



**Research Paper**

# Breakeven analysis of custom hiring service centres operating in agriculture – An economic study in Karnataka

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**ABSTRACT :** The present study has been carried out in Eastern dry of Karnataka with objective of analyzing the feasibility of CHSCs and to document the farm machinery generating higher incomes to CHSC in the study region. The primary data for the study has been collected from the 30 custom hire service (CHS) providers comprise of government sponsored CHSCs operated by NGOs and private firms and farmers owning farm machinery for CHS in the study region by following purpose multi-stage random sampling procedure. The study highlighted that the farmer CHS providers own farm machinery which are having greater demand from the users and able to generate higher profits in shorter period of time. The break point analysis showed all the machinery owned by farmers is capable of generating higher incomes. While in case of government sponsored CHSCs, the breakeven point analysis showed that some of the implement such as brush cutter, ground nut pod stripper, power tiller, ragi reap and rotary tiller were unable to cover even the fixed and variable costs occurred an account use of these machinery. It indicates owning these machineries/implements are unworthy and can think of replacing these with the machineries which are in great demand from the farmers.

**KEY WORDS:** Custom hire services, CHSCs, Farm machinery, Farm mechanization, BEP

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## INTRODUCTION :

Agriculture labour is a major input in production process. An increasing cost for maintenance of draft animal and growing scarcity of farm labour has created new challenges in competitive productive system. The basic requirement to meet this competition is to reduce labour usage and maximize labour productivity which depends greatly on the availability and judicious use of mechanized power by the farmers. As a result, a gradual shift from dependence on human and animal power to

mechanical power in agriculture sector over a period was observed (Singh *et al.*, 2013).

Mechanization is observed largely in the large agricultural holders and still beyond the reach of small/marginal holdings which constitute around 80 per cent of the total agricultural land holdings. The inadequacy of farm power and machinery with the farm-operators and particularly with the marginal and small farmers, has always been perceived as one of the major impediments to increasing agricultural production and productivity (Anonymous, 2015a and b). This is due to the fact that

the small/marginal farmers, by virtue of their economic condition are unable to own farm machinery on their own or through institutional credit which calls for government and others agencies or manufactures of farm machineries and equipments to promote farm mechanization.

The government is promoting farm mechanization through subsidies to purchase farm machinery and equipment and to establish custom hiring service centres. In several states many private firms (Cormandal, Mahindra, John deere and etc.) have initiated the custom hiring services of farm machinery and equipments to farmers who expect services at cheaper rate than those offered by informal sources (Anonymous, 2016). The custom hiring services have the peculiarity of spreading the equipment ownership costs over a larger area (Bansal and Mukesh, 2010 and Anonymous, 2015a). It was found that custom hiring services have enough scope for providing better implements to farmers at competitive rates.

Karnataka is one of major agricultural production zone facing sever labour shortage and have scope for establishment of CHSC to promote farm mechanization. However, the farmers were availing farm machineries and equipment from various informal institutions such as private firms and farmers owning farm machineries and equipment on rental basis. These informal sources have higher rental charges for the machinery services and also unable to meet the farm machinery needs of farmers especially small, marginal and medium farmers during peak seasons (Hiremath *et al.*, 2015). Therefore, in order to bring farm machinery available within the reach of small/marginal holdings the Government of Karnataka has promoted custom hiring and service centres in a big way. Keeping this in view the present study has been undertaken in Eastern Dry Zone of Karnataka with objective of analyzing the feasibility of CHSCs and to document the farm machinery generating higher incomes to CHSC in the study region.

## MATERIALS AND METHODS :

### Sampling procedure:

A purposive multistage random sampling procedure was employed for the selection of study area. In the first stage, three districts namely Kolar, Chikkaballapur and Tumkur districts of Eastern Dry Zone of Karnataka were purposely selected since based on the preliminary survey it was found that the region is facing severe labour shortage and higher farm labour wage rates causing

increased cost of cultivation which can be minimised thorough mechanization. In the second stage, from each selected district one taluka such as Mulbagal from Kolar, Siddlagatta from Chikkaballapur and Gubbi from Tumkur districts were selected. In the final stage, the sample of 10 CHS providers from each taluka was interviewed. One NGO operated and private firm operated CHSC from each taluka and four farmers providing CHS from each taluka were selected for the study. Thus, the total sample size constitutes 30 suppliers of custom hiring services providers.

The custom hire service (CHS) providers can be classified in to formal and informal institutions. The formal CHS providers comprise Model I which represents the government sponsored NGO operated CHSCs and Model II which represent government sponsored private firm (John deere in Kolar and VST tillers and tractors in Chikkabalapur and Tumkur) operated CHSCs. The informal institution comprise of Model III represents the farmers owning farm machinery for hire purpose only (own usage is negligible) and Model IV represents the farmers owning farm machinery for both hire and own farm usage.

### Analytical technique used :

The breakeven point analysis was carried to analysis the feasibility of the custom hiring service centre (CHSC) and to know the farm machinery which is more worthy to place in the CHSCs. Breakeven point (BEP) is the point at which the total revenue is exactly equal to the total costs. At this point no profit is made and no losses are incurred. BEP can be expressed in terms of the hiring hours *i.e.* it represents the number of units required to cover the costs. Hiring hours above that number results in profit and below that number results in loss. BEP was calculated in terms of the fixed costs, variable costs and hiring charges. Breakeven point analysis per CHSC as a whole and for individual equipments were worked out using the following formula:

$$BEP = \frac{\text{Fixed cost (Rs. / year)}}{[(\text{Hiring cost})_i - (\text{Variable cost})_i (\text{Rs. / h})]}$$

where,

*i* = Type of the implement like cultivator, seed drill, MB plough etc.

### Calculation of annual fixed cost of the farm machinery :

*Amortization of establishment cost:*

To get the apportioned investment made to establish

each CHS model (CHSC), it is amortized using the formula:

$$A = P \frac{r(1+r)^n}{(1+r)^n - 1}$$

where,

A = Amortized cost per year

P = Total establishment cost

r = Interest rate per period, r is taken as 9 per cent (based on commercial banks prevailing fixed deposit rate)

n = Total life of CHSC (machinery/equipment or other assets).

*Interest on investment :*

According to Hunt (2001), Annual interest on the investment is calculated as follows:

$$I = \frac{P-S}{2} \times \frac{i}{100}$$

where,

P = Purchase value of the machinery

S = Salvage value

I = Annual interest rate

i = 11.5 per cent because term loan is being given at this rate of interest.

Therefore, total annual fixed cost (TAFC) = Amortized establishment cost + Interest on the investment + rent paid to shed/site and insurance premium.

### Calculation of the variable cost of the farm machinery:

*Fuel cost :*

The fuel cost depends upon specific fuel consumption, horse power of tractor and fuel price:

$$\text{Fuel cost (Rs. /hr)} = \text{Fuel price (Rs. /lit)} \times \text{Fuel consumption (lit/hr)}.$$

*Repair and maintenance cost :*

According to the Kepner *et al.* (2005) the repair and maintenance estimated by taking a percentage of the purchase price. The repair and maintenance was a product of machine's cost price and repair and maintenance percentage factor (0.025) and expressed as follows:

$$RM = (2.5\%) \times \text{Purchase price (Rs. per year)}$$

where,

RM = Repair and maintenance cost (Rs. per year).

*Lubrication oil cost:*

It can be determined depending upon the

maintenance cost or depending upon the oil price or oil consumption.

Average lubrication cost = 1.5 per cent of fuel cost (Rs./ h).

*Operator and labour wages :*

The labour cost (Rs.) was the product of number of labour required for number of days for any operation and labour charges per person per day. It was given by following formula :

$$\text{Labour cost} = \text{Number of days} \times \text{Labour charges (Rs./day)}$$

Therefore, total variable cost (TVC) = Fuel cost + Repair and maintenance cost + Lubrication Cost + Operator and labour wages + tractor attachment charges.

### Annual use (h) of an implement :

Total annual use (h) of an implement can be calculated by the total amount earned by a particular implement divided by the hiring charges of the implement or machine.

$$(\text{TAUH})_i = \frac{\text{Total annual earned by the } i^{\text{th}} \text{ implement (Rs./year)}}{\left[ \frac{(\text{Number of } i^{\text{th}} \text{ implements})^*}{(\text{Hiring cost of the } i^{\text{th}} \text{ implement Rs./h})} \right]}$$

where,

(TAUH) i = Total annual use (h) of i<sup>th</sup> implement under hiring.

## RESULTS AND DATA ANALYSIS :

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

### Breakeven point analysis of CHS providers operating in EDZ :

Breakeven point (BEP) is the point at which the total revenue is exactly equal to the total costs. At this point no profit is made and no losses are incurred. BEP for the entire CHSC was calculated in terms of the fixed costs, variable costs and hiring charges of the CHSC. The fixed costs components comprises amortized establishment cost, rent paid to shed/site, insurance premium and interest on investment. The variable costs comprise the operator charges, fuel charges, repair and maintenance costs, water and electrical charges and miscellaneous costs.

**Breakeven point of formal CHS providers operating in EDZ:**

Breakeven point of machineries and equipment owned by formal CHS providers is given in Table 1. It is clear from the table that the NGO operated CHSC (Model I) in needs to attract at least 22,306 hrs of farm machinery services from farmers to cover fixed (Rs. 692678 per year) and variable costs (Rs.358 per hr) occurred in the year otherwise the CHSC will incur loss. At present this CHSC is receiving only 5328 hrs of demand from farmer’s shows CHSC is operating under loss. The Mercury/John Deere operated (Model II) CHSC has to get 2740 hrs of demand for farm machinery and equipment from farmers to reach the breakeven point. However, this CHSC is receiving more than BEP hours of demand from the farmers indicates it is operating with profits in Kolar.

Further, the Model I requires 3237 hrs and 3842 hrs of demand from the farmers in Chikkaballapur and Tumkur districts, respectively to achieve BEP. The Model II need to attract 516 and 318 hrs of demand for machinery services to reach BEP in Chikkaballapur and Tumkur, respectively. It can be concluded that the Model II of Kolar requires less machinery hours to reach BEP *i.e.* 2740 hrs compared to other formal CHS provider. Since this CHS provider incurred lower fixed costs (Rs. 562348/year) and variable costs (Rs. 312/ hour) compared to other formal CHS providers operating in EDZ.

**Breakeven point of informal CHS providers operating in EDZ:**

The breakeven analysis of informal CHS providers

has been given in Table 2. The annual fixed cost was Rs. 2,23,552, Rs. 3,00,445 and Rs. 2,84,603, respectively in Kolar, Chikkaballapur and Tumkur districts while the variable cost per hour was Rs. 337, Rs. 306 and Rs. 270 in Kolar, Chikkaballapur and Tumkur districts respectively. The Model III requires 389,578 and 535 hrs of demand for machinery services from farmers to reach breakeven point in Kolar, Chikkaballapur and Tumkur district, respectively.

The Mode IV need to get demand for machinery hours of 447, 516 and 386 hrs in Kolar, Chikkaballapur and Tumkur districts, respectively. From the breakeven analysis it is clear that the Model IV requires less machinery hours to reach the BEP, since the fixed cost incurred by Model IV is relatively low compared to Model III. However, all the informal CHS providers are operating under profit except in the case of Model IV in Kolar district.

**Breakeven point (BEP) of individual farm machineries and equipment owned by formal CHS providers :**

The Table 3 presented the breakeven point of individual machineries and equipment owned by formal institutions (Model I and II). After calculating the BEP, it is observed that around 50 per cent of implements have BEP more than their annual use *i.e.* net annual usage of machinery after the BEP is reached is positive [(where net annual usage after BEP (h) = Annual use of machinery (h) - BEP of machinery (h)] and if the annual usage > BEP *i.e.* net annual usage is positive, implement provide profit and vice versa. It is clear from the table that fixed

**Table 1: Breakeven point of formal CHS providers operating in EDZ**

District	Model I					Model II				
	Fixed cost (Rs./year)	Variable cost (Rs./hr)	Hiring price (Rs.hr)	Annual hiring (hrs)	BEP (hrs/year)	Fixed cost (Rs./year)	Variable cost (Rs./hr)	Hiring price (Rs.hr)	Annual hiring (hrs)	BEP (hrs/year)
Kolar	692678	358	389	5328	22306	562348	312	518	3215	2740
Chikkaballapur	737215	143	371	13887	3237	597665	215	382	6299	3571
Tumkur	650968	219	389	7076	3842	638670	277	400	3443	5185

**Table 2: Breakeven point analysis of informal CHS providers operating in EDZ**

District	Model III					Model IV				
	Fixed cost (Rs./year)	Variable cost (Rs./hr)	Hiring price (Rs.hr)	Annual hiring (hrs)	BEP (hrs/year)	Fixed cost (Rs./year)	Variable cost (Rs./hr)	Hiring price (Rs.hr)	Annual hiring (hrs)	BEP (hrs/year)
Kolar	223552	337	912	2664	389	103121	469	700	437	447
Chikkaballapur	300445	306	826	3143	578	107430	518	726	649	516
Tumkur	284603	270	802	2762	535	100810	441	702	520	386

cost per year in cultivator was Rs.4285 and variable costs comprise of fuel charges, lubricant charges and manual labour per hour is Rs.103 and it requires at least 14 hrs to recover the fixed cost and over and above 14 hrs the implement earns profit otherwise incurs loss means it is unworthy to own such implements. The same interpretation holds for all the implements.

The machinery or equipments such as cultivator, disk plough, furrow opener, harrow, leveller, rotary weeder, rotovator and single MB plough, the annual use of machinery comes more than the BEP. *i.e.* net annual usage of machinery after BEP is positive means these machinery and equipments provide profit to CHSC. The FME such as brush cutter, ground nut pod stripper, seed cum fertilizer drill, power tiller, ragi, reappear, rotary tiller and trolley were having less annual use than the BEP which causes loss of profit shows that these machineries or implements are having least demand from the farmers. However some of the machineries like trolley, seed cum fertilizer drill and many other were having greater demand from the farmers, the formal institutions were not able to supply because of the frequent breakdown of these machineries, high maintenance cost, lack availability of machine operator and more demand for other equipments during the same period which requires more skilled operators.

At least 14 hrs of annual usage is required to reach the breakeven point of cultivator, disk plough (13 hrs/

year), furrow opener (13 hrs/year), harrow (9 hrs/year), leveller (7 hr/year), rotary weeder (23 hr/year), rotovator (34 hrs/year) and followed by others. The net annual usage after BEP were higher in single MB plough which is 450 hrs/year followed by furrow opener (409 hrs/year) and others. The breakeven point of individual farm machinery and equipment owned by formal CHS models were shown in Fig. 1. The highest profit were received in single MB plough of Rs. 2,47,516/year followed by furrow opener Rs. 204614/year and others.

### Breakeven point (BEP) of individual farm machineries and equipment owned by informal CHS providers :

Breakeven point of individual farm equipment owned by informal CHS provider (Model III) is given in Table 4. The annual usage of all machineries and equipments were found to be more than BEP except in case of rotary tiller. The breakeven of cultivator requires 10 hrs per year in informal institutions compared to 14 hrs per year in case of formal institutions and same pattern has been observed in all other implements. However, the fixed cost were merely similar in both formal and informal CHS providers, for instance in cultivator, the fixed cost was Rs.4285 and Rs.4698 per year in formal and informal CHS providers, respectively while the variable cost incurred was relatively higher in informal CHS providers (Rs.120/hr) than formal CHS provider (Rs.103/hr). Due

**Table 3: Break-even point of individual machinery and equipments owned by formal institutions**

Sr. No.	Particulars	Fixed cost (Rs./year)	Variable cost (Rs./hr)	Hiring price (Rs./hr)	Annual usage (hr/year)	BEP (hr/year)	Net use of implement after BEP (hr/year)	Profit and loss (Rs./year)
1.	Cultivator	4285	103	400	396	14	382	152627
2.	Brush cutter	9069	152	250	18	93	-75	-18707
3.	Disk plough	3927	169	475	356	13	343	163010
4.	Furrow opener	4441	152	500	422	13	409	204614
5.	Ground nut pod stripper	22594	116	300	16	123	-107	-32083
6.	Harrow	2611	103	400	403	9	394	157683
7.	Leveller	1714	103	350	24	7	17	5970
8.	Power tiller	44688	136	400	23	169	-146	-58485
9.	Ragi reappear	19151	123	500	27	51	-24	-11885
10.	Rotary tiller	59352	136	300	34	362	-328	-98308
11.	Rotary weeder	4830	136	350	54	23	31	11003
12.	Rotovator	15348	152	600	168	34	134	80230
13.	Seed cum fertilizer drill	15940	136	550	32	38	-6	-3571
14.	Single MB plough	4129	136	550	460	10	450	247516
15.	Trolley	21710	120	400	32	77	-45	-18160

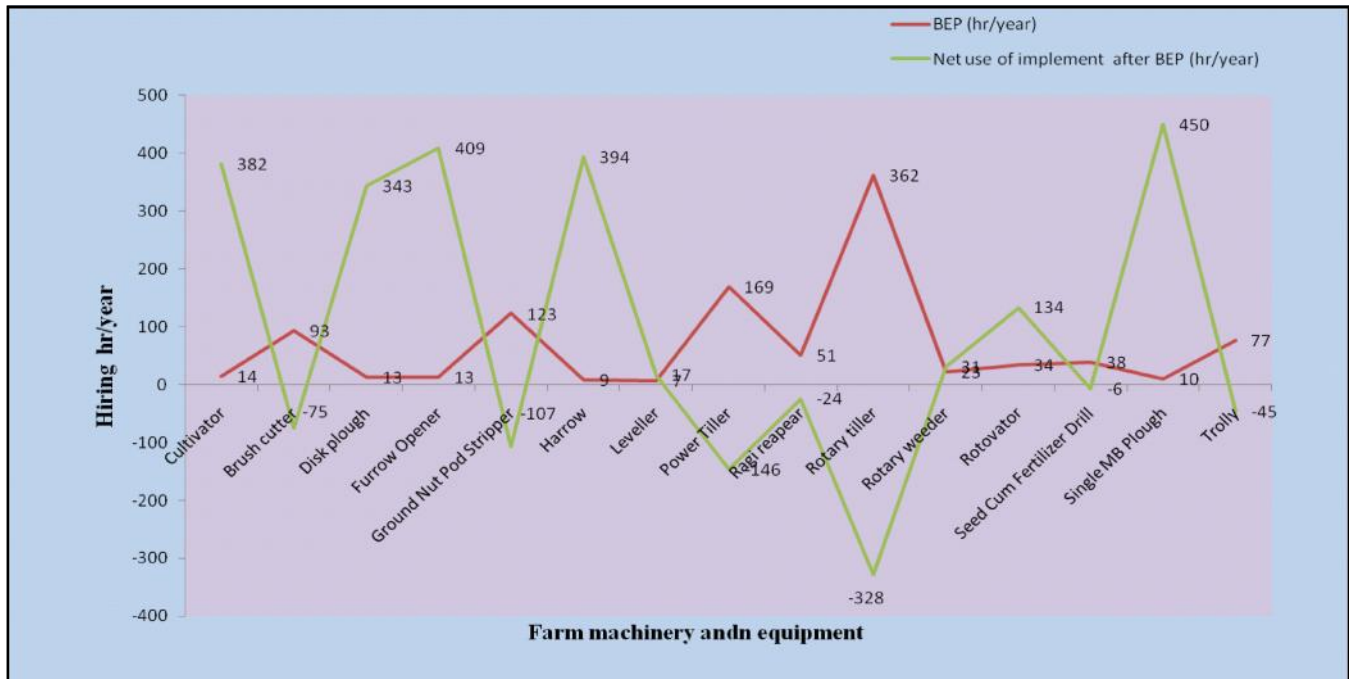


Fig. 1 : Breakeven point of farm machinery and equipment in formal CHS models

Table 4: Break-even point analysis of machinery and equipments owned by informal institutions (Model III)

Sr. No.	Particulars	Fixed cost (Rs./year)	Variable cost (Rs./hr)	Hiring price (Rs./hr)	Annual usage (hr/year)	BEP (hr/year)	Net use of implement after BEP (hr/year)	Profit and loss (Rs./year)
1.	Cultivator	4698	120	600	375	10	365	219134
2.	Bed preparation machine	7802	390	1500	241	7	234	351000
3.	Disk plough	6576	169	1175	155	7	148	174446
4.	Furrow opener	6414	152	800	215	10	205	164078
5.	Harrow	2682	103	600	108	5	103	61561
6.	Leveller	1897	103	600	130	4	126	75709
7.	Rotary tiller	64238	136	700	50	114	-64	-44714
8.	Rotovator	13551	152	850	651	19	632	536841
9.	Single bottom MB plough	8130	136	850	202	11	191	162022
10.	Trolley	19478	136	500	298	54	244	122000

Table 5: Break-even point analysis of the machinery and equipments owned by informal institution (farmers owning farm machinery for hire purpose only)

Sr. No.	Particulars	Fixed cost (Rs./year)	Variable cost (Rs./hr)	Hiring price (Rs./hr)	Annual usage (hr/year)	BEP (hr/year)	Net use of implement after BEP (hr/year)	Profit and loss (Rs./year)
1.	Cultivator	4285	120	600	194	10	184	110219
2.	Furrow opener	3194	152	800	91	11	80	64000
3.	Leveller	1831	103	600	30	5	25	15000
4.	Rotovator	9170	152	850	70	15	55	46595
5.	Single bottom MB plough	8819	152	850	98	15	83	70888
6.	Trolley	15507	136	500	45	31	14	7051

to higher renting charges charged by informal CHS providers requires less machinery hours to reach BEP. The net annual usage after BEP was higher in rotovator which is 632 hrs/year followed by cultivator (365 hrs/year) and others. The breakeven point and net annual usage of farm machinery and equipment of Model III were shown in Fig. 2. The highest profits were received in rotovator is Rs.536841/year followed by bed preparation machine Rs. 351000 and others.

The breakeven point of model IV of informal institutions was presented in Table 5. The BEP can be

interpreted that the cultivator in Model IV requires 10 machinery hours to cover the fixed cost of Rs. 4285/year and variable cost of Rs. 120/hr incurred in cultivator. Further, it is revealed that the annual usage of all machineries and equipments were found to be more than BEP which means all the machineries are generating the profits. Net annual usage of machinery after BEP was higher in case of cultivator which is 184 hrs/year which results in higher profits of Rs.110219/ year followed by others. The breakeven point and net annual usage of farm machinery and equipment of Model IV were depicted in

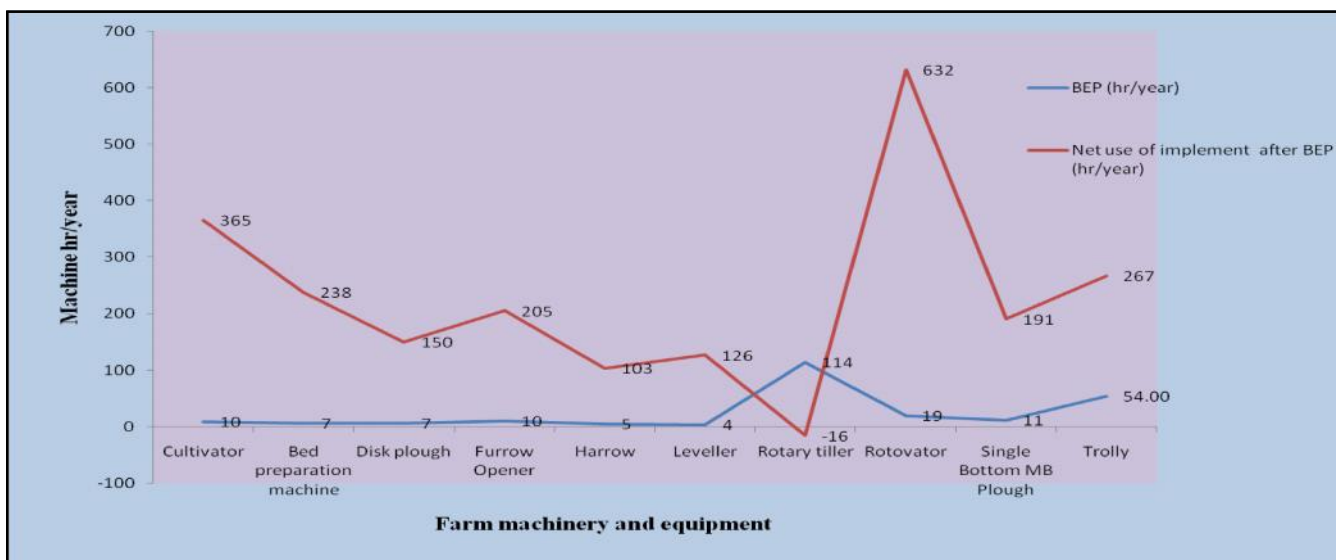


Fig. 2 : Breakeven of point farm machinery and equipment in model III (farmers owning FME for hire purpose only)

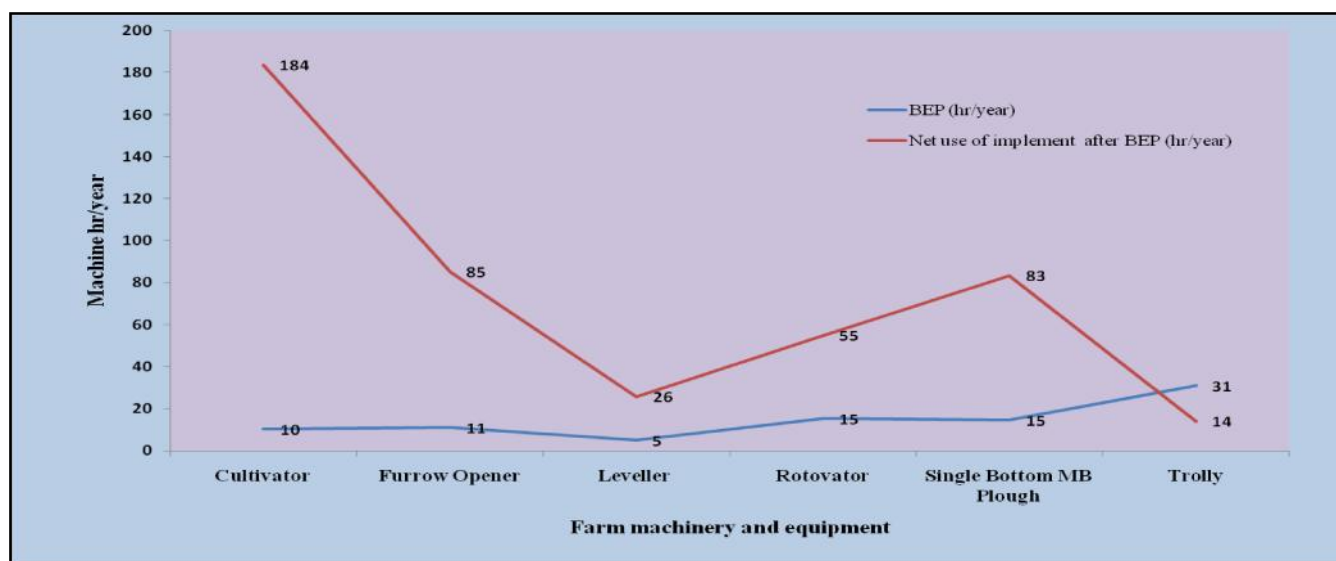


Fig. 3 : Breakeven point of farm machinery and equipment in farmers owning FME for hire and own purpose only

Fig. 3. The results of the study were supported by Kamboj *et al.*, 2012 where the researcher found that the implements like laser leveller, tractor, rotovator, disc harrow, water tanker and weeder, net annual usage of machinery after BEP is positive results in profit to the societies hiring out the farm machinery and equipment services to farmers and the implements like trolley, bund former etc. causes the loss to the society because of less annual use than the BEP.

### Conclusion :

The NGO operated CHSC is receiving only 5328 hrs of demand from farmer's in Kolar shows the CHSC is operating under loss. The Mercury/John Deere operated (Model II) CHSC has to get 2740 hrs of demand for farm machinery and equipment from farmers to reach the breakeven point. However, this CHSC is receiving more than BEP hours of demand from the farmers shows that it is operating with profits. The government subsidized John Deere/Mercury operated CHSC of Kolar requires less supply of machinery hours to reach BEP *i.e.* 2740 hrs compared to other formal CHS provider operating in the EDZ. While the Model IV requires less machinery hours to reach BEP compared to Model III operating in EDZ.

The farm machinery and equipments such as cultivator, disk plough, furrow opener, harrow, leveller, rotary weeder, rotavator, seed cum fertilizer drill and single MB plough, the annual use of machinery were more than the BEP which means these equipments generate profit to formal CHS providers (Sidhu and Vatta, 2012). At least 14 hrs of annual usage is required to reach the breakeven point of cultivator, disk plough (13hrs/year), furrow opener (13hrs/year), harrow (9hrs/year), leveller (7hrs/year), rotary weeder (23hr/year), rotavator (34hrs/year) in formal CHS providers operating in EDZ.

The breakeven point analysis confirms that it is unworthy to own implements such as brush cutter, ground nut pod stripper, power tiller, ragi reappear, rotary tiller and trolley which were having less annual use than the BEP which causes loss to CHSCs. Since it is unable to meet the fixed and variable costs incurred an account of these implements. Hence the CHSC can replace these

machineries with the farm machinery or equipment which is in great demand in the study region.

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