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Economic Feasibility of Custom Hiring Service Models in Agriculture in Eastern Dry Zone of Karnataka

P. S. Ranjith Kumar and G. S. Mahadevaiah
Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru-560 065
E-mail : ranjithagmaco225@gmail.com

Abstract

The huge capital investment in purchase of farm machinery and equipment (FME) made small and marginal farmers not accessible to FME. Therefore, the Government of Karnataka has promoted Custom Hiring and Service Centres (CHSC) to meet the machinery needs of farmers in a big way**.** The study has been conducted in Eastern Dry Zone of Karnataka. The results of the study indicated that the formal institutions providing Custom hiring service (CHS) of FME are owning more number of tractors and other FME compared to informal institutions.The cost of establishment of CHS models of formal institutions was higher compared to informal institutions. The annual machinery hours supplied by formal institutions such as Model I and II were 5,328.11 and 3,215 respectively and informal institutions such as Model III and IV were 2,895 and 1,973, respectively. However, the machinery hours supplied by formal institutions are more, the net returns realized by Model III of informal institution was high due to its higher hiring charges than formal institutions. Further, the discounted measures such as BC ratio, NPV and IRR of different CHS models have indicated that the Model I, II and III were economically feasible. Since, the formal institutions are economically feasible the government can promote these models to supply farm machinery needs of farmer.

Keywords: Custom hiring, institutions, economic feasibility, farm machinery, discounted measures

Agriculture sector is a labour intensive activity. It requires labour throughout its production process. The cost of cultivation data shows that labour accounts for more than 50 per cent of the total variable cost of production for most of the crops (Raghavan, 2008). Due to rapid economic growth, increase in non-farm incomes, increase in minimum wages and adoption of employment generation programmes like, MGNREGA have witnessed a significant increase in agricultural wages in the recent years (Anon., 2015a). Further, it has been observed that the percentage of agricultural workers to total workers in India has been gradually declining from 59.1 per cent in 1991 to 54.6 per cent in 2011. It is expected to further decline to 25.7 per cent by 2050 leading to severe farm labour shortage (Anon., 2015b). The basic requirement to meet this labour scarcity is to reduce labour usage and maximize labour productivity which depends greatly on the availability and judicious use of mechanised power by the farmers (Singh and Sangeet, 2013).

Karnataka is one of the major agrarian state in the country with 190.5 lakh ha of geographical area with 99.23 lakh ha of net sown area (2013-14) and has about 78.32 lakh ha operational holdings (Agri. Census 2010-11) of which 76 per cent are small and marginal holdings. The state is blessed with different agro-climatic regions favorable to grow diversified agriculture and horticulture crops. However, at present the state is facing several challenges in agriculture sector. The major challenge is to get higher yields with the minimum cost of production, in spite of vagaries of nature, decrease in the availability of agriculture labours, migration of farmers from rural area to cities, increased wages in the non-farm sector etc. Therefore, farm mechanization is the need of the hour is to increase production and productivity besides reducing cost of production and drudgery in the agricultural operations.

Though government has promoted farm mechanization through various schemes by providing subsidies for farm machinery and equipment (FME),

majority of the beneficiaries were large farmers. The huge capital investment required for purchase of FME made small and marginal farmers not accessible to FME (Anon., 2016).Therefore, to provide FME services to small/marginal and medium holders at affordable charges the Government of Karnataka has promoted CHSCs (Custom Hiring and Service Centre) in a big way. Keeping this in view the present study has been undertaken in Eastern Dry Zone of Karnataka with an objective to study the economic feasibility of CHS (Custom Hiring Service) models in agriculture.

METHODOLOGY

Purposive multi-stage random sampling procedure was used in the present study. The sample respondents were collected from Kolar district of Eastern Dry Zone of Karnataka. Mulbagal taluk of Kolar district was selected and a sample of 10 CHS providers from this taluka were interviewed using the pre-tested scheduled. The sampling design of the study has been given in Table I.

The sample of the study comprises of both formal and informal institutions providing CHSs of FME to farmers in the study region. The formal institutions are government sponsored/subsidized CHSCs and informal institutions are CHS provided by farmers owning FME. The formal institution comprises of Model I and Model II, whereas informal institutions comprises of Model III and Model IV. The Model I represents the custom hiring service centre (CHSC) operated by NGO (*i.e,*. SKDRDP: Shri Kesthra Dharmastala Rural Development Project). The Model II represents the CHSC operated by private firm (Mercury in collaboration with John Deere), Model III represents the CHS provided by the farmers owning FME only for the hiring purpose (own usage is negligible) and Model IV represents CHS provided by the farmers owning FME after meeting their own farm machinery requirement.

Analytical tools used: The analysis was carried out using the following analytical tools

1. Descriptive statistical tools such as summation, mean and percentages
2. Financial models used in the study are discounting methods such as Net Present Value (NPV), Benefit-Cost Ratio (BCR) and Internal Rate of Returns (IRR)

Net Present Value (NPV)

Net present value is the difference between the discounted annual inflow and discounted annual outflow during the life of the project. Net present value is estimated as follows:

$$NPV = \sum_{t=1}^{n} \frac{Bt-Ct}{(1+r)^t}$$

Where Bt denotes Benefit (Cash inflow) in year t, Ct denotes cost (Cash outflow) in year t, n denotes

TABLE I

The sampling design of the study

Distict	Taluk	Suppliers of CH services n = 10				Total
		Fromal Institutions		Informal Institutions		
		Model I : CHSCs owned by NGO	Model II : CHSCs owned by Private	Model III : FME owned by Farmers for hire purpose only	Model IV : FME owned by Farmers for own hire purpose	
Kolar	Mulbagal	1	1	4	4	**10**

Note : CHSCs: Custom hiring and service centers; CHS: Custom hiring service ;FME: Farm machinery & equipment

investment lifespan, r denotes cost of capital and t denotes time measured in years. If the calculated NPV is positive, it implies the investment is viable, and where the NPV is equal to zero implies that the investment breaks even. The rule with NPV is to accept investments with a zero or greater NPV.

Benefit cost ratio (BCR)

The discounted gross benefit divided by the discounted gross cost. A decision of B/C ratio is to accept projects with a ratio above one that is B/C>1. Its formula for estimation is as follows:

$$B - C\ Ratio = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}$$

Where,

Bt = Benefits in year t
Ct = Cost in year t
n = Investment lifespan
t = time measured in years
r = Cost of capital

It refers to the ratio of discounted cash flows to investments. The minimum ratio required is 1:1. This indicates the coverage of costs without any surplus benefits. But usually the ratio should be more than unity in order to provide some additional returns over the cost for clear decision.

Internal Rate of Return (IRR)

It is the rate of return, which equates the present worth of benefits to the present worth of costs, which means the net present worth is zero, or it is the rate of return, which makes the net present value of a project is zero. This represents the average earning power of an investment made on purchase of farm machinery.Mathematically, it is represented as:

$$IRR = \frac{\sum_{t=1}^{n} B_t - C_t}{(1+r)^t} = 0$$

Where,

Bt = Benefits in year t
Ct = Cost in year t
n = Investment lifespan
t = time measured in years
r = Cost of capital

IRR is the discount rate which just makes the net present worth of cash flow equal to zero. The investment is considered viable if the calculated IRR is greater than that of the bank interest rate on fixed deposits (opportunity cost of capital) which is 9 per cent.

- Depreciation on each capital equipment and machinery was calculated using the straight line method.

$$\text{Annual depreciation} = \frac{\text{Purchase value} - \text{Junk value}}{\text{Economic life of the asset}}$$

- Annual interest on the investment was 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

Results and Discussion

The Custom hiring service centres offer farm machineries and equipment on rental basis to farmers who cannot afford to purchase high-end agricultural machineries and equipments.The CHCs play a pivotal role in introducing high technology agricultural machinery to even small farmers with the objective to increase crop production, improve quality, timeliness and efficiency of agriculture operations Chahal *et al.* (2014) and Kulkarni (2009).

The Table II shows that the formal institutions possess more number of tractors compared to informal institutions in the study region. The Model I and II are owning four tractors each with capacity ranges from 45 to 50hp (horse power) and the total cost incurred was Rs. 23,23,944/- and Rs. 23,04,424/-, respectively. Whereas Model III and IV were owning two and one tractor each with capacity ranges 22 to 60 hp and 35 to 40hp, respectively and the cost incurred was Rs. 9,55,000/- and 4,17,600/-, respectively. Though Model III owns only two tractors but the engine capacity ranges from 22 to 60hp. It shows that the Model III is having greater advantage with respect to demand from the farmers since higher the hp of the tractor will perform better in farm operations.Whereas Model I and II are having advantage in serving to more number of farmers since they are own more number of tractors.

TABLE II

Comparison of profile of tractors available with formal and informal institutions of CHSCs in Kolar district

(n=10)

	Formal Instutions						Formal Instutions					
	Model I			Model II			Model III			Model IV		
Farm machinery & Equipment	hp	No.	Cost / Unit (Rs.)	hp	No.	Cost / Unit (Rs.)	hp	No.	Cost / Unit (Rs.)	hp	No.	Cost / Unit (Rs.)
	35	1	5,75,000	45	2	5,60,340	50-60	1	5,30,000	35-40	1	4,17,600
Tractor	45	1	5,65,200	50	2	5,91,872	22-35	1	4,25,000	-	-	-
	50	2	5,91,872	-	-	-	-	-	-	-	-	-
Total		4	23,23,944		4	23,04,424		2	9,55,000		1	4,17,600

Note : In informal institutions the tractors purchased at different years and different brands; hp= horse power

The farm machinery inventory available with the different CHS models in Kolar district are given in Table III. The FME were divided into eight categories according to the operations for which these machineries are used like land development, tillage, sowing and planting and other operations. The Model I owned highest number of equipments followed by Model III, Model II and Model IV which is 29, 12, 11 and 6, respectively. In all CHS models the number of tillage equipment was maximum.

Among all CHS models the tillage equipment accounts more in number compared to all other equipments. The Model I owns maximum number (19) of tillage equipments which was followed by Model III (10), Model I (8) and Model IV (4). The total cost incurred by Model I on tillage equipments was highest followed by Model II, Model III and Model IV i.e. Rs.13,56,350/-, Rs. 4,31,000/-, Rs. 3,68,500/- and Rs. 1,45,450/-, respectively and percentage to total cost was 62, 59, 73 and 52 per cent, respectively. This implies that the utilization of these implements was maximum.This shows that the demand for tillage implements was quite high in the study region. The results are in line with the study conducted by the Kamboji *et al.* (2012), where the agricultural cooperative societies were having maximum number of tillage equipment due to more demand from the farmers.

In Model I, Rs. 21,98,050/- was invested on FME except tractor cost followed by Model II (Rs. 7,36,000), Model III (Rs. 5,04,000/-) and Mode IV (Rs. 2,82,200/-) which shows that Model I is having more number of FME and able to serve more number of farmers in the region. The Model I and Model II are the only sources for the farmers to avail machinery and equipment related to sowing, weeding, harvesting and threshing, the FME are not available for such operation in Model III and Model IV.

Due to huge capital requirement and non-availability of skilled labour to operate FME has led to non-availability of these implements in different custom hiring service models.

Table IV revealed the cost of establishment of CHS models in Kolar district. The total cost incurred to establish CHSC by Model I was Rs. 71,97,962/- followed by Model II (Rs. 45,47,773/-), Model III (Rs. 25,76,352/-) and Model IV (Rs. 10,40,368/-). The fixed cost was highest in Model I which was Rs. 52,83,863/- followed by Model II (Rs. 35,43,717/-), Model III (Rs. 16,78,353/-) and Model IV (Rs. 8,35,497/-) and accounts for 73.4, 77.9, 65.1 and 80.3 per cent of total cost, respectively. The variable cost was more in Model I which was Rs. 19,14,099/- followed by Model II (Rs. 10,04,056/-), Model III (Rs. 8,97,999/-) and Model IV (Rs. 204,871/-) with

TABLE III

Farm machinery inventory available with the different CHS models in Kolar district

(n = 10)

Particulars	Model I			Model II			Model III			Model IV		
	No.	Total Cost (Rs.)	% share to total cost	No.	Total Cost (Rs.)	% share to total cost	No.	Total Cost (Rs.)	% share to total cost	No.	Total Cost (Rs.)	% share to total cost
Land development equipment	1	11,000	1	-	-	-	1	10,500	2	1	11,750	4
Tillage equipment	19	13,56,350	62	8	4,31,000	59	10	3,68,500	73	4	1,45,450	52
Sowing & planting equipment	3	2,14,000	10	2	1,52,000	21	-	-	-	-	-	-
Intercultivation & weeding equipment	1	58,200	3	-	-	-	-	-	-	-	-	-
Plant protection equipment	1	12,500	1	-	-	-	-	-	-	-	-	-
Harvesting equipment	2	2,51,000	11	1	1,53,000	21	-	-	-	-	-	-
Threshing	1	1,20,000	5	-	-	-	-	-	-	-	-	-
Transportation machinery or equipment	1	1,75,000	8	-	-	-	1	1,25,000	25	1	1,25,000	44
Grand total	29	21,98,050	100	11	7,36,000	100	12	5,04,000	100	6	2,82,200	100

TABLE IV

Cost of establishment of CHS models in Kolar district

(n = 10)

Particulars	Model I		Model II		Model III		Model IV	
Fixed cost	Costs (Rs.)	Per cent Share	Costs (Rs.)	Per cent Share	Costs (Rs.)	Per cent Share	Costs (Rs.)	Per cent Share
				Fixed Cost				
Machinary and equipments	45,21,994	85.6	30,40,424	85.8	14,59,000	86.9	6,99,800	83.8
Depreciation	3,95,183	7.5	3,22,709	9.1	1,29,150	7.7	96,732	11.6
Site Rent	36,000	0.7	78,000	2.2	10,450	0.6	-	0.0
Computer & related expenses	48,458	0.9	62,500	1.8	-	0.0	-	0.0
Furniture & Fixtures	15,598	0.3	10,500	0.3	-	0.0	-	0.0
Interest on Investment	2,34,013	4.4	15,734	0.4	75,503	4.5	36,215	4.3
Insurance Premium	32,617	0.6	13,850	0.4	4,250	0.3	2,750	0.3
Sub total	52,83,863	73.4	35,43,717	77.9	16,78,353	65.1	8,35,497	80.3
				Variable Cost				
Salary	5,53,016	28.9	3,10,500	30.9	1,87,005	20.8	40,053	19.6
Fuel Charges	11,04,686	57.7	5,35,500	53.3	4,89,640	54.5	1,12,750	55.0
Repair & Maintenance	2,43,303	12.7	1,50,506	15.0	2,08,809	23.3	49,568	24.2
Water/Electricity charges	2,798	0.1	2,300	0.2	-	0.0	-	0.0
Miscellaneous	10,295	0.5	5,250	0.5	12,545	1.4	2,500	1.2
Sub total	19,14,099	27.5	10,04,056	22.1	8,97,999	34.9	2,04,871	19.7
Total	71,97,962		45,47,773		25,76,352		10,40,368	

TABLE V

Cost and returns of CHS models in Kolar district

(n = 10)

Particulars	Model I	Model II	Model III	Model IV
Total annual cost (Rs.)	19,14,099	10,04,056	8,97,999	2,04,871
Hiring hours (per year)	5,328.11	3,215	2,895	1,973
Gross returns (Rs./year)	20,72,555	16,63,800	24,30,905	3,05,700
Net returns (Rs./year)	1,58,456	6,59,744	15,32,906	1,00,882
Returns per rupee invested	1.08	1.66	2.70	1.49

the share of 27.5, 22.1, 34.9 and 19.7 per cent in the total cost respectively. Across all the CHS models the cost of FME (including tractor cost) was the major component contributing tothe fixed cost followed by others. The fuel charges, salary, repair and maintenance are the major components which are contributing to variable cost followed by others.

The cost of FME in Model I was Rs. 45,21,994/-, Model II (Rs. 30,40,424/-), Model III (Rs. 14,59,000/-) and Model IV was Rs. 6,99,800/- with percentage share to total variable cost was more than 80 per cent in all CHS models. The variable costs such as fuel charges, salary, repair and maintenance were highest in Model I, which is Rs. 11,04,686/-, Rs. 5,53,016/- and Rs. 2,43,303/-, respectively followed by other models.

The cost is returns of CHS models in Kolar district was given Table V. The total annual cost incurred was highest in Model I which was Rs. 19,14,099/- followed by Model II (Rs. 10,04,056/-), Model III (Rs. 8,97,999/-) and Model IV (Rs. 2,04,871/-). It clear that all the CHS models were able to cover their expenditures, though there is huge difference in the yearly profits (Sidhu and Vatta, 2012).The annual machinery hours supplied by Model I was 5,328.11, 3,215, 2,895 and 1,973, respectively. The net returns are high, Rs. 15,32,906/- in Model III followed by Model II (Rs. 6,59,744/-), Model I (Rs. 1,58,456/-) and Model IV (Rs. 1,00,882/-). Though the machinery hours supplied by formal institutions was highest, the net returns were more in Model III of informal institution. Since the formal institutions have charged the hiring rates fixed by the district steering committee which is much lower compared to hiring rates of informal institutions. The results are supported by the study conducted by Hiremath, *et al*. (2015). He found that the private owners charge higher rates (average Rs. 50 per hour) for machineries compared to CHSCs.The return per rupee invested was higher in Model III followed by others.

The results of the economic feasibility of CHS models in agriculture are presented in the Table VI. The discounted measures such as Net Present Value (NPV), Benefit-Cost Ratio (BCR) and Internal Rate

TABLE VI

Economic feasibility of CHS models in Kolar

Discounted measures	Model I	Model II	Model III	Model IV
B-C ratio	1.09	1.24	1.85	0.98
NPV (Rs.)	18,95,932	27,96,218	68,49,577	-27,835
IRR (per cent)	17.24	24.92	80.44	7.99

Note : Discount rate: 9 per cent

TABLE VII

Hiring charges of tractor mounted and other FME in formal and informal institutions of CHS models in Kolar district

(n=10)

Farm machinery & equipment	Units	Formal institutions	Informal institutions	Absolute difference	Percentage difference
Land development equipment					
Leveller blade	Rs./hr	350	600	-250	-42
Tillage equipment					
Trailer	Rs./load	400	600	-200	-33
MB Plough(single bottom fixed)	Rs./hr	450	850	-400	-47
MB Plough (single bottom reversible)	Rs./hr	450	850	-400	-47
MB Plough (double bottom fixed)	Rs./hr	450	850	-400	-47
MB Plough (3 bottom fixed)	Rs./hr	450	850	-400	-47
Disc plough	Rs./hr	600	1,175	-575	-49
Rotovator (42 blades)	Rs./hr	600	850	-250	-29
Rotovator (36 blades)	Rs./hr	600	800	-200	-25
Cultivator (9 tyne)	Rs./hr	400	600	-200	-33
Cultivator (5 tyne)	Rs./hr	400	600	-200	-33
Forrow opener ridger (5tyne)	Rs./hr	500	800	-300	-38
Forrow opener ridger (3tyne)	Rs./hr	500	800	-300	-38
Bed preparation machine	Rs./ac	1,300	2,000	-700	-35
Harrow	Rs./hr	350	600	-250	-42
Disc harrow (14 disc)	Rs./hr	475	750	-275	-37
Mulching paper machine	Rs./ac	500	800	-300	-38
Cage wheel	Rs./hr	-	1,200	-	-
Rotary tiller	Rs./hr	300	700	-400	-57
Sowing & planting equipment					
Seed cum fertilizer drill	Rs./hr	550	700	-150	-21
Post hole digger	Rs./ pit	15	-	-	-
Inter-cultivation and weeding equipment					
Brush cutter	Rs./day	150	350	-	-
Plant protection equipment					
Knapsack sprayer (without fuel)	Rs./day	100	100	-	-
HTP sprayer	Rs./day	150	150	-	-
Harvesting equipment					
Ragi Reaper	Rs./hr 500	-	-	-	-
Groundnut pod stripper	Rs./hr 300	-	-	-	-
Threshing					
Multi crop thresher (top feed)	Rs./q 50	75	-25	-33	

Note : FME : Farm machinery and equipment

of Return (IRR) were computed by assuming (i) Increasing annual recurring cost of FME as increase in fuel, labour and repair charges and operator wages year after year for 10 years, and (ii) Increasing annual gross returns as CHS models operates at its full potential.

The annual net cash inflows were discounted at a discount rate of 9 per cent to obtain the present value of net benefits from CHS model. The initial investment made on to establish CHS model was then deducted from the present value of their net benefits. It can be seen from Tables VI that, the NPV of the investment was highest in Model III which is Rs. 68,49,577/-, followed by Model II (Rs. 27,96,218/-), Model I (Rs. 18,95,932/-) and Model IV showed negative NPV i.e.(- Rs. 27,835/-). The investment made on Model I, Model II and Model III are economically feasible since NPV values are positive.

The benefit-cost ratio indicates the returns per rupee invested in CHS models. The magnitude of the ratio also indicates the priority to be assigned for each of the alternative investment opportunities. The table VI shows that Model III is having highest B-C ratio of 1.85, followed by Model II, Model I and Model IV which is 1.24, 1.09 and 0.98, respectively. This clearly indicates all CHS models except Model IV are financially feasible since benefit cost ratio of these CHS models are having more than one.The internal rate of return measures the rate of return that can be earned by CHS model. The results in Table VI also revealed that, Model I, II and III are considered as economically feasible since IRR for Model I, Model II and Model III was higher than the opportunity cost of capital, which was 9 per cent as considered in the evaluation. In Model IV, the IRR was 7.99 which was less than the opportunity cost of capitaland also NPV is negative. Therefore, Model IV is not economical feasible.

The Table VII reveals the hiring charges of tractor mounted and other FME in formal and informal institutions of CHS models in Kolar district. It was observed that there was a wide variation in respect of hiring charges being charged by formal and informal institutions of CHS models. However, hiring charges of agricultural machinery from the formal institutions such as Model I and II was at much lower rate (Kamboji *et al*. (2012) and Sidhu & Vatta (2012) compared to informal institutions.

It is clear from the table VII that the percentage variation of hiring charges ranges from 21 per cent to 49 per cent. This means that formal institutions provide custom hiring services at 21 to 49 per cent less than the local rates. The same pattern was observed in Punjab, where the cost of hiring farm machinery from private owners was higher between 9 and 40 per cent as compared to machinery hiring from Co-operative Agro-Machinery Service Centres (AMSC) (Sidhu and Vatta, 2012). It shows that these formal institutions have further scope to expand their hiring services to farmers.

The maximum variation in hiring charges was observed in tillage equipment. The custom hiring charge was high for Bed preparation machine which is Rs. 1300 per acre and Rs. 2000 per acre in formal and informal institutions, respectively and the variation observed was Rs. 700 per acre that means the formal institutions offers bed preparation machine service to farmers at Rs. 700/- lesser than the informal institutions. The same interpretation holds goods for other implement also.

The formal institutions are owning more number of tractors and other FME compared to informal institutions showed that the formal institutions are having greater advantage in meeting machinery needs of large number of farmers. It is observed that in all CHS models the tillage equipment are more in number. It means that there is more demand for tillage equipment as compared to others. The formal institutions are the only sources of equipment related to sowing and planting, intercultivation and weeding, plant protection, harvesting and threshing in the study region.Therefore, there is a need to strengthen the formal institution CHS models by increasing the number of farm machinery. It will solve the problem of timely non-availability of machinery services to farmers particularly during peak season, especially to the small / marginal and medium farmers.

The repair and maintenance of FME is the major component which adds to the variable cost of CHS models. This needs to be addressed by the government

by establishing FM service stations at local level on PPP mode. The discounted measures such as BC ratio, NPV and IRR of different CHS models have indicated that the formal institutions such as Model I, II and informal institution model III were economically feasible. Since the formal institutions are economically feasible the government should promote these models,especially where the FME services are not available. The expansion of these models will bring more competition in the custom hiring services of FME and will bring down the price differentials between CHS models offormal and informal institutions.It will further reduce the burden on farmers from paying higher hiring charges to informal institutions which in turn reduce the costs of operations.

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