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Economic Impact of Custom Hiring Service Centres in Maize Cultivation: A Case Study from Karnataka

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ABSTRACT

In order to overcome the problem of acute labour scarcity, Government of Karnataka in collaboration with Shri Kshetra Dharmastala Rural Development Project has established custom hiring service centres (CHSCs) on public private partnership mode in the year 2014 to provide services of machines and implements to farming community at affordable rates. The study has been conducted to examine the economic performance of the centre and economic benefits accrued to maize farmers of Shimoga district, representative of Malnad region of Karnataka in terms of reduced cost of cultivation, increased productivity, increased profit and reduced drudgery. The results indicated that maize farmers reaped additional profit of Rs. 5554.39 (24 per cent) and saved cost of Rs. 2928.46 (15.71 per cent) per acre by availing machines from CHSCs compared to private individual farmers. The reduced dependence on human labour was to the tune of 16.29 per cent and increased yield observed was about 4.90 per cent compared to those farms who have availed services from private individual farmers. The economic performance of selected CHSC in terms of net returns over total cost was negative. The negative performance was due to the magnitude of dead investment made by the centre in terms of erroneous selection of non-location specific machineries and implements. Though, the performance of these centres was not satisfactory but by looking at the magnitude of economic gains realised by the farmers, Government of Karnataka should think of proliferating the number of centres with a caution of minimising dead investment through proper choice of implements and machineries.

Keywords: Public private partnership, CHSCs, Labour scarcity, Karnataka

JEL: J43, O15, O18, Q13

I

INTRODUCTION

Agriculture is facing the brunt of acute labour scarcity. Agricultural labour is not only physically scarce but also exhibited economic scarcity constraining agricultural production. The constraint is more visible on marginal and small farms which form the major chunk of Indian agriculture. The plausible solution to address labour scarcity is farm mechanisation (Singh *et al*., 2013). The financial condition of marginal and small farmers will not facilitate them to afford necessary equipments and machineries. In order to enable them to adopt mechanisation, Government of Karnataka in collaboration with Shri Kshetra Dharmastala Rural Development Project (SKDRDP), an NGO on public-private partnership (PPP) mode has established 164 custom hiring service centres locally known as Krishi Yantra Dhare

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in 25 districts of the state during 2014. The centres are established at hobli[1] level and their financial requirements are met by Government of Karnataka and SKDRDP in the proportion of 75:25. The centres are equipped with suitable machineries and equipments based on the prevailing cropping pattern in the locality. The main objective of the centre is to enable all the resource poor farmers to reap the economic advantage of farm mechanisation at concessional rates. Mechanisation improves crop productivity and production, reduces drudgery, rationally solves labour scarcity, conduct of timely agricultural operations, minimises cost of cultivation and increases profitability of enterprise, adds competitiveness to the crop in the national and international markets. At present, custom hiring service centres are functioning in 490 hoblies covering 6 lakh farmers. In order to benefit all the farmers of the state, the present government has thought of establishing centres in the remaining 250 hoblies for which Rs. 122 crores has been earmarked.

The present study attempts to assess the economic impact of Government sponsored custom hiring service centres in maize cultivation. Based on the dominance of the crop in terms of total cropped area and extent of mechanisation, maize crop was purposively selected. In Malnad region, it is extensively cultivated in Shimoga district with an area of 0.59 lakh ha with annual production of 2.1 lakh tonnes. Among cereals, it stands next to paddy crop in terms of area in the district (19.71 per cent of total cropped area). The district is specialised in maize cultivation during last decade as indicated by the location quotient of 3.81 (Patil *et al.*, 2013*).* It is an important cash crop, demands intensive cultivation. The cultural operations such as land preparation, sowing and fertiliser application, harvesting and threshing are labour intensive in nature. The acute scarcity of labour has paved way for invention of suitable machineries to enable maize cultivation. The previous studies have focused mainly on the extent of mechanisation whereas, the present study is modest in its attempt to assess the impact of government sponsored custom hiring service centres in maize cultivation in terms of reduced cost of cultivation, increased returns, extent of human and bullock labour displacement, reduction in drudgery, profitability of crop enterprise and extent of penetration of mechanisation among farming community.

The study is divided into five sections. Section II provides details of previous studies conducted in India pertaining to custom hiring of farm machineries and how the present study is distinct from previous studies. Section III details out the methodology adopted to assess the economics, economic impact and efficiency of maize cultivation by sources of mechanisation. In the fourth section, the results and discussion is presented. The last section deals with policy issues.

II

CUSTOM HIRING OF FARM MACHINERIES IN INDIA: A REVIEW

Custom hiring of farm machineries dates back to 19th century in India. The inception of Agro Industries Corporation in the 1960's has paved way for organised

custom hiring services of various farm implements and machineries. It has got further fillip when Government of India launched scheme to set up agro services centres across country in 1971. The utilisation of these centres was conditioned upon initiation of irrigation projects. The system of sharing of individual implements on hired basis is not a new concept in India but systematic and structured framework for maintaining and disbursing more number of implements at one place on hired basis has gained importance in the recent past. Central Research Institute for Dry land Agriculture (CRIDA) is pioneer in establishing custom hiring centres of farm implements across ecological regions of India under National Innovations in Climate - Resilient Agriculture Project (NICRA), an ICAR flagship platform. Later, many of the state government agencies, non-governmental organisations, private companies and other entrepreneurs have established and operating custom hiring centres in various parts of the country.

Co-operatives Led CHCs

Sidhu and Vatta (2012) evaluated the contribution of co-operative agro machinery service centres (AMSCs) in economic viability of farming in Punjab. The centres were found to be economically viable generating profits of 2 to 30 per cent of annualised cost. The rental charges levied by AMSCs were 16 per cent lower compared to that of private operators. Hiring in of farm machineries from AMSCs, farmers could save 35 per cent of cost compared to self-owned machineries. The study recommended for strengthening of existing AMSCs, establishment of new AMSCs and for government intervention in the form of subsidies to resolve the issue of timely non-availability of machineries during peak season.

Chahal *et al*. (2014) conducted a study to assess the role of co-operatives in institutionalisation of custom hiring services in Punjab. The study covered 100 AMSCs across 20 districts of the state in 2011-12. All were found to have tractors, laser leveler and rotovators. The AMSCs served 114 farmers in 2011-12 constituting 18 per cent membership of PACS. The average area covered per centre increased from less than 300 acres in 2009-10 to 400 acres in 2011-12. The centres had an annual average income of Rs. 3.3 lakh in 2011-12 ranging from Rs. 3 lakh to Rs. 6.7 lakh with an average expenditure of Rs. 1.9 lakh ranging from Rs. 15,000 to Rs. 4.2 lakh. This gave a net income of Rs. 1.37 lakh per centre ranging from Rs. 10,000 to Rs. 3.05 lakh.

Singh *et al*. (2015) examined the present status, economic viability and economic impact of custom hiring services of farm machinery by PACS on farm economy. Around 65 per cent of PACS were providing custom hiring service of farm machineries. The capital investment made by PACS on agro machinery service centres in Ludhiana and Moga district was Rs.18.16 lakhs and Rs.16.13 lakhs, respectively. Annual expenditure and gross returns realised per centre in Ludhiana was Rs.6.67 lakh and Rs.6.77 lakh and Rs.6.02 lakh and Rs.6.04 lakh in Moga district, respectively. Net returns as percentage of annualised expenditure in Ludhiana

and Moga districts were found to be positive at 1.55 and 0.37 per cent. Availing mechanical services from agro machinery service centres have reduced cost of cultivation of crops by 12 per cent.

National Innovations in Climate Resilient Agriculture (*NICRA) Model of CHCs:*

The model aimed at small farmers to overcome climate vulnerabilities. Around 151 CHCs were established across ecological zones of the country under NICRA project. Village climate risk management committee (VCRMC) played a crucial role in selection of need based equipments sponsored by NICRA with an amount of Rs. 6.25 lakhs sanctioned to each KVK. Out of 151 centres, 22 CHSCs were evaluated for their economic performance. The results indicated that around 48 per cent of the centres earned returns below Rs. 20000, 30 per cent earned between Rs. 20000 to Rs. 45000 and remaining 22 per cent earned returns more than Rs. 45000 (Srinivas *et al.*, 2017).

Individual Entrepreneurship Led CHCs

The state government of Madhya Pradesh encouraged prospective entrepreneurs to establish custom hiring centre of farm machineries on individual entrepreneurship mode. The government has established 1300 CHCs. ICAR-Central Institute of Agricultural Engineering, Bhopal made an assessment about the operational and economic aspects of established CHCs in the state. The initial investment made on the centre ranged between Rs.14 to Rs. 5 lakhs. Each centre on an average is making an profit of Rs.1.5 to Rs.4.5 lakhs. The operational hours of machineries and implements ranged between 500 to 1400 hours (Srinivas *et al.,* 2017).

Group Based/Crop Based CHCs

Custom hiring centres in Andhra Pradesh are operating through farmers groups in collaboration with state government. Around 1170 centres were established during 2011-2016. The economic assessment of paddy crop based CHC established by Surya Rytu Mitra Group in East Godavari district of Andhra Pradesh indicated that farmers earned a net income of Rs. 17 lakhs at the rate of Rs. 3.35 lakh per farmer. Farmers saved Rs. 2100 and gained Rs. 3000 as an additional income due to increased yield of 2.25 quintal by resorting to mechanical cultivation of paddy compared to conventional method. In Telangana state, similar crop based CHC was established for maize crop by Mytri Rythu Mithra Sangam with an initial investment of Rs. 27.32 lakhs. The net profit earned by the centres ranged between Rs. 4 to 5 lakhs per annum (Srinivas *et al.,* 2017).

Comparison of Private, Co-operative and Local Service Providers of Machines and Implements

Singh (2017) examined inclusiveness and effectiveness of various machine service providers in the custom rental space in Punjab state. ZFS, PACS and local providers are mainly involved in custom rental space. The study indicated increasing demand for such services from small farmers in general and other farmers for expensive implements and machineries. PACS mode custom renting of machines was considered as innovative move as it is known for farmers' linkage at local level/grass root level. Farmers were found satisfied with respect to all the sources and their combinations in terms of provision of services. The study recommended the custom rental service practice across all states and regions with proper incentivisation of service providers as it is the most effective way of reducing cost of cultivation. In addition, it makes farm operation efficient and increases yields and profits. The centres should rationally procure and maintain equipments giving due consideration for local farmers. The custom rentals on co-operative mode should be replicated elsewhere and space should be provided for private agri start ups through softer loans under priority sector lending.

The economics and economic viability of custom hiring of farm machineries on cooperative mode, individual entrepreneurship mode and group based mode in India had been assessed. The custom hiring of farm machineries in Karnataka is through NGO on PPP mode, which has not been examined so far. Hence, it is imperative from the view point of Government of Karnataka, to have perusal at functioning of the centres and also to capture the economic benefits accrued by farming community through this intervention. The study will throw light on strengths and weaknesses of the existing system and enable Government of Karnataka and NGO to rectify the same for effective and efficient utilisation of the centres. It will also provide solution to labour related problems faced by farmers in rationale and realistic way.

III

PROFILE OF STUDY NGO AND METHODOLOGY

Profile of SKDRDP

SKDRDP[2] is a charitable institution established during the year 1982 at Belthangady taluk under the leadership of Dr. Veerendra Hegde. The mission of the institution is sustainable development of poor and marginalised sections of the society. Through array of programmes, institution is uplifting society financially, socially, and intellectually. The programmes organised and implemented by the institution are grouped as agricultural programmes, women empowerment activities, community development programmes, health insurance, business correspondence and rehabilitation. The group approach is used as the basis for the implementation of

programmes. Agricultural programmes aim at improving farmers' knowledge, capacity building, financial and social support. Women empowerment activities are performed through Jnana Vikasa Mahila SHGs, simple SHGs and Group enterprises SHGs. In the year 1996, the institution has initiated business correspondence through micro finance under Pragathi Nidhi Programme. It is also facilitating income generating activities through creation of forward and backward linkages under Shree Dharmastala SIRI gramodyoga samsthe. Around 75 products are produced and marketed under the brand name SIRI by SHGs. Health insurance is the other sector covered by the institution under Sampoorna Suraksha. In the rehabilitation programme, institution aims at creation of social awareness among citizens about ill effects of addiction to alcoholism. In the year 2014, the institution has collaborated with the agricultural department of Government of Karnataka to provide required machineries and implements to farmers on custom hiring basis at affordable rates to hasten the rate of adoption of mechanisation.

Private Individual Farmers: They represent those farmers owning necessary implements for cultivation of location-specific crops. Private individual farmers possessed tractor and tractor mounted primary and secondary tillage implements, seed-cum-fertiliser drill and thresher. They are large farmers bestowed with capital assets. They provide required machines to local farmers on rental basis. The rent charged by them is relatively higher than CHSCs. They also provide machines to loyal farmers on credit basis, such arrangements are not available in case of CHSCs. They are profit oriented. They create cut throat competition to CHSCs.

A sample of 47 farmers cultivating maize was selected from Shimoga district, representative of Malnad region of Karnataka. The sample farms were post stratified as highly mechanised farms (HMF), moderately mechanised farms (MMF) and less mechanised farms (LMF) based on degree of mechanisation adopted in maize cultivation. Farms where land preparation, sowing and basal dose of fertiliser application, harvesting and threshing operations are mechanised were considered as HMF. MMF are those farms where sowing, basal dose of fertiliser application and threshing operations are mechanised and on LMF only land preparation and threshing operations are mechanised. In order to assess the impact of government sponsored custom hiring service centres on income and profitability of maize cultivation, farms were classified into two groups as those availing services from CHSCs and private individual farmers. Thirty farms had availed services from private individual farmers and 17 had availed services of CHSCs. The purposive random sampling was followed to select the respondents who had availed services from CHSCs and private players. The categorisation of sample respondents based on land holding was not relevant because the study focuses on the impact assessment of Government of Karnataka launched CHSCs in heralding mechanisation of agriculture. The primary data pertaining to operation wise labour use pattern and material inputs used in maize cultivation was elicited from farmers using pretested schedule through personal interview method for the agricultural year 2016-17. The sources of mechanisation

along with rental charges of mechanical services were obtained. In order to estimate the input energy and output energy of maize cultivation, the details of energy contributions of human labour, machine labour, bullock labour and material inputs such as seeds, fertilisers (NPK), FYM, plant protection chemicals and weedicide was obtained from previous research publications of national and international journals. Tabular and budgeting techniques were used to estimate the economics of maize cultivation across sources of mechanisation. In addition, the economic performance of the custom hiring service centre from which sample respondents have availed mechanical services was assessed for the financial year 2016-17. The secondary data pertaining to capital investment made on procurement of machineries and implements, operational and fixed expenses incurred towards maintenance of the centre, returns generated from renting out of machineries was elicited. Energy use indicators such as energy efficiency, energy productivity, specific energy, net energy, profit per MJ, cost per MJ of energy and other related ratios were estimated using relevant formulae (Lorzadeh *et al*., 2012; Lawal *et al.*, 2014 and Memon *et al*., 2015).

Energy use efficiency: $\frac{\text{Output energy } (\frac{\text{MJ}}{\text{acre}})}{\text{Input energy } (\frac{\text{MJ}}{\text{acre}})}$

Specific energy or Energy intensity (MJ/kg): $\frac{\text{Input energy } (\frac{\text{MJ}}{\text{acre}})}{\text{crop yield } (\frac{\text{kg}}{\text{acre}})}$

Energy productivity (kg/MJ): $\frac{\text{Crop yield } (\frac{\text{Kg}}{\text{acre}})}{\text{Input energy } (\frac{\text{MJ}}{\text{acre}})}$

Net energy: Output energy (MJ/acre) - Input energy (MJ/acre)

Cost per MJ of input energy: $\frac{\text{Total cost per acre}}{\text{Total input energy } (\frac{\text{MJ}}{\text{acre}})}$

Returns per MJ of input energy: $\frac{\text{Total cost per acre}}{\text{Total input energy } (\frac{\text{MJ}}{\text{acre}})}$

Profit per MJ of input energy: $\frac{\text{Net returns per acre}}{\text{Total input energy } (\frac{\text{MJ}}{\text{acre}})}$

Profit Function Analysis

To capture the influence of different degrees and sources of mechanisation in maize cultivation, profit function was estimated considering profit realised per acre as dependent variable and expenditure on human labour, bullock labour, machine labour, intercept dummy variables representing degrees of mechanisation and sources of mechanisation as independent variables. The functional form of the profit function is as below:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4D_1 + b_5D_2 + b_6D \quad \ldots.(1)$$

Y: Profit per acre (Rs.)

X_1: Expenditure on machine labour (Rs.)

X_2: Expenditure on human labour (Rs.)

X_3: Expenditure on bullock labour (Rs.)

D_1: Dummy variable to represent HMF which takes the value '1' and '0' for MMF and LMF

D_2: Dummy variable to represent MMF which takes the value '1' and '0' for HMF and LMF

D: Dummy variable to represent sources of mechanisation which takes the value '1' for CHSCs and '0' for private based farms

b_1, b_2, b_3, b_4, b_5 and b_6 are the regression coefficients

a: intercept.

Derived Profit Functions

a) Profit per acre on LMF availing mechanical services from private individual farmers: D_1, D_2 and D takes the value '0' thus, the profit function (1) reduces to

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 \quad \ldots.(2)$$

b) Profit per acre on LMF availing mechanical services from CHSCs: D_1 and D_2 takes the value '0' while D takes the value '1' thus, the profit function (1) becomes

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_6 \quad \ldots.(3)$$

c) Profit per acre on HMF availing mechanical services from private individual farmers: D_1 takes the value '1', D_2 and D takes the value '0' thus, the profit function (1) becomes

$$Y = a + b_4 + b_1X_1 + b_2X_2 + b_3X_3 \quad \ldots.(4)$$

d) Profit per acre on HMF availing mechanical services from CHSCs: D_1 and D takes the value '1', D_2 takes the value '0' thus, the profit function (1) becomes

$$Y = a + b_4 + b_6 + b_1X_1 + b_2X_2 + b_3X_3 \quad \ldots.(5)$$

e) Profit per acre on MMF availing mechanical services from private individual farmers: D_1 and D takes the value '0' and D_2 takes the value '1' thus, the profit function (1) is written as

$$Y = a + b_5 + b_1X_1 + b_2X_2 + b_3X_3 \quad \ldots.(6)$$

f) Profit per acre on MMF availing mechanical services from CHSCs: D_1 takes the value '0' and D_2 and D takes the value '1' thus, the profit function (1) is written as

$$Y = a + b_5 + b_6 + b_1X_1 + b_2X_2 + b_3X_3 \quad \ldots.(7)$$

The shift in intercept measures the effect of different degrees and sources of mechanisation. In case of HMF availing mechanical services from CHSCs, the effect of mechanisation is captured in the term $a + b_4 + b_6$. The term $a + b_5 + b_6$ captures the effect of moderate degree of mechanisation and CHSCs in maize cultivation.

Data Envelopment Analysis (DEA)

It is a non-parametric and deterministic measure of efficiency. It is an alternative approach to stochastic production function and is devoid of assumptions pertaining to distribution or functional form. Cost efficient input oriented constant returns to scale model was employed to assess efficiency of mechanised maize farms. The analysis was performed using software designed by Coelli which encompasses technical efficiency, allocative efficiency and cost/economic efficiency (Suresh and Chandrakanth, 2016). The term technical efficiency indicates the ability of the farm to produce maximum output from a given set of inputs, whereas cost efficiency requires achieving the lowest possible cost, given the current prices and output. Mechanised maize farms were considered as decision making units (DMUs). Farms were categorised based on source from which they have availed machinery services as private and CHSCs based farms and extent of mechanisation (HMF, MMF and LMF). Farms aim at minimising usage of inputs in general and labour in particular to attain the desired level of output. To ascertain efficiency, production frontier was constructed in DEA approach based on linear programming. The term envelopment is derived from production frontier which envelops the set of observations. For each DMU, maize output in quintal (output category), human labour (man-days), bullock labour (pair-days), machine labour (hours) and their corresponding unit prices (input category) were considered in the calculation of cost- DEA efficiency score. The best DMU operates at 100 per cent technical efficiency (efficiency score = 1) and the DMU with lower technical efficiency (score <1) works at a percentage less than 100. Allocative efficiency or otherwise called as pricing efficiency relies on cost of inputs. It is related to cost of inputs in relation to output, and equilibrium condition is attained when marginal cost equates average revenue. DMU's allocative efficiency is with regard to the allocation of inputs vis-a vis its price for a given level of output, so as to minimise the cost of production. The cost efficiency refers to the product of technical and allocative efficiencies expressed in percentage.

IV

RESULTS AND DISCUSSION

Cropping Pattern of Mechanised Maize Farms

Table 1 presents cropping pattern of mechanised maize farms. Maize formed 53.38 per cent of the gross cropped area and cultivated by majority of farmers during *kharif* season. During *rabi* season, jowar is cultivated on minimal area of 12 acres accounting for 2.42 per cent of the gross cropped area. Arecanut is another major crop accounting for 21.36 per cent of the gross cropped area in the region. The cropping intensity was 126.40 per cent in the area. It may be inferred that maize dominates the cropping scenario.

TABLE 1. CROPPING PATTERN OF SAMPLE FARMERS

	Crops	Area (acre)	Proportion of GCA (per cent)
(1)	(2)	(3)	(4)
Kharif	Paddy	35	7.07
	Maize	264.25	53.38
	Ragi	2	0.40
	Groundnut	14	2.83
	Cotton	6	1.21
	Tomato	4	0.81
	Chilli	2	0.40
	Onion	8.5	1.72
	Sub total	335.75	67.83
Rabi	Sunflower	14	2.83
	Jowar	12	2.42
	Sub total	26	5.25
Summer	Paddy	18	3.64
	Leafy vegetables	3.5	0.71
	Sub total	21.5	4.34
Perennials	Arecanut	105.74	21.36
	Coconut	3	0.61
	Mango	3	0.61
	Sub total	111.74	22.57
Gross cropped area		494.99	100.00
Net cropped area		391.62	
Cropping intensity		126.3955	

Extent of Mechanisation in Maize Cultivation

Maize crop is grown for earning cash income. It requires intensive cultivation including operations such as land preparation, sowing, inter-cultivation, harvesting and threshing. The above operations are mechanised in maize cultivation. The details pertaining to extent of mechanisation in maize is given in Table 2. The degree of mechanisation varied across maize growers. It could be observed that 58 per cent of the sample farmers have adopted mechanisation for land preparation and threshing operations (LMF) as against meagre nine per cent of farmers adopting mechanical

devices for completing land preparation, sowing, application of basal dose of fertilisers, harvesting and threshing (HMF). This shows that very few farmers have knowledge and confidence regarding mechanical devices for sowing and harvesting. In between these two extreme situations, there exist moderately mechanised farms wherein mechanical devices are being used for tillage, sowing, fertiliser application and threshing operations. This calls for wide publicity by Karnataka State Department of Agriculture for popularising machineries in the area.

TABLE 2. EXTENT OF MECHANISATION IN MAIZE CULTIVATION

(n=47)

Extent of mechanisation (1)	Operations mechanised (2)	Number of sample farmers (3)
HMF	Land preparation, sowing and basal dose of fertiliser application, Harvesting, Threshing	4 (9)
MMF	Land preparation, Sowing and basal dose of fertiliser application, Threshing	16 (34)
LMF	Land preparation, Threshing	27 (58)

Note: Figures in the parentheses indicate percentage.

Economics of Maize Cultivation

Economics of maize cultivation across sources of mechanisation was worked out to ascertain the impact of custom hiring service centres on costs and returns of maize cultivation (Table 3). There are two players in the input market providing machineries and equipments required for maize cultivation to farmers on rental basis namely private individual farmers and custom hiring service centres (CHSCs). As could be seen in the table that the farmers who availed machineries and equipments from CHSCs have incurred total cost of Rs. 15716.77/acre as compared to farmers availing from private individual farmers (Rs.18645.23/acre). This clearly shows the scope for cost reduction in cultivation of maize when farmers make use of machineries and equipments from CHSCs. The extent of cost reduction was Rs.2928.46 (15.71 per cent). Singh *et al*. (2015a) in his study observed cost reduction in case of major crops to the tune of 12 per cent. Contrary to private individual farmers who charge higher rents, the CHSCs provide services at reasonable and affordable rates (Hiremath *et al.*, 2014). The rent charged by CHSCs is 30 per cent lower in case of machineries and equipments required for land preparation and 10 per cent lower in case of thresher as compared to private individual farmers. Sidhu and Vatta, 2012 observed that hiring of machineries from agro machinery service centres was 16 per cent cheaper compared to private operators. With regard to yield, farms availing services from CHSCs could produce additional 1.33 quintal due to usage of seed cum fertiliser drill which enabled them to maintain optimum plant population as compared to farms availing services from private individual farmers. Net returns per acre could be enhanced to an extent of Rs. 5554.39 (24 per cent) by availing machineries and equipment services from CHSCs. Thus, farmers by availing

machineries and equipments from CHSCs could reduce cost of cultivation of maize by 15.71 per cent and reap additional profit of 24 per cent. This is the positive aspect of state sponsored CHSCs to be disseminated among the maize growers.

TABLE 3. ECONOMICS OF MAIZE CULTIVATION BY SOURCES OF MECHANISATION

(*Rs./acre*)

Particulars/Sources of mechanisation	CHSCs			Private		
	Qty	Rate (Rs.)	Value (Rs.)	Qty	Rate (Rs.)	Value (Rs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
I. Machine labour (h)						
a) Land preparation	2.93	490.00	1435.70	3.50	700.00	2450.00
b) Sowing	1.61	750.00	1207.50			
c) Threshing	0.95	1350.00	1281.15	0.905	1500.00	1357.50
Sub-total	5.49		3924.35	4.405		3807.50
II. Human labour (man-days)						
a) Sowing	1.00	300.00	300.00	2.00	300.00	600.00
b) Fertiliser application	1.38	300.00	414.00	1.62	300.00	486.00
c) Weeding	2.17	300.00	649.50	2.56	300.00	768.00
d) Weedicide application	1.00	300.00	300.00	1.00	300.00	300.00
e) Application of PP chemicals				1.00	300.00	300.00
f) Harvesting	7.34	300.00	2202.00	7.22	300.00	2166.00
Sub-total	12.89		3865.50	15.40		4620.00
III. Bullock labour						
a) Sowing				2.00	1088.88	2177.76
b) Inter-cultivation	1.00	1183.23	1183.23	1.00	1088.88	1088.88
Sub-total	1.00		1183.23	3.00		3266.64
IV. Inputs						
1. Seeds (kg)	7.47	241.53	1804.22	8.38	180.59	1513.34
2. Fertiliser (50kg bag)						
a) DAP	1.64	1200.00	1968.00	1.31	1200.00	1572.00
b) Urea	1.44	300.00	432.00	1.20	300.00	360.00
c) Potash	0.57	900.00	513.00	0.70	900.00	630.00
d) Complex	0.85	1000.00	850.00	1.00	1000.00	1000.00
3. Weedicide		1176.47	1176.47			859.09
4. Plant protection chemicals						1016.66
Sub-total			6743.69			6951.09
Total cost (Rs.)			15716.77			18645.23
Yield (qtl.)	28.47			27.14		
Price / qtl			1496.47			1488.88
Returns from main product (Rs.)			42604.50			40408.20
By-product (Rs.)			1700.00			1270.37
Gross returns			44304.50			41678.57
Net returns			28587.73			23033.34

Input Energy and Output Energy of Maize Cultivation

Table 4 presents information on input energy and output energy in maize cultivation across different sources of mechanisation. A total of input energy was estimated to be 6334.76 MJ in case of CHSCs consisting of energy contributed by machines, humans and bullocks in the order of 1399.43 MJ, 202.12 MJ and 64.56 MJ, respectively. The output energy contributed by grain yield was 41850.90 MJ. As regards private individual farmers, the total input energy was estimated to be 5955.26 MJ with contribution of machines, humans and bullocks

in the order of 1139.24 MJ, 241.47 MJ and 203.71MJ. The input energy derived from machines was 22.83 per cent higher in case of CHSCs compared to private based farms due to the concessional rates levied by the former source. The dependence on human and bullock energy was relatively lesser on CHSCs by 16.29 per cent and 68.30 per cent compared to private based farms. The corresponding output energy generated was 39895.80 MJ. It is clear from the table that farmers availing mechanical services from CHSCs have used 22.83 per cent more of mechanical energy than private individual farmers due to its affordable rates. With regard to bullock energy, dependence of farmers was more who availed mechanical services from private individual farmers to perform sowing and intercultural operations.

TABLE 4. DETAILS OF INPUT AND OUTPUT ENERGY IN MAIZE CULTIVATION ACROSS DIFFERENT SOURCES OF MECHANISATION

		CHSCs			Private		
Particulars/Sources of mechanisation	Energy equivalents (MJ)	Qty./acre	Total energy requirement (TER)	Share in total input energy (per cent)	Qty./acre	Total energy requirement (TER)	Share in total input energy (per cent)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Input Energy							
a) Machine labour							
1) MB plough(h)	2.51	1.79	4.49	0.07	2.25	5.65	0.09
2) Cultivator(h)	3.14	1.14	3.57	0.06	1.25	3.93	0.07
3) Seed drill(h)	8.65	1.61	13.93	0.22			
4) Tractor(h)	62.70	4.54	284.66	4.49	3.50	219.45	3.68
5) Threshing(h)	7.52	0.95	7.14	0.11	0.905	6.80	0.11
6) Fuel (L)	51.33	21.15	1085.63	17.14	17.60	903.41	15.17
Sub-total			1399.43	21.98		1139.24	19.12
b) Human labour(h)	1.96	103.12	202.12	3.19	123.20	241.47	4.05
Sub-total			202.12			241.47	4.05
c) Bullock labour (pair days)	64.56	1.00	64.56	1.02	3.00	193.68	3.25
1.Seed drill	1.25				8.00	10.03	0.17
Sub-total			64.56	1.02		203.71	4.42
d) Materials							
1) Seeds(kg)	14.70	7.47	109.81	1.73	8.38	123.19	2.07
2) Fertiliser (kg)							
a) Nitrogen	66.14	52.13	3447.88	54.43	44.39	2935.95	49.30
b) Phosphorous	12.44	48.77	606.70	9.58	43.13	622.80	10.46
c) Potassium	11.15	28.15	313.87	4.95	34.00	379.10	6.37
3) Weedicide (L)	238.00	0.80	190.40	3.01	0.80	190.40	3.20
4) Plant protectior chemicals (L)	199.00				0.6	119.4	2.00
Sub-total			4668.66	73.70		4247.65	71.33
Total input energy			6334.76	100.00		5955.26	100.00
B. Output Energy							
Maize grain yield (kg)	14.70	2847.00	41850.90		2714.00	39895.80	

Energy Indicators in Maize Cultivation

The energy indicators related to maize cultivation across sources of mechanisation is presented in Table 5. Energy use efficiency is the ratio of output energy to input energy was on par across private individual farmers (6.70) and CHSCs (6.61) indicating that every mega joule of input energy consumed in maize cultivation yielded 6.70 or 6.61 mega joule of output energy. Energy productivity, the ratio of maize output and total input energy was found to be on par across sources of mechanisation. The cost per MJ of energy was lower at Rs. 2.48/MJ in case of CHSCs compared to private individual farmers. The farms availing services from CHSCs were found to be economically efficient in terms of input energy usage as reflected by the indicator value of 4.52. This indicates that every MJ of input energy consumed on farm could earn profit of Rs. 4.52.

TABLE 5. ENERGY INDICATORS IN MAIZE CULTIVATION BY SOURCES OF MECHANISATION

SI. No.	Particulars	CHSCs	Private
(1)	(2)	(3)	(4)
1.	Total output energy (MJ)	41850.90	39895.80
2.	Total input energy (MJ)	6334.76	5955.26
3.	Maize Yield in Kg/ acre	2847	2714.00
4.	Energy use efficiency (1/2)	6.61	6.70
5.	Specific energy in MJ/Kg (2/3)	2.23	2.19
6.	Energy productivity in Kg/MJ (3/2)	0.45	0.46
7.	Net energy in MJ (1-2)	35516.14	33940.54
8.	Total cost per acre (Rs.)	15716.77	18645.23
9.	Gross returns per acre (Rs.)	44304.50	41678.57
10.	Net returns per acre (Rs.)	28587.73	23033.34
11.	Cost per MJ of input energy in Rs. (7/2)	2.48	3.13
12.	Returns per MJ of input energy in Rs. (8/2)	7.00	7.00
13.	Profit per MJ of input energy in Rs. (9/2)	4.52	3.87

Cost of Input Energy

The cost of input energy across sources of mechanisation is given in Table 6.

TABLE 6. COST OF DIFFERENT INPUT ENERGY BY SOURCES OF MECHANISATION

	CHSCs			Private		
Sources of input energy/ Sources of mechanisation	Cost (Rs.)	Total energy equivalents (MJ)	Cost/MJ of energy (Rs.)	Cost (Rs.)	Total energy equivalents (MJ)	Cost/MJ of energy (Rs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Machine labour	3924.35	1399.43 (83.99)	2.80	3807.5	1139.23 (72.36)	3.34
Human labour	3865.5	202.12 (12.13)	19.12	4620	241.47 (15.34)	19.13
Bullock labour	1183.23	64.56 (3.87)	18.32	3266.64	193.68 (12.30)	16.87
Total labour		1666.11 (100)			1574.38 (100)	
Materials	6743.69	4668.66	1.44	6951.09	4247.65	1.64

The cost of mechanical energy was Rs. 2.8/MJ in case of CHSCs as against Rs. 3.34/MJ in case of private individual farmers. The cost of human and animal energy is highly expensive calling for the use of mechanical energy to the extent possible by the maize growers. During peak agricultural season, farmers find it difficult to complete agricultural operations on time due to acute labour scarcity. CHSCs go a long way in mitigating physical and economic scarcity of labour since it provides mechanical services at concessional rates.

Estimated Profit Function

The estimated profit function was found to be statistically significant at one per cent level of significance as reflected by the significant F statistic (5.16). The goodness of fit of model in terms of coefficient of determination was 0.44 indicating that included independent variables could explain 44 per cent of the total variation in the dependent variable (profit per acre). The coefficient of expenditure on machine labour (X_1) was found to be statistically significant at one per cent level of significance. The intercept dummy variables D_1 and D_2 capturing the influence of degrees of mechanisation in maize cultivation were found to be statistically significant at ten per cent alpha. The coefficient of dummy variable representing sources of mechanisation was statistically non-significant but found to be economically substantial. The results indicate that every rupee spent on machine labour results in additional profit of Rs. 4.56 and similarly every additional rupee spent on bullock labour could earn incremental profit of Rs. 2.86. The contribution of human labour towards profit per acre was meagre at Rs. 0.47. This clearly demonstrates that mechanisation results in increased profits in maize cultivation. The magnitude of increased profits due to different degrees and sources of mechanisation is reflected in the coefficients D_1, D_2 and D. The increased profit per acre on HMF availing mechanical services from CHSCs was Rs. 6165, HMF availing services from private individual farmers was Rs. 3900.64, MMF availing services from CHSCs was Rs. 6243 and MMF availing services from private individual farmers was Rs. 3978. The differences in the magnitude of profits are apparent across sources of mechanisation. The estimated profits realised by HMF and MMF availing services from CHSCs were on par with each other. The value of intercept indicates that the LMF could save Rs. 3888 through mechanisation. They may lose profit of Rs.3888 by not resorting to higher degree of mechanisation. They are likely to be left behind advances taking place in the field of mechanisation. The estimated profit per acre on farms with different degrees and sources of mechanisation at the mean level of independent variables was estimated and presented in Table 7. The profit realised per acre on HMF was 26 per cent higher compared to LMF. This result clearly demonstrates the economic advantage of mechanisation in maize cultivation.

$$Y = -3888 + 4.56X_1 + 0.47X_2 + 2.86X_3 + 7788.64\,D_1 + 7866D_2 + 2265D \quad \ldots(5)$$
$$(-0.33)\ (3.61)\ (0.38)\ \ (1.38)\ \ (1.41)\ \ \ (2.34)\ \ (0.32)$$

TABLE 7. ESTIMATED PROFIT ACROSS DIFFERENT DEGREES AND SOURCES OF MECHANISATION IN MAIZE CULTIVATION

	Mean expenditure on				
	Machine labour (X1)	Human labour (X2)	Bullock labour (X3)	Profit function	Estimated profit
(1)	(2)	(3)	(4)	(5)	(6)
HMF, CHSCs	4505.62	1350	1300	$Y = 6165.64 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3$	31063.77
MMF, CHSCs	3827.91	3565.38	1153.84	$Y = 6243 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3$	28673.98
MMF, Private	2990.5	3025	3322	$Y = 3978 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3$	28537.35
LMF, Private	3791	4050	3246	$Y = -3888 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3$	24586.02

Profit function of LMF availing mechanical services from private individual farmers

$$Y = -3888 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3 \quad \ldots. (6)$$

Profit function of MMF availing mechanical services from private individual farmers

$$Y = -3888 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3 + 7866 D_2$$

$$Y = 3978 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3 \quad \ldots. (7)$$

Profit function of MMF availing mechanical services from CHSCs

$$Y = -3888 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3 + 7866 D_2 + 2265 D$$

$$Y = 6243 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3 \quad \ldots.(8)$$

Profit function of HMF availing mechanical services from private individual farmers

$$Y = -3888 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3 + 7788.64 D_1$$

$$Y = 3900.64 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3 \quad \ldots.(9)$$

Profit function of HMF availing mechanical services from CHSCs

$$Y = -3888 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3 + 7788.64 D_1 + 2265 D$$

$$Y = 6165.64 + 4.56 X_1 + 0.47 X_2 + 2.86 X_3 \quad \ldots.(10)$$

Cost Efficiency in Maize Cultivation

Cost efficiency is the sole measure of overall economic efficiency of decision making units as it considers both allocative and technical efficiency. The mean scores of technical efficiency, allocative efficiency and cost efficiency of 47 sample farmers were found to be 0.85, 0.72 and 0.61, respectively. The mean score of cost efficiency indicates 67 per cent of economic efficiency. The cost inefficiency was mainly due to allocative inefficiency rather than technical inefficiency. Allocative inefficiency is due to misallocation of scarce capital on human labour and bullock labour which are relatively costlier than machine labour. The frequency distribution of cost efficiency in maize cultivation across degrees and sources of mechanisation is presented in Table 8. The perusal of table indicates that cent per cent of the HMF availing mechanical services from CHSCs were found to be economically efficient with cost efficiency score of more than 0.8. The cost efficiency score ranged between 0.6-0.7 for majority of MMF availing mechanical services from CHSCs. Majority of the

farmers availing mechanical services from private individual farmers were found to be less efficient in terms of overall economic efficiency with cost efficiency score of 0.5-0.6. This finding reiterates the existence of economic efficiency on farms hiring mechanical services from CHSCs.

TABLE 8. FREQUENCY DISTRIBUTION OF COST EFFICIENCY IN MAIZE CULTIVATION ACROSS DEGREES AND SOURCES OF MECHANISATION

	CHSCs		Private	
	HMF	MMF	MMF	LMF
Cost efficiency	(n=4)	(n=13)	(n=3)	(n=27)
(1)	(2)	(3)	(4)	(5)
0.3-0.4				1
				(3.70)
0.4-0.5				4
				(14.81)
0.5-0.6		4	3	18
		(30.76)	(100)	(66.66)
0.6-0.7		5		3
		(38.46)		(11.11)
0.7-0.8		2		1
		(15.38)		(3.70)
0.8-0.9	1	2		
	(25)	(15.38)		
0.9-1.0	3			
	(75)			

Investment, Utilisation and Returns Generated by CHSC

CHSCs maintain stocks of various types of machinery and equipments. They are broadly categorised into (1) tillage machinery, (2) planting and sowing machinery, (3) plant protection equipments, (4) intercultural equipments, (5) harvesting equipments, (6) post harvesting equipments and (7) other accessories presented in Table 9. Investment made on the machineries and equipments jointly by government

TABLE 9. INVESTMENT, UTILISATION AND RETURNS GENERATED BY CHSC

SI. No.	Machineries/equipments	Investment	Hours used or days used	Returns generated
(1)	(2)	(3)	(4)	(5)
1)	Tillage machinery	4645004	6283.17	3292505
		(61.21)		(91.99)
2)	Planting and sowing machinery	61500	52.90	39675
		(0.81)		(1.11)
3)	Plant protection equipments	65009	208.40	12501
		(0.86)		(0.35)
4)	Intercultural equipments	90135	32.00	10900
		(1.19)		(0.30)
5)	Harvesting equipments	2380000	1911.93	206874
		(31.36)		(5.79)
6)	Post-harvesting equipments	184000	10.00	7000
		(2.42)		(0.20)
7)	Accessories	162700	8.50	4625
		(2.14)		(0.13)
	Total	7588348	8506.90	3574080

and SKDRDP (NGO) in the proportion of 75:25 came to Rs. 75,88,348. Out of the total investment, investment on tillage machinery alone accounted for 61.21 per cent followed by harvesting machineries with 31.36 per cent. The tillage equipments and machineries included tractors, tillers, disc ploughs, rotovators, cultivators, levellers, harrows, cage wheels etc., which are highly expensive and beyond the means of ordinary farmers. The second highest investment was made on harvesting machineries at Rs. 23,80,000 mainly consisting of combined harvester of diverse crops such as paddy, maize etc. It could be observed that hours of usage of tillage machinery and equipments was found to be the highest at 6283 hours generating annual income of Rs. 32,92,505 accounting for 92 per cent of the total income. Next in order was harvesting machinery and equipments whose usage was 1912 hours yielding income of Rs. 2,06,874. The facts mentioned above indicate farmers need for tillage and harvesting machineries as these two operations need to be completed on time to realise the potential crop yield. The post harvesting group comprises multi-crop threshers necessitating investment of Rs. 1,84,000. They are put to limited use mainly because of its labour intensive nature. The operation of multi-crop thresher requires 8-10 labourers, which cannot be arranged by the centre. Plant protection equipments and weeding implements are put for minimum usage because of their availability among farming community at subsidised rates from line departments. Frequent repairs encountered by the centre emerged as the other reason for its limited use.

Economics of Custom Hiring Service Centre

Economics of working CHSC was estimated and presented in Table 10. The total expenditure involved in maintenance of the centre was estimated at Rs. 41,44,766 per annum. The operational expenses worked out to Rs. 27,78,864 formed the major share in the total expenses (67.05 per cent). Of the operational expenses, the expenditure made on fuel for operating machineries and equipments was the highest at Rs. 1169131.85 (28.20 per cent) followed by salary at Rs. 1031648.99 (24.90 per cent) and annual repairs at Rs. 381193 (9.20 per cent). It was observed that expenditure on account of repairs was considerably high, which could be reduced by establishing nodal workshops at taluk or district headquarters employing technical graduates. Depreciation on machineries and interest on fixed investment formed 33 per cent of the total expenses. The returns realised over total expenses indicate that the centre is incurring loss of Rs. 5,70,686 per annum. The probable reason is the higher overheads on account of depreciation and interest on fixed investment made on idle machineries. However, the centre could earn profit of Rs. 7,95,216 over operational expenses. Singh *et al*. (2015) reported that the magnitude of net returns realised by the agro service centres at Ludhiana and Moga district of Punjab over total expenses was meagre Rs. 10000 and Rs. 2000, respectively. The higher operational and fixed expenses reflect the improper maintenance of the centre. The

government should have to strategise for improving the economic performance of the centre through increasing employability for graduates of agricultural engineering. It is a win-win situation for government since it ensures employment on one hand to technical graduates and improves viability of the centre on the other hand.

TABLE 10. ECONOMICS OF CUSTOM HIRING SERVICE CENTRE

(Rs.)

Particulars (1)	Value (2)
I. Operational expenses	
1) Fuel	1169131.85 (28.20)
2) Salary towards manager, driver (casual + permanent), office staff and their allowances	1031648.99 (24.90)
3) Annual repairs	381193 (9.20)
4) Insurance	39006.34 (0.95)
5) Rent	36000 (0.86)
6) Miscellaneous	121883.68 (2.94)
Sub-total	2778863.86 (67.05)
II. Fixed expenses	
1) Depreciation	1138252.20 (27.46)
2) Interest on the fixed capital @ 12 per cent on the investment made by SKDRDP	227650.44 (5.49)
Sub-total	1365902.64 (32.95)
III. Total expenses	4144766.5
Total returns	3574080.00
Returns over operational expenses	795216.14
Returns over total expenses	-570686.50

Utilisation of Machinery and Equipments

Utilisation pattern of machinery and equipments is presented in Table 11 under three sub-heads as more frequently used, less frequently used and unused. Tractor mounted primary and secondary tillage implements combined harvester and battery sprayer are the more frequently used machineries. The findings are in conformity with that of Vaja *et al.,* (2016). These machines have generated income of Rs.34,25,840 per annum constituting 95.85 per cent of the total income of the centre. Implements such as seed-cum-fertiliser drill, power and knapsack sprayer, thresher, power weeder, diggers, wood cutters are grouped under less frequently used machines based on the extent of usage. The income generated by these machines amounted to Rs. 1,48,240 (4.15 per cent). Implements listed in table (row 26 to 38) from spring cultivator onto bund maker were found to be unused. Location non-specificity is the reason for non-utilisation of implements as expressed by the manager of the centre. Singh (2017) in his study indicated that the centres should

TABLE 11. UTILISATION OF MACHINERY AND EQUIPMENTS

SI. No. (1)	Machines (2)	Investment (3)	Hours used or days used (4)	Returns generated (5)
	More frequently used			
1.	Combined Harvester (Uin-1488)	2380000	1911.93	206874 (5.80)
2.	M.B. plough(Svew-3025)	58000	1184.02	651225 (18.24)
3.	Rotovator (36 Blade)	224750	928.05	702155 (19.67)
4.	Rotovator (42 blade)	114000	704.8	529538 (14.84)
5.	M.B plough 2 pare	40000	690.4	103222 (2.89)
6.	Duck foot cultivator (5Tyne)	65000	689.2	331806 (9.30)
7.	Disk Harrow	116000	618.06	342213 (9.59)
8.	Post hole digger (35 HP)	252000	425	150050 (4.20)
9.	Reversible disc plough (Svew3024)	50000	325.88	160936 (4.51)
10.	Spring cultivator (Svew3021)	70000	267.87	132242 (3.70)
11.	Leveler plate and blade	22000	181.19	52027 (1.33)
12.	Battery sprayer	4409	129	2950 (0.08)
13.	Blade Harrow (Big)	21500	121.4	60602 (1.70)
	Subtotal	3417659	8176.8	3425840 (95.85)
	Less frequently used			
14.	Rigid cultivator (9 Tynes)	32200	77.2	39551 (1.11)
15.	Power sprayer (4 HP)	43000	71.5	8176 (0.23)
16.	Seed cum fertiliser drill (9 Tynes)	61500	52.9	39675 (1.11)
17.	Diesel Pumpset	132000	36	19400 (0.54)
18.	Power weeder	25135	32	10900 (0.31)
19.	Rotary driller	70000	15.5	9349 (0.26)
20.	Multi Crop Thresher (10 HP)	154000	10	7000 (0.20)
21.	Cage Wheel	39500	8.6	7139 (0.20)
22.	Knapsack sprayer	17600	7.9	1375 (0.04)
23.	Wood cutter (DCS403)	64500	5.5	1625 (0.05)
24.	Post Hole Digger (P-H-D-1)	84000	3	3000 (0.08)
25.	Disc plough(Svew3023)	43000	1.5	1050 (0.03)
	Subtotal	766435	321.60	148240 (4.15)
	Unused			
26.	Spring cultivator	35000		
27.	Kubota rotary	60000		
28.	Mini tractor	360000		
29.	Single bottom reversible M.B. plough	116000		

Contd.

TABLE 11. CONCLD.

SI. No. (1)	Machines (2)	Investment (3)	Hours used or days used (4)	Returns generated (5)
30.	HTP power sprayer	43000		
31.	Mulching machine DCS232T 1 HP	65000		
32.	Tree climbing machine (7 TYNES)	42000		
33.	tractor wood	7200		
34.	Kubota tractor	416902		
35.	Tractor (escort)	2006752		
36.	Tractor trolley	178200		
37.	Trencher	32200		
38.	Bund maker	42000		
	Subtotal	3404254	0	0
	Total	7588348	8498.40	3574080 (100.00)

rationally procure and maintain equipments and machinery considering the need of local farmers. The investment made on these idle machines came to Rs. 34,04,254 forming 44.86 per cent of the total investment which is regarded as dead investment. This substantial dead investment contributes towards non-viability of the centre. The centre reaped benefits only from more frequently and less frequently used implements. The returns per rupee of investment on these implements came to Rs. 1.00 and 0.19, respectively. In order to ensure profitability, idle machineries maintained at the centre should be transferred to those centres where they actually find utility. Machines made available to the farming community on subsidised rates from line departments should not be maintained at the centre.

V

CONCLUSIONS

The economic impact in terms of cost saving, increased yield and increased net returns was to the tune of 15.71 per cent, 4.90 per cent and 24 per cent, respectively compared to those farms that have availed services from private individual farmers. The dependence of farmers on human and bullock labour can be relieved to the extent of 16.29 per cent and 68.30 per cent, respectively by resorting to mechanical services from CHSCs compared to private individual farmers. The energy use efficiency was more in case of CHSCs compared to private. The cost per MJ of mechanical energy was Rs. 2.48 which is relatively lower compared to private source at Rs. 3.13. The profit analysis indicated that HMF availing services from CHSCs realised additional profit of Rs. 6165 per acre. The efficiency analysis indicated that cent per cent of HMF availing services from CHSCs have cost efficiency score of more than 0.8. Economic performance of the CHSC in terms of returns over total expenses was negative. The extent of dead investment due to wrong selection of machineries and implements at the time of establishment was the major reason for negative performance. Erroneous selection was due to lack of technical knowledge among the staff of the centre. Though, the centre is functioning with negative profits but the

extent of positive impact made by it on the farming community is substantial. Keeping this in view, government should increase the number of CHSCs and narrow down its operational area to village level. In order to improve economic performance of the centre, government should recruit and place technical graduates having degree in agricultural engineering as managers of these centres. To reduce the expenditure on account of annual repairs, nodal workshops with technical graduates should be established at taluk/district headquarters. Centres should procure machineries based on the cropping pattern having greater utility among farming community to ensure their viability.

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NOTES

1) Hobli refers to cluster of adjoining villages administered together for tax and land tenure purposes. Each hobli consists of several villages. Cluster of hoblis form Taluk. Hoblis are commonly called as Nad or Magani. Hobli is commonly used in Karnataka and Andhra Pradesh.

2) http://skdrdpindia.org/browsed on 31/05/2018 at 4.10 pm.

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APPENDIX

ENERGY EQUIVALENTS OF INPUTS, INPUT SERVICES AND OUTPUTS IN MAIZE CULTIVATION

Particulars (1)	Unit (2)	Energy equivalents (MJ/unit) (3)
A. Input Energy		
a) Human labour	Hours	1.96
b) Machinery	Hours	
1) MB plough		2.51
2) Cultivator		3.14
3) Sowing(seed drill)		8.65
4) Tractor		62.70
5) Harvesting and threshing		47.03
6) Threshing		7.52
7) Fuel	Litres	51.33
c) Bullock labour	Pair days	64.56
d) Materials		
1) Seeds	Kg	14.70
2) Fertiliser	Kg	
a) Nitrogen		66.14
b) Phosphate		12.44
c) Potassium		11.15
3) Weedicide	Litres	238.00
4) Plant protection chemicals	Litres	199.00
B. Output		
Maize	Kg	14.70