endorsed hiring rates and parameters adopted for assessment by the government, the FMCL is making substantial profit especially through the hiring of tractors and combine harvesters. This is a potential scope for business for any enterprise wanting to venture into this sector. However, there is also an opportunity to reduce the total custom rates to bring down the overall cost of farming as the private rates for similar machines are still low.

Acknowledgement

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