Journal of AgriSearch, 12 (4) : 253-261
An Open Access International Peer Reviewed Quaterly

ISSN : 2348-8808 (Print), 2348-8867 (Online)
https://doi.org/10.21921/jas.v12i04.15264

Custom Hiring Centres for Climate Smart Agriculture: Profitability, Performance and Policy outlook

Bikash Sarkar, Prem K Sundaram*, Pawan Jeet, Deokaran, Ramkewal, Indra Jeet, A P Anurag, B P Bhatt, Banda Sainath, Anirban Mukherjee, Ujjwal Kumar, Abhay Kumar, A Upadhyaya and Anup Das

ABSTRACT

Custom Hiring Centres (CHCs) have emerged as a pivotal mechanism for promoting agricultural mechanization, particularly among small and marginal farmers who face constraints in accessing costly farm machinery. This study examines the economic feasibility, operational efficiency, and socio-economic impact of CHCs, emphasizing their integration with Farmer Producer Organizations and Self-Help Groups to enhance collective management and sustainability. The analysis considers capital investment, recurring costs, revenue generation, and cost-saving potential across a ten-year operational horizon. Findings indicate that CHCs recover their initial investment within three years, with stable annual net income ranging from Rs. 11.22 lakh to Rs. 12.28 lakh. Key financial indicators, including a Net Present Value (NPV) of Rs. 32.26 lakh, an Internal Rate of Return (IRR) of 68%, and a Benefit–Cost Ratio (BCR) of 1.49, demonstrate strong financial viability. Mechanization through CHCs significantly reduces cultivation costs, improves labor efficiency, and facilitates timely farm operations, contributing to enhanced cropping intensity and productivity. By providing equitable access to machinery, CHCs support resource-poor farmers, address labor shortages, and promote technology adoption. The study underscores the importance of institutional support, skill development, and systematic maintenance for maximizing operational efficiency.

Keywords: Custom Hiring Centers (CHCs), Agricultural mechanization, Small and marginal farmers, Farm productivity, Farmer Producer Organizations (FPOs)

ARTICLE INFO

Received on	:	28/10/2025
Accepted on	:	23/11/2025
Published online	:	18/12/2025

INTRODUCTION

Agricultural mechanization is a key determinant of productivity, resource efficiency, and equity in modern farming systems. Landholding patterns significantly influence the adoption and economic viability of farm machinery, as costly equipment often becomes uneconomical for small and marginal farms. Mechanization levels in India were estimated at 40% in 2015-16, while the proportion of the population engaged in agriculture declined from 40% in 2019-20 and is projected to fall to 26% by 2050 (Rahman, 2023). Correspondingly, farm power availability has increased from 1.1 kW/ha in 1995-96 to 2.4 kW/ha in 2015-16, reaching a national average of 2.76 kW/ha in 2020-21, with a target of 4.0 kW/ha by 2030 to meet the demands of intensifying agriculture (Anon. 2021, Mehta et al. 2025).

However, farm power distribution remains uneven across states, with Punjab recording 3.5 kW/ha, while Bihar, Odisha, and Jharkhand register less than 1 kW/ha. Constraints such as fragmented landholdings, hilly topography, socio-economic limitations, high transport costs, lack of institutional finance, and limited local machinery manufacturing hinder mechanization, particularly in Eastern India (Sundaram et al. 2020). Custom Hiring Centres have emerged as a promising mechanism to bridge this gap by providing small and marginal farmers access to high-cost machinery at nominal charges. CHCs facilitate timely farm operations, increase cropping intensity, enhance input-use efficiency, and reduce production costs (Ranade et al., 2006; Nagaraj et al., 2020; Parashunath et al., 2016). The joint ownership model allows new machines to be used at maximum capacity and enables technology adoption by resource-poor farmers (Chahal and Malhi, 2005; Sidhu, 2005; Sidhu and Vatta, 2012). Studies in Karnataka and Punjab highlight the profitability and efficiency of CHCs, demonstrating that tractors, rotavators, cultivators, seed drills, and threshers are highly profitable, whereas disc ploughs may generate losses (Tayade and Jogdand, 2022; Kadaraiah et al., 2022). Farmers report positive perceptions of CHCs in overcoming labour shortages and improving access to machinery, with 43.8% indicating favourable perceptions in Karnataka (Kadaraiah et al., 2022). Currently, India hosts over 78,000 CHCs, with Punjab (22,800) and Uttar Pradesh (10,392) having the highest concentrations, while states like Meghalaya report very few centres (Anon, 2021). CHCs can also be established through public–private partnerships, cooperatives, FPOs, SHGs, and charitable trusts, offering rural youth income-generating opportunities and strengthening local mechanization networks (Roy et al., 2022). Systematic evaluation of CHCs is still limited, especially in areas with low farm power and fragmented landholdings. Key gaps exist in understanding their operational efficiency, financial viability, and socio-economic impact. Assessing how CHCs influence productivity, cost reduction, and equitable mechanization access is essential for optimizing their performance and guiding policy. This study aims to analyze

ICAR-Research Complex for Eastern Region, Patna-800 014, Bihar, India
*Corresponding Author E-mail: prem.k.sundaram@gmail.com

the operational and economic outcomes of CHCs, focusing on their role in improving mechanization access, lowering production costs, and increasing smallholder farmers' income, ultimately offering evidence-based recommendations for policymakers and rural institutions.

Conceptual Framework

The conceptual framework illustrates how institutional support, farm characteristics, and operational factors interact to shape the effectiveness of CHCs in promoting agricultural mechanization. CHCs provide small and marginal farmers with affordable access to machinery, helping overcome labour shortages and low farm power availability. Farm-level factors such as land size, fragmentation, and cropping patterns determine the need for mechanization, while socio-economic aspects—awareness, education, perceptions, and income—influence CHC adoption and usage. Institutional backing from FPOs, SHGs, cooperatives, and PPP models strengthens CHC management and financial sustainability. Operational efficiency depends on technical capacity, skilled operators, maintenance, and timely service delivery, which together increase machinery utilization and support timely farm operations. CHCs supply a range of implements that enhance land preparation, sowing, harvesting, and overall productivity.

CHCs generate multiple benefits: they reduce cultivation costs, raise farm income, address labour shortages, promote rural entrepreneurship, and support climate-resilient, sustainable agriculture. By integrating technical, institutional, and socio-economic factors, CHCs enhance equitable access to mechanization and strengthen mechanization ecosystems in smallholder farming regions.

MATERIALS AND METHODS

Research Design

The study employed a descriptive-cum-evaluative research design to systematically assess the economic, operational, and socio-institutional dimensions of CHCs in the context of small and marginal farmers. Recognizing the multifaceted objectives of the study ranging from financial viability and resource-use efficiency to adoption behavior and institutional effectiveness a mixed-methods approach was adopted. This approach integrated quantitative economic analysis with qualitative insights from stakeholders, thereby enabling a comprehensive evaluation of CHC performance under real-world operational conditions. The design was oriented to capture the interplay between mechanization access, farmer participation, and organizational structures such as Farmer Producer Organizations and Self-Help Groups.

Data Collection Methods

Data were collected through a combination of primary and secondary sources to ensure triangulation and methodological robustness.

Primary Data Collection

Structured Interviews: Pre-tested interview schedules were administered to CHC operators, supervisors, and beneficiary farmers to capture detailed information on machine usage, operational schedules, rental patterns, labor deployment, and maintenance practices.

Field Observations: Systematic field visits were undertaken to verify machinery deployment, assess operational efficiency, and record real-time utilization patterns.

Focus Group Discussions (FGDs): FGDs were conducted with farmer groups, FPO coordinators, and SHG members to elicit qualitative information on awareness, adoption barriers, socio-economic benefits, and perceptions of mechanized farming services.

Secondary Data Collection:

Institutional records of CHCs, FPOs, and SHGs provided historical data on machinery procurement, maintenance costs, revenue generation, and utilization trends. Published reports, IS standards, and peer-reviewed literature informed cost calculations, operational norms, depreciation rates, and best practices in farm mechanization.

Sample Selection

A purposive sampling strategy was employed to select CHCs and associated beneficiaries, ensuring representativeness across agro-ecological zones, cropping systems, and organizational models (FPO- or SHG-managed CHCs).

Custom Hiring Centres: Twelve CHCs were selected based on criteria such as machinery portfolio, scale of operations, service coverage, and operational history.

Beneficiary Farmers: From each CHC, 20–25 farmers were randomly selected, with emphasis on small and marginal farmers, women farmers, and producers of high-demand crops such as potato and cereals.

Key Informants: CHC operators, supervisors, and part-time mechanics were included to provide technical and operational perspectives.

Data Analysis Techniques

Collected data were analyzed using a combination of descriptive, economic, and inferential statistical techniques to derive actionable insights regarding CHC performance and mechanization impact.

Descriptive Analysis: Quantitative variables such as demographic profiles, machine utilization, operational hours, and rental charges were summarized using mean, frequency distributions, percentages, and standard deviations.

Economic and Financial Analysis: Key indicators including Net Present Value (NPV), Internal Rate of Return (IRR), Benefit-Cost Ratio (BCR), breakeven year, and percentage economic savings were computed to evaluate the financial viability of CHCs. Both full-capacity and 75% utilization scenarios were considered to assess sensitivity to operational intensity. Maintenance costs, fuel and lubricant consumption, and labor expenses were incorporated into the analysis to determine realistic operational costs.

Comparative Analysis: Economic outcomes and labor savings of mechanized practices were compared against traditional farming methods to quantify efficiency gains, cost reductions, and productivity improvements.

Qualitative Analysis: Content analysis of FGDs and interviews was performed to identify themes related to adoption behavior, awareness levels, institutional support, and constraints to CHC utilization. Data management and statistical analyses were conducted using SPSS (v26), Microsoft Excel, and standard cost-benefit computation frameworks. Tabular and graphical representations were employed to facilitate interpretation and communicate key findings effectively.

Ethical Considerations

The study adhered to ethical research standards by ensuring voluntary participation, informed consent, confidentiality, and anonymity of respondents. Institutional permissions were obtained from FPOs and SHGs prior to data collection, and findings were shared with stakeholders in aggregate form to prevent identification of individual participants.

RESULTS AND DISCUSSION

Machinery utilization data from the CHC showed clear differences in demand across equipment categories. The CHC operated a single tractor, which recorded 831 hours/year, approaching the optimal benchmark of 1,000 hours/year for economic use. Overall machinery-use patterns indicated a strong concentration in sowing and planting operations.

Seeding-related implements accounted for 68.6% of total operational hours, indicating the highest demand among farmers. The multi-crop planter was the most utilized machine (29.25%), followed by the raised bed planter (25.69%), laser land leveler (17.45%), happy seeder (10.14%), cultivator (8.17%), rotavator (3.24%), and zero tillage machine (2.35%). This hierarchy reflects farmers' need for precision sowing and soil moisture conservation, particularly in regions like Bihar where access to such equipment is limited.

Tillage machinery collectively contributed only 11.4% of total use hours, suggesting that economic constraints and the continued availability of traditional tillage tools reduce dependency on hired services for land preparation. In contrast, the high use of planters and seeders confirms the hypothesis that CHCs primarily fill gaps in sowing machinery availability, a major bottleneck in timely crop establishment.

Overall utilization ranking (Fig. 1) multi-crop planter > raised bed planter > laser land leveler > cultivator > happy seeder > rotavator > zero tillage machine > potato digger > potato planter aligns with seasonal crop requirements and underscores the CHC's effectiveness in meeting peak operational demands. These data clearly demonstrate that CHCs enhance mechanization access for smallholders, support timely field operations, and address labour scarcity during critical cropping windows

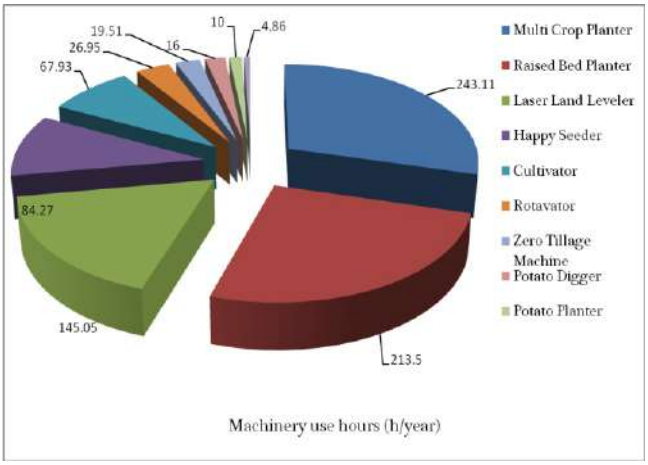

Fig. 1: Machinery use hours (ha/year) in decreasing order: Multi crop planter > Raised bed planter> Laser land leveler > Cultivator > Happy seeder >Rotavator > Zero Tillage machine > Potato digger> Potato planter.

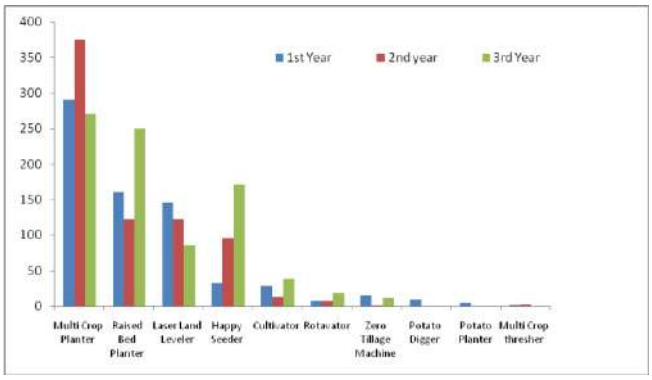

Fig. 2: Yearly pattern of use hours of different machinaries

The yearly utilisation trend of CHC machinery (Fig. 2) shows clear seasonal and inter-annual variations corresponding to the cropping calendar and operational demand. Across the observed years, seeding and planting machinery consistently recorded the highest use hours, with the multi-crop planter and raised bed planter showing peak usage during the Rabi sowing window, reflecting sustained farmer dependence on mechanized planting. The laser land leveler displayed stable annual usage, aligned with land preparation requirements prior to both Kharif and Rabi seasons. In contrast, the cultivator and rotavator exhibited moderate but fluctuating use, indicative of variability in tillage intensity and a gradual shift toward reduced-tillage practices. The happy seeder and zero tillage machine showed comparatively lower yet increasing use over the years, suggesting a slow but steady adoption of conservation agriculture technologies. Potato-specific machines such as the potato digger and potato planter demonstrated highly seasonal usage peaks, corresponding precisely with the potato cropping cycle. Overall, the yearly pattern confirms that CHC machinery use is strongly driven by crop seasonality, with maximum concentration during sowing periods, reinforcing the earlier observation that mechanized planting is the most critical service demanded by farmers.

Economics

The economic evaluation of the Custom Hiring Centre indicates a total capital outlay of Rs. 24,90,000 comprising Rs. 21,70,000 allocated for machinery procurement and Rs. 3,20,000 invested in infrastructure, including a 400 ft² storage shed for safeguarding implements. The CHC houses 12 essential farm machines, each supporting specific stages of crop production. The 45 hp tractor, valued at (Rs.5,59,928), constitutes the single largest investment, reflecting its pivotal role as the primary power unit for most field operations. Among the planting and land-preparation implements, the raised bed planter (Rs.3,34,845), laser land leveler (Rs.3,55,642), and multi-crop planter (Rs.95,200) form the core machinery suite facilitating efficient and timely sowing activities. Complementing these are equipment supporting soil preparation and residue management, including the happy seeder (Rs.1,84,000), cultivator (Rs.37,900), rotavator (Rs.92,423), and zero tillage machine (Rs.39,623). To cater to crop-specific requirements particularly for potato-based systems the CHC is equipped with a potato digger (Rs.1,02,460), potato planter (Rs.1,74,837), and a multi-crop

thresher (Rs.1,79,245). Additionally, a dedicated set of servicing tools (Rs.13,897) ensures timely maintenance and operational readiness of all equipment. The cost distribution highlights a deliberate emphasis on machinery that enhances sowing efficiency, land leveling precision, and timely crop establishment operations that are inherently labor-intensive and critically important for small and marginal farmers operating within constrained production windows.

Table 1: List of farm Machineries in CHC

Sl. No.	Name of implements	Qty	Cost (Rs.)
1	Tractor (45 hp)	01	559928.00
2	Multi Crop Planter	01	95200.00
3	Raised Bed Planter	01	334845.00
4	Laser Land Leveler	01	355642.00
5	Happy Seeder	01	184000.00
6	Cultivator	01	37900.00
7	Rotavator	01	92423.00
8	Zero Tillage Machine	01	39623.00
9	Potato Digger	01	102460.00
10	Potato Planter	01	174837.00
11	Multi Crop thresher	01	179245.00
12	Servicing Tools	01 set	13897.00
Sub Total			2170000.00
13	A open shed for keeping the tools and machinery - 400 ft^2 @ Rs. 800/-		320000.00
Total Cost	24,90,000.00		

Table 2 presents the rental structure for the agricultural machinery available at the CHC, which plays a critical role in improving machinery access for farmers who are unable to invest in high-cost equipment. Rental rates were determined by an expert committee, taking into account machine cost, operational lifespan, and expected annual usage. The tractor, serving as the primary power source for most operations, has an expected utilization of 1,000 hours per year over a 10-year lifespan. Key planting implements such as the multi-crop planter and raised bed planter are hired at Rs.700 per hour, each with an annual usage expectation of 200 hours across 10 years.

Equipment supporting soil preparation and residue management, including rotavator and happy seeder, are rented at Rs. 600 per hour and Rs. 650 per hour, respectively, with annual usage set at 300 hours, reflecting their importance during peak land-preparation and sowing periods. The laser land leveler, hired on an acreage basis at Rs. 2,500 per acre, is expected to operate on 200 acres annually, facilitating precision land leveling essential for uniform crop establishment. Potato-specific implements, including the potato digger and potato planter, command a rental charge of Rs. 750 per hour, aligning with their seasonal demand and crop-cycle specificity. Additionally, the multi-crop thresher, hired at Rs. 700 per hour, supports post-harvest operations with an estimated 313 hours of annual use.

Overall, the rental framework reflects a balanced approach to affordability and operational cost recovery, enabling farmers to access a wide range of machinery critical for timely, efficient, and cost-effective crop production.

Table 2: Rental charges for different equipment

Sl. No	Equipments	Unit	Working hrs/yr*	Life span (yr)	Hiring/ Rental charges including Tractor
1	Tractor	hour	1000	10	-
2	Multi Crop Planter	hour	200	10	700/-
3	Rotavator	hour	300	8	600/-
4	Raised Bed Planter	hour	200	10	700/-
5	Laser Land Leveler	Acre	200	10	2500/-
6	Happy Seeder	hour	300	5	650/-
7	Cultivator	hour	400	10	550/-
8	Zero Tillage	hour	250	8	550/-
9	Potato Digger	hour	200	10	750/-
10	Potato Planter	hour	200	5	750/-
11	Multi Crop thresher	hour	313	8	700/-

(*Hunt 2013 and IS 9164-1979.)

Table 3 presents the annual recurring costs associated with operating the CHC under two utilization scenarios full capacity and 75% utilization during the first year providing insight into the operational expenditure required to sustain CHC services. Under full utilization, the tractor accounts for the highest recurring cost, totaling Rs. 5,21,964, which includes the driver's annual salary (Rs. 1,20,000), fuel expenses (Rs. 3,14,519), lubricant costs (Rs. 31,452), and maintenance charges equivalent to 10% of the tractor's purchase price (Rs. 55,993). At 75% utilization, these costs proportionally decrease to Rs. 3,91,473, reflecting reduced operational intensity during the initial establishment phase.

All implements incur recurring maintenance costs calculated at 10% of their acquisition value. Accordingly, maintenance expenses for key implements such as the multi-crop planter decline from Rs. 9,520 (full capacity) to Rs. 7,140, while the raised bed planter, laser land leveler, and happy seeder decrease from Rs. 33,485 to Rs. 25,113, Rs. 35,564 to Rs. 26,673, and Rs. 18,400 to Rs. 13,800, respectively. Similar proportional

reductions are observed for the cultivator, rotavator, zero tillage machine, potato digger, potato planter, and multi-crop thresher. The cumulative maintenance cost for all implements is Rs. 1,59,618 at full utilization and Rs. 1,19,714 at the reduced 75% capacity. Additional recurring expenses include salaries for a part-time mechanic (Rs. 72,000 at full capacity; Rs. 54,000 at 75% utilization), supervisor remuneration (Rs. 1,44,000 and Rs. 1,08,000, respectively), and an insurance premium equivalent to 2% of the tractor cost. These expenditures contribute Rs. 2,27,199 under full utilization and Rs. 1,70,399 at 75% use. Overall, the total recurring cost amounts to Rs. 9,08,781 for full operation and Rs. 6,81,586 during the first year at reduced capacity. These results highlight the substantial share of fuel, labour, and maintenance in CHC operational expenditure and underscore the importance of achieving higher utilization levels to improve cost efficiency and ensure financial sustainability.

Table 3: Annual reccuring cost for custom hiring centres

Sl. No	Items	Cost	
		Full capacity Utilization	75 % during 1st year
1	**Tractor**	-	-
	Driver's Salary @ Rs.10000 per month×12	1,20,000	90,000
	Fuel Cost (831.18 h/year × 4 Lts/h) @ 94.36/Lts (avg)	3,14,519	2,35,889
	Lubricants @10% of fuel cost	31,452	23,589
	Repair and maintenance charges @ 10 % of cost of tractor	55,993	41,995
	Sub Total	5,21,964	3,91,473
2	**Multi Crop Planter**		
	Repair and maintenance @ 10 %	9,520	7,140
3	**Raised Bed Planter**		
	Repair and maintenance @ 10 %	33,485	25,113
4	Laser Land Leveler		
	Repair and maintenance @ 10 %	35,564	26,673
5	**Happy Seeder**		
	Repair and maintenance @ 10 %	18,400	13,800
6	**Cultivator**		
	Repair and maintenance @ 10 %	3,790	2,843
7	**Rotavator**		
	Repair and maintenance @ 10 %	9,242	6,932
8	**Zero Tillage Machine**		
	Repair and maintenance @ 10 %	3,962	2,972
9	**Potato Digger**		
	Repair and maintenance @ 10 %	10,246	7,685
10	**Potato Planter**		
	Repair and maintenance @ 10 %	17,484	13,113
11	**Multi Crop thresher**		
	Repair and maintenance @ 10 %	17,925	13,443
	Sub Total	1,59,618	1,19,714
12	**Other recurring cost**		
	Salary for the part-time mechanic for repairing work @ Rs. 6000/- × 12 months	72,000	54,000
	Salary for Supervisor @12000/-	1,44,000	1,08,000
	Insurance premium @ 2% of tractor	11,199	8,399
	Sub Total	2,27,199	1,70,399
	Total recurring cost	**9,08,781**	**6,81,586**

Table 4 presents a detailed assessment of the annual income generated by each implement under full operational capacity and 75% utilization during the initial year, offering a clear perspective on the revenue structure and economic contribution of individual machines within the Custom Hiring Centre. Under full utilization, the laser land leveler emerged as the predominant income-generating implement, contributing Rs.5,00,000 annually, underscoring its critical role in precision land preparation and its consistently high service demand among farmers. This was followed by substantial income from the cultivator (Rs.2,20,000) and the multi-crop thresher (Rs.2,19,100), reflecting their significance in primary tillage and post-harvest handling operations.

Other key contributors included the rotavator (Rs.1,80,000), happy seeder (Rs.1,95,000), raised bed planter (Rs.1,40,000), and multi-crop planter (Rs.1,40,000), collectively demonstrating the centrality of sowing and residue-management implements in the CHC's operational portfolio. In contrast, implements with more seasonal or crop-specific use such as the zero-tillage machine (Rs. 1,37,500), potato digger (Rs. 1,50,000), and potato planter (Rs. 1,50,000) generated comparatively lower annual income, though they remain essential for diversified cropping systems.

When utilization was reduced to 75% during the first year,

income levels declined proportionately across all implements. For example, revenue from the multi-crop planter decreased from Rs. 1,40,000 to Rs. 1,05,000, while the happy seeder declined from Rs. 1,95,000 to Rs. 1,46,250. Similar proportional reductions were recorded for all other machines, consistent with anticipated reductions in operating hours.

The aggregated revenue under full utilization reached Rs. 20,31,600 compared to Rs. 15,23,700 at the 75% utilization level. After deducting total recurring costs, the net income amounted to Rs. 11,22,819 under full capacity and Rs. 8,42,114 during the first year. These findings highlight the strong dependence of CHC profitability on high utilization rates and underscore the need for efficient scheduling, robust demand generation, and effective machinery maintenance to optimize financial performance. The income pattern also reinforces the strategic value of prioritizing high-demand implements particularly land-leveling and planting machinery to maximize revenue potential and operational sustainability.

Table 4: Annual income from the custom hiring centre (Amount in Rs.)

Sl. No.	Items	Full capacity Utilization	75 % during 1st year
1	Tractor	-	-
2	Multi Crop Planter	1,40,000	1,05,000
3	Rotavator	1,80,000	1,35,000
4	Raised Bed Planter	1,40,000	1,05,000
5	Laser Land Leveler	5,00,000	3,75,000
6	Happy Seeder	1,95,000	1,46,250
7	Cultivator	2,20,000	1,65,000
8	Zero Tillage	1,37,500	1,03,125
9	Potato Digger	1,50,000	1,12,500
10	Potato Planter	1,50,000	1,12,500
11	Multi Crop thresher	2,19,100	1,64,325
	Total income	20,31,600	15,23,700
	Net income	**11,22,819**	**8,42,114**

Table 5 synthesizes the key economic performance indicators Net Present Value (NPV), Internal Rate of Return (IRR), Benefit–Cost Ratio (BCR), and breakeven year for the CHC over a 10-year operational horizon. These indicators collectively assess the long-term financial viability and investment efficiency of the CHC model. At a 15% discount rate, the present value of total benefits is estimated at Rs.97,54,478, while the present value of total costs amounts to Rs.65,28,618, resulting in a Net Present Worth (NPW) of Rs.32,25,860. The positive NPW clearly demonstrates that the discounted benefits exceed the corresponding costs, confirming the economic soundness of the investment.

The computed Internal Rate of Return (IRR) of 68% substantially surpasses the assumed discount rate, indicating exceptionally high financial returns relative to capital invested. This suggests that the CHC generates strong annualized returns, making it a highly attractive investment option. The Benefit-Cost Ratio (BCR) of 1.49 further reinforces this conclusion, implying that every rupee invested yields Rs. 1.49 in benefits. Additionally, the breakeven analysis reveals a breakeven year of Year 3, demonstrating that the CHC can recover its initial investment within a relatively short period and begin contributing net positive benefits thereafter. Complementing these financial indicators, the table also presents the percentage economic savings of mechanized practices compared to traditional methods for major field operations. Mechanization resulted in substantial savings across almost all implements, including multi-crop planter (86.84%), raised bed planter (85.53%), happy seeder (88.47%), cultivator (81.01%), rotavator (92.11%), and zero tillage machine (90.36%). These significant reductions in per-hectare operational costs highlight the economic advantage of mechanized interventions. Notably, the laser land leveler shows a negative saving (–49.63%), which may be attributed to its higher operational charges and specialized use, despite long-term agronomic benefits such as improved water-use efficiency and enhanced crop uniformity. Crop-specific implements like the potato digger (55.88%) and potato planter (63.94%) also demonstrated considerable cost savings relative to traditional practices.

Overall, the economic indicators and cost-saving patterns unequivocally confirm that the CHC model is financially viable, operationally efficient, and economically advantageous for farmers. The high IRR, favourable BCR, early breakeven point, and substantial cost reductions achieved through mechanization collectively highlight the potential of CHCs to strengthen farm productivity, reduce production costs, and promote sustainable mechanization in resource-constrained regions.

Table 5: Percentage economic saving of Traditional Practices vis-à-vis Mechanized Practices

Implements	Expenditure (Rs/ha)		Economic Savings (%)
	Traditional Practices	Mechanized Practices	
Multi Crop Planter	12800	1685.00	86.84
Raised Bed Planter	14600	2113.00	85.53
Laser Land Leveler	12800	19153.00	(-) 49.63
Happy seeder	15900	1834.00	88.47
Cultivator	8200	1557.00	81.01
Rotavator	16100	1270.00	92.11

Implements	Expenditure (Rs/ha)		Economic Savings (%)
	Traditional Practices	Mechanized Practices	
Zero Tillage Machine	12900	1244.00	90.36
Potato Digger	6800	3000.00	55.88
Potato planter	10400	3750.00	63.94
Multi Crop thresher	5200	1750.00	66.35

Prices are based on 2022 @ subsidized rate

The economic appraisal of the Custom Hiring Centre over a 10-year period demonstrates strong financial viability and operational efficiency. With a total capital investment of Rs. 24.90 lakh, primarily for machinery procurement, the CHC recovers its initial outlay by Year 3, as indicated by the breakeven analysis. From Year 2 onward, annual net income remains stable between Rs. 11.22 lakh and Rs. 12.28 lakh, reflecting consistent revenue across crop cycles and high machinery utilization. Key financial indicators further validate the model's profitability. The Net Present Value (NPV) at a 15% discount rate is Rs. 32.26 lakh, the Internal Rate of Return (IRR) is 68%, and the Benefit–Cost Ratio (BCR) is 1.49, confirming that each rupee invested returns Rs. 1.49 in benefits. Mechanization through the CHC substantially reduces cultivation costs; implements like the multi-crop planter, raised bed planter, happy seeder, rotavator, and zero-tillage machine offer savings of 81–92%, while potato-specific tools provide 55–64% reductions. Though the laser land leveler incurs higher immediate costs, its long-term benefits in land leveling, water efficiency, and crop uniformity are significant.

Table 6: Calculation of NPV, IRR, BCR and Breakeven year

Sl No	Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
1	Capital Cost	2490000	-	-	-	-	-	-	-	-	-
2	Recurring cost (RC)	681586	908781	908781	908781	908781	908781	908781	908781	908781	908781
3	**Total cost**	3171586	908781	908781	908781	908781	908781	908781	908781	908781	908781
4	Net Income	842114	1122819	1122819	1122819	1122819	1122819	1122819	1122819	1122819	1122819
5	**Benefit** (RC+net income)	1523700	2031600	2031600	2031600	2031600	2031600	2031600	2031600	2031600	2031600
6	Salvage value considering the rate of depreciation as 10 %	-	-	-	-	88130	-	-	21887	-	105593
7	**Total Benefits** (Benefit+ Salvage value)	1523700	2031600	2031600	2031600	2119730	2031600	2031600	2053487	2031600	2137193
8	Net Benefits **(Total benefit-total cost)**	-1647886	1122819	1122819	1122819	1210949	1122819	1122819	1144706	1122819	1228412
9	Discounting factor	15%									
10	NPV Benefit @ 15 % DF	Rs.	97,54,478								
11	NPV cost @ 15 % DF	Rs.	65,28,618								
12	NPW @15% DF	Rs.	32,25,860								
13	**BCR**		1.49								
14	**IRR**		68%								
15	**Breakeven year**		3								

Year-wise analysis indicates that the CHC records a negative net benefit only in Year 1 due to the initial capital outlay of Rs. 24.90 lakh. From Year 2 onward, net benefits remain positive (Rs. 11.22–12.28 lakh), with breakeven achieved in Year 3. Inclusion of salvage values in Years 5, 8, and 10 further enhances total benefits. Overall, the CHC is financially robust, operationally sustainable, and effectively promotes mechanization and income enhancement in rural farming systems.

The study shows that CHCs play a vital role in promoting climate-smart agriculture, especially when integrated with community institutions such as FPOs and SHGs also endorsed

by Mukherjee et al. 2022 and Mukherjee and Maity 2015. These platforms enhance farmers' awareness, access, and use of modern machinery, exposing small and marginal farmers to mechanization and fostering a culture of technology adoption (Anand et al., 2025). Timely access to implements through CHCs enables efficient land preparation, sowing, and harvesting, increasing cropping intensity, diversification, and reducing dependence on labour—particularly important in tribal and resource-constrained regions.

CHCs help farmers respond quickly to climate-related risks by enabling rapid completion of operations, thus mitigating the impact of delayed monsoons or unseasonal weather. They lower cultivation costs, reduce drudgery, improve resource efficiency, and strengthen the resilience of farming systems. FPO-managed CHCs also democratize access to costly machinery and build institutional capacity.

However, CHCs face challenges such as high investment costs, underutilized machinery, shortage of skilled operators, weak repair infrastructure, inadequate storage facilities, and low farmer awareness, all of which limit their operational and financial sustainability.

CONCLUSION

The study underscores the critical role of CHCs in enhancing agricultural mechanization, particularly for small and marginal farmers who face constraints in accessing high-cost farm machinery. By providing timely, affordable, and efficient access to a range of implements, CHCs contribute to increased cropping intensity, optimized resource utilization, and reduced production costs, thereby strengthening farm productivity and income generation. The economic evaluation demonstrates the financial viability of CHCs, highlighting positive net returns, high internal rates of return, and early breakeven periods, which collectively affirm their sustainability as an investment model. Integration of CHCs with Farmer Producer Organizations, Self-Help Groups, and cooperative frameworks not only facilitates collective ownership and operation but also promotes skill development, local entrepreneurship, and inclusive mechanization. Despite these advantages, challenges persist in terms of equitable access, skilled operation, maintenance infrastructure, and crop-specific underutilization. Addressing these constraints through targeted policy interventions, capacity building, and technological support can enhance CHC effectiveness, ensuring broader adoption and long-term sustainability. Overall, CHCs emerge as a strategic mechanism for fostering modern, efficient, and climate-resilient agricultural systems, bridging the gap between resource-poor farmers and mechanized farming technologies.

REFERENCES

Anand S, Ghosh S, Mukherjee A and Roy A.2025. How sustainable are the farmer producer companies (FPCs) in India ? —Unravelling the determinants of farmers' perceptions through multivariate analyses. Ann. Public Coop. Econ.1–31. https://doi.org/10.1111/apce.70017

Anon.2021. Mechanization and Technology Division, Department of Agriculture, Co-operation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India dated.

Chahal H S and Malhi V.2005. Analysis of custom hiring/ rental services of farm machinery through cooperative societies. Unpublished B. Tech. Dissertation Report of Department of Farm Power & Machinery, College of Agricultural Engineering, P.A.U., Ludhiana.

Ghosh S, Mukherjee A and Roy A. 2025. How sustainable are the farmer producer companies (FPCs) in India? —Unravelling the determinants of farmers' perceptions through multivariate analyses. Annals of Public and Cooperative Economics.

Hunt D.2013. Farm Power and Machinery Management (10e).Scientific International Pvt.Ltd, New Delhi, pp. 368.

IS 9164. 1979. Guide for estimating cost of farm machinery operation. Bureau of Indian Standards, New Delhi.

Kadaraiah A, Jirli B, Shivananda P , Nandini H M and Chaubey P N. 2022. Perception of farmers towards custom hiring service centres in Tumakuru District of Karnataka. Indian Journal of Extension Education 58 (2):209-212.

Kamble H G and Srivastava A P.2003. Repair and maintenance of experimental plot machinery. NATP on MEP, FOSU, IARI. New Delhi;2003.

Mehta C R, Chandel N S, Jena P C and Jha A. 2019. Indian agriculture counting on farm

Mechanization. Agricultural Mech. in Asia, Africa And Latin America 50(1):84-89.

Mukherjee A and Maity A. 2015 Public–private partnership for convergence of extension services in Indian agriculture. Current Science 109 (9) :1557-1563

Mukherjee A, Roy S, Pradhan K, Yadav V K, Shubha K, Singh D K, Anand S, Barua S, Rakshit S, Raman R K, Kumar U, Sainath B, Pal A K and Das A. 2025. Current challenges and solutions for sustainability of Farmers Producer Organisations through grassroots organisational ecosystem. Current Science 128(7): 699-709.

Nagaraj B, Srilatha Ch, Vikram S, Venkatesh M, Prameela Ch.2020. Establishing a Model Custom Hiring Center: A Feasibility Study at Kandi Mandal. Int. J. Curr. Microbiol. App. Sci. 9(5):1299-1307.

Parashunath G M, Hiremath and Prashanth.2016. Constraints of farmers in utilizing Custom Hiring Service (CHS) of tractor-based farm machineries - An Analysis. International Journal of Ag. Science and Research 6(1):217-220.

Rahman S.2023. CHC: Solution for mechanised agriculture. pp:19-26 https://timesofagriculture.in/3d-flip-book/march-issue-times-of-agriculture-magazine/

Ranade D H, Chourasia M C, Shrivastava MK, Patidar ID.2006. Improved tools and scope for their custom hiring in Malwa region - a case study. Agril Engg Today 30(1-2):28-31.

Roy P, Hansra B S, Burman R R, Bhattacharyya S, Roy T N and Ahmed R.2022. Can farm mechanization enhance small farmers' income? Lessons from Lower Shivalik Hills of the Indian Himalayan Region. Current Science 123(5): 667-676.

Sidhu H S.2005. Custom hiring of farm machinery- problems and prospects. Unpublished B. Tech (Agril. Engg.) Thesis, Department of Farm Power & Machinery, College of Agricultural Engineering, P.A.U, Ludhiana.

Sidhu R S and Vatta K.2012. Improving economic viability of farming: A study of cooperative agro machinery service centres in Punjab. Agril Econ Res Rev. 25: 427-434.

Sundaram P K, Sarkar B, Jeet P, Patel S K, Anurag A P, Upadhyaya A and Bhatt B P.2020. Dynamics of farm power sources and their availability in Bihar. Journal of AgriSearch 7(3):128-131.

Tayade N and V Jogdand S.2022. A Feasibility Study of Custom Hiring Service of Farm Machinery at Kanker District of Chhattishgarh. Asian Journal of Agricultural Extension, Economics & Sociology 40(12):454-460.

Citation:

Sarkar B, Sundarm P K, Jeet P, Deokaran, Ramkewal, Jeet I, Anurag A P, Bhatt B P, Sainath B, Mukherjee A, Kumar U, Kumar A, Upadhyaya A and Das A.2025. Custom hiring centres for climate smart agriculture: Profitability, performance and policy outlook. Journal of AgriSearch 12(4): 253-261