

## Original Research Article

# Perception vs. Performance: Correlation Assessment of Custom Hiring Centres in the Era of Climate-Smart Agriculture

### ABSTRACT

Farm mechanization is crucial for boosting land productivity by ensuring timely and precise agricultural operations, reducing crop loss, increasing labor efficiency, and enhancing the quality of farm work. However, small and marginal farmers often cannot afford the necessary equipment due to the limited financial resources, high cost of equipment, lack of access to credit, low economies of scale, high interest rates and unfavorable loan terms, lack of awareness and knowledge. Agriculture, vulnerable to and a contributor of climate change must adapt to changing conditions without worsening environmental issues. This has shifted agricultural development priorities. Custom Hiring Centers (CHCs) are vital in this context, as they provide affordable machinery rentals, making Climate-Smart Agriculture (CSA) technologies more accessible. CHCs are crucial in supporting farmers with CSA tools and financial resources. Custom Hiring Centers (CHCs) provide a solution by offering affordable access to farm implements, addressing labor shortages, ensuring efficient operations, and increasing yields by sharing the cost of implements through 'innovative arrangements'. An ex-post facto research design was used in present investigation. The study was confined to Vijayapur district of Karnataka. Five talukas having seven CHSCs within the entire Vijayapur district were chosen for this research study with 140 respondents. The study is all about the relationship between the efficiency of CHSC & farmers' profile of Vijayapur district, Karnataka. The study involved fifteen independent variables and one dependent variable. Data were gathered using structured interview schedules through personal interviews and analyzed using correlation coefficients. The result indicated the correlation between the efficiency of CHSCs vs age ( $r=0.028$ ), gender ( $r=0.059$ ), education ( $r=0.188$ ), farm size ( $r=-0.163$ ), farming experience ( $r=0.005$ ), social participation ( $r=0.208$ ), attitude ( $r=0.381$ ), annual income ( $r=0.223$ ), management orientation ( $r=0.236$ ), accessibility ( $r=0.241$ ), innovativeness ( $r=0.265$ ), extension contact ( $r=0.295$ ), mass media exposure ( $r=0.249$ ), economic orientation ( $r=0.278$ ), achievement motivation ( $r=0.259$ ). The result obtained might help to explore and widen the scope of farm mechanization and can help unleash the complete potential of custom hiring services, benefiting farmers and the agricultural domain alike. A synoptic study has been conducted regarding the farmers' notion and apprehension about the Custom Hiring Service Centers in advancing climate-smart agriculture (CSA) in Vijayapura district. Overall it was noted that Climate-Smart Agriculture (CSA) technologies and practices can effectively help the farmers especially the small farmers to overcome climate vulnerabilities. It also suggested that increasing the number of custom hiring centres and service providers can facilitate more inclusivity through competition.

**Key words:** *Climate-smart agriculture, Correlation Analysis, Custom Hiring Centers (CHCs), Efficiency, Implements, Mechanization.*

### 1. Introduction

Agriculture serves as the cornerstone of the Indian economy, serving as the primary livelihood for a significant portion of the population. The population of India stood at 1.42 billion during the period of 2022-23, agriculture contributed approximately 15% to the Gross Value Added (GVA) of the overall economy, with a growth rate averaging 4.3% over the past six years. Of India's total land area, approximately 139.4 million hectares are utilized for cultivation. A vast number of rural households rely on agriculture, with

approximately 82% of farmers categorized as small and marginal, and 54.3% of the workforce engaged in agriculture and related sectors (PIB, 2023).

Labor shortages and dwindling draft animal populations have made timely agricultural operations increasingly difficult, leading to higher wages and lower productivity. Farm mechanization emerges as a solution, promising timely and precise operations, minimizing crop loss, and optimizing labor efficiency. Yet, the affordability of necessary machinery poses a challenge, particularly for small and marginal farmers, since there are more than 12 crore small and marginal farmers in India, with an average land holding size of less than 1.1 hectares. Custom Hiring Centers (CHCs) present a viable solution by offering access to farm machinery at affordable rates.

Custom hiring of farm mechanization made its debut in Indian agriculture during the 19th century, with the introduction of custom hiring services dating back to 1912 in Punjab, where a steam thresher was employed (Srinivasarao et al., 2013). In 1971, the Government of India initiated a nationwide scheme to establish agro services centers, significantly promoting custom hiring services. Although custom hiring received attention under schemes like the National Agriculture Technology Project (NATP) and the National Agricultural Innovation Project (NAIP), its prioritization remained limited. In 2014, the Department of Agriculture, Government of Karnataka proposed the establishment of 186 Custom Hiring Service Centers (CHSCs), to be operated by two private entities. The Shri Kshethra Dharmasthala Rural Development Project, a charitable trust associated with the administrator of Dharmasthala temple in Dakshina Kannada, and the Indian Society of Agribusiness Professionals, New Delhi, are already operating 161 and 17 centers, respectively. In Vijayapur district, custom hiring services are available at seven centers across five talukas (Vijayapur, Basavan Bagewadi, Sindagi, Indi, and Muddebihal) at the hobli level. These services in Vijayapur district are provided by the social and human resource organization Kala Chetana Yuva Samasthe.

Climate change is rapidly becoming one of the most pressing global issues today. Its effects are particularly severe on agriculture, which relies heavily on local climatic conditions such as temperature, rainfall, and humidity. As a sector highly sensitive to climate fluctuations, agriculture is directly impacted by changing climate conditions and is one of the most vulnerable to climate-related risks. To address these challenges, agriculture must adopt a "climate-smart" approach, which involves sustainably enhancing productivity and income while adapting to and building resilience against climate change. This shift is crucial for meeting the demand for sufficient, nutritionally balanced food for a growing and increasingly demanding population amidst resource constraints and climate variability. Therefore, it is essential to both improve agricultural productivity and minimize yield variability over time under adverse climate conditions. One proposed solution is the increased adoption of Climate-Smart Agriculture (CSA) (FAO, 2010). CSA, which focuses on its intended outcomes rather than specific practices, is built on three main pillars: increasing agricultural productivity and income sustainably; adapting to and building resilience against climate change; and reducing or removing greenhouse gas emissions compared to traditional practices (FAO, 2013). In India, various technologies and practices have been emphasized to boost the adoption of Climate-Smart Agriculture (CSA). Key CSA technologies and practices, their potential to meet CSA's three objectives, and their estimated adoption costs are detailed in previous studies. Many of these technologies and practices have improved farm profitability, climate resilience, and reduced emissions. However, some technologies, such as Laser Land Leveler, zero-till (ZT), and seed planters, have seasonal applications. To support the adoption of other CSA practices like direct-seeded rice, alternate wetting and drying in rice, and crop diversification, establishing custom hiring services for small farmers should be promoted. Climate-smart agriculture is a strategy designed to sustainably evolve and redirect agricultural development. It focuses on boosting productivity, improving adaptation to changing conditions, and reducing greenhouse gas emissions to ensure food security amid the challenges posed by climate change. Thus, CSA is a critical approach for tackling the major global challenge of climate change by enhancing food system resilience, improving productivity, and addressing the interconnected issues of food security, adaptation, and mitigation.

This paper discusses & explores the relationship between the efficiency of CHCs and farmers' profile in the study area. This study would facilitate enhancing the suitability of CHC services for farmers, the role of mechanization in current farming practices, and potential these government and non-government institutions hold to improve CHC accessibility to farmers. This paper also provides a literature background

about Climate-Smart Agriculture and presents the opinion of farmers, extension resource persons and CHSC operators through different variables (like age, gender, annual family income, availability, achievement motivation, management orientation) supporting the adoption of CSA practices and technologies under CHSCs.

The policy implications of this study on the Custom Hiring Service Centres (CHSCs) in advancing climate-smart agriculture in India include promoting the expansion of CHSCs and providing financial incentives for acquiring climate-smart technologies. Policies should support training programs for CHSC operators and farmers, invest in infrastructure, and integrate CHSCs into broader agricultural strategies. Additionally, fostering public-private partnerships, establishing monitoring frameworks, and encouraging innovation are crucial for enhancing the effectiveness of CHSCs in supporting sustainable agricultural practices.

## 2. Materials and Methods

The present study was conducted in Vijayapur district of Karnataka. Vijayapur district was purposively selected for the study as Custom Hiring Service Centers were implemented in all the five talukas of Vijayapur district i.e. Vijayapur, Indi, Basavana Bagewadi, Muddebihal and Sindagi. *Ex-post facto* research design was employed, since the phenomenon had already occurred and the design was considered appropriate. All these talukas were selected purposively, as in all these talukas custom hiring service centers were started at hobli level (a cluster of adjoining villages administered together for tax and land tenure purposes in the states of Karnataka India). By using proportionate random sampling procedure, numbers of respondents were selected. Thus total sample size constituted for the study was 140 farmers from each hobli (CHSCs). The selected farmers were interviewed and desired information was collected with the help of predesigned and pre-tested schedule. The 15 variables viz., age, gender, education, farm size, farming experience, social participation, management orientation, annual family income, accessibility, innovativeness, extension contact, mass media exposure, attitude, achievement motivation and economic orientation for the present study have been selected on the basis of discussing formally and informally extension experts, resource personnel, researchers, previous studies taken up on the related subjects and followed the available reviews obtained. To examine the relationship between the selected independent variables and the efficiency of CHSC, correlation coefficients ( $r$ ) were calculated. The relationship between the scores of selected independent variables and the efficiency of the custom hiring centres was tested using both the null hypothesis and the empirical hypothesis.

### Null hypothesis

There will be no significant relationship between the selected independent variables viz., age, gender, education, farm size, farming experience, social participation, management orientation, annual family income, accessibility, innovativeness, extension contact, mass media exposure, attitude, achievement motivation and economic orientation and the efficiency of custom hiring centres.

### Empirical hypothesis

There will be significant relationship between the selected independent variables viz., age, gender, education, farm size, farming experience, social participation, management orientation, annual family income, accessibility, innovativeness, extension contact, mass media exposure, attitude, achievement motivation and economic orientation and the efficiency of custom hiring centres. Only those variables, which were having most relevance to the present investigation, were selected for the study. The data collected were scored, tabulated, and analyzed by using statistical tool such as correlation coefficient (Jyothi 2012).

Later on a snapshot survey of the farming community in the research area was conducted through personal interview method regarding the farmers', extension resource persons' and CHSC operators' notion and apprehension about the Custom Hiring Service Centers in advancing climate-smart agriculture (CSA) in Vijayapura district, alongside with the suggestive measures from the experts.

### 3. Results and discussion

#### Efficiency vs. age

The data presented in Table 1 shows that the computed coefficient of correlation ( $r = 0.028$ ) between age and the efficiency of custom hiring centers in the study area is less than the table value of ' $r$ ' at the 0.05 level of significance. Consequently, the null hypothesis was accepted, and the empirical hypothesis was rejected. Thus, it can be concluded that there is a positive but non-significant relationship between age and the efficiency of custom hiring centers (Dash 2004, Hiremath *et al.* 2015, Kohisatani *et al.*, 2018, Rajyalakshmi, 2019).

The results indicated that the efficiency of custom hiring centers was not affected by the age of the respondents. This outcome could be due to the fact that individuals, irrespective of their age, are capable of learning and adapting to mechanization technologies. This adaptability enables them to effectively utilize the equipment, thereby maintaining the efficiency of the custom hiring centers. Additionally, the widespread availability of training programs and resources could further facilitate the acquisition of these skills across different age groups.

Additionally through the synoptic survey, it can be pointed out that the young generation are more upfront towards the climate-smart technology practice adaptation as it might result in better productivity and greater profit in the long run. Since as the age of the household head rises, the likelihood of adopting and utilizing climate-smart agricultural practices decreases. This is because older farmers often prefer to reduce activities that require significant labor and management compared to their younger counterparts (Hailemariam *et al.*, 2019).

#### Efficiency vs. gender

The results in Table 1 showed that the coefficient of correlation ( $r = 0.059$ ) between gender and the efficiency of custom hiring centers was below the table value of ' $r$ ' at the 0.05 level of significance. Therefore, the null hypothesis was accepted, and the empirical hypothesis was rejected. This indicates that there is a positive but non-significant relationship between gender and the efficiency of custom hiring centers (Srinivasrao *et al.*, 2013, Shoba 2018, Kohisatani *et al.*, 2018, Rajyalakshmi, 2019).

The findings revealed that the efficiency of custom hiring centers was not impacted by the gender of the respondents. This may be attributed to the fact that both men and women are equally capable of acquiring skills and knowledge related to mechanization technologies. As a result, the ability to effectively operate machinery and equipment is not dependent on gender, allowing both male and female respondents to contribute equally to the operational efficiency of the custom hiring centers. Furthermore, the presence of gender-inclusive training programs and supportive environments may also enhance skill development and utilization, leading to consistent efficiency outcomes regardless of gender.

The snapshot survey indicates that male-headed households are more likely to access technologies and information related to climate-smart agriculture than female-headed households. This disparity may be due to gender-specific differences in access to resources, networks, and education, which can influence the ability to obtain relevant agricultural knowledge and technologies. Additionally, cultural norms and societal structures might further limit women's access to agricultural extension services and climate-smart agricultural innovations, creating barriers to their engagement with these resources. (Tekeste, 2021).

#### Efficiency vs. education

From Table 1, it is evident that the computed coefficient of correlation value ( $r = 0.188$ ) between education and the efficiency of custom hiring centers was greater than the table value of ' $r$ ' at the 0.05 level of significance. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted.

Therefore, it can be inferred that there was a positive and significant relationship between education and the efficiency of custom hiring centers (Chandrashekar, 2016, Kohisatani *et al.*, 2018).

A plausible explanation for this trend could be that education substantially improves the cognitive skills of the respondents, enabling them to better understand and apply agricultural knowledge. Educated farmers, even with a moderate level of exposure to mass media, are more adept at accessing diverse sources of agricultural information, including magazines, bulletins, and extension publications. Additionally, they are more inclined to seek advice and information from extension agencies, agricultural scientists, research stations, and Krishi Vigyan Kendras (KVKs) regarding farm mechanization. This proactive approach to learning and adopting new technologies can enhance their ability to efficiently utilize custom hiring centers, thereby improving the centers' overall performance and impact.

In harmony with the above result, the comprehensive survey too shows that the climate-smart practices interests the literate section of the community more than the other ones. This makes the literate farmers more inclined to obtain information on climate-smart agricultural practices from extension agents and various institutions (Tekeste, 2021).

### **Efficiency vs. farm size**

The data presented in Table 1 reveal that the coefficient of correlation ( $r = -0.163$ ) between farm size and the efficiency of custom hiring centers is less than the critical value of 'r' at the 0.05 significance level. Consequently, the null hypothesis was accepted, and the empirical hypothesis was rejected (Hiremath *et al.*, 2015, Rajyalakshmi, 2019).

It can thus be concluded that there is a negative and non-significant correlation between farm size and the efficiency of custom hiring centers. This pattern suggests that small and marginal farmers have greater access to these centers, as custom hiring services are often tailored to meet the needs of smaller farming operations. This focus on smaller farms may stem from the centers' ability to provide affordable mechanization solutions and specialized equipment that cater specifically to the requirements of small-scale farmers, enhancing their operational efficiency.

In line with this, the synoptic study accentuates that the farmers with larger landholdings were more inclined to implement these environmentally-friendly agricultural techniques. Farm Size can positively influence CSA adoption (Hailemariam *et al.*, 2019).

### **Efficiency vs. farming experience**

The results in Table 1 show that the computed coefficient of correlation ( $r = 0.005$ ) between farming experience and the efficiency of custom hiring centers was less than the table value of 'r' at the 0.05 level of significance. Consequently, the null hypothesis was accepted, and the empirical hypothesis was rejected. Therefore, it can be inferred that there is a positive but non-significant relationship between farming experience and the efficiency of custom hiring centers (Vanetha & Senthil, 2013, Srinivasrao *et al.*, 2013, Shoba 2018).

The findings revealed that the efficiency of custom hiring centers did not significantly affect the farming experience of the respondents. This outcome may be attributed to the fact that middle-aged farmers with moderate levels of experience are more inclined to adopt farm mechanization, primarily due to the shortage of labor. Their preference for mechanization, driven by the need to mitigate labor constraints, could be a key factor influencing the operational efficiency of custom hiring centers, rather than their own farming experience. Additionally, this demographic may already be familiar with the benefits of mechanization, making their experience level less relevant to the efficiency of these centers.

### **Efficiency vs. social participation**

From Table 1, it is evident that the coefficient of correlation ( $r = 0.208$ ) between social participation and the efficiency of custom hiring centers was greater than the table value of 'r' at the 0.01 level of significance. Hence, the null hypothesis was rejected and the empirical hypothesis was accepted. Therefore, it can be inferred that there is a positive and significant relationship between social participation and the efficiency of custom hiring centers (Kohisatani *et al.*, 2018, Rajyalakshmi, 2019).

A possible explanation is that farmers who are members of one or more organizations have greater opportunities for networking and exchanging ideas related to farm mechanization. These interactions provide valuable insights and shared experiences, which can enhance their understanding and adoption of mechanization practices. This collaborative exchange of knowledge likely plays a significant role in improving the operational efficiency of custom hiring centers, as farmers are better informed about the benefits and effective use of available technologies. Furthermore, organizational membership may also provide access to additional resources and support, further contributing to the effectiveness of these centers.

It can be seen from the summary analytic survey that the farmers' perceive the local institutions like Custom Hiring Centers (CHCs) and Farmer Producer Organizations (FPOs) play a crucial role in facilitating farmers' access to climate-smart agriculture (CSA) technologies and financial resources. CHCs, in particular, offer mechanization services that enable farmers to implement CSA practices that depend on specialized equipment.

### **Efficiency vs. attitude**

The correlation coefficient ( $r = 0.381$ ) between attitude and the efficiency of custom hiring centers exceeded the table value of 'r' at the 0.01 level of significance, as evident from Table 1. Thus, the null hypothesis was rejected, and the empirical hypothesis was accepted. This implies a positive and significant relationship between accessibility and the efficiency of custom hiring centers. The studies were supported by the findings of Vanetha & Senthil (2013), Srinivasrao *et al.* (2013), Hiremath *et al.* (2015), Kohisatani *et al.* (2018).

The probable explanation is that custom hiring enables the efficient use of modern machinery, granting farmers' access to advanced technologies that they might not afford to purchase outright. Furthermore, custom hiring services are instrumental in promoting agricultural diversification, allowing farmers to shift from traditional crops such as wheat and paddy to a wider range of agricultural products. This access to a variety of equipment supports the cultivation of different crops and helps farmers adopt more sustainable and profitable farming practices.

From the synoptic study, it is showcased that the farmers exhibit diverse cultures, resources, preferences, and choices when it comes to adopting climate-smart agricultural practices (Loevinsohn *et al.*, 2013). These practices are employed in various combinations to address climate change challenges, increase income, ensure food security, and alleviate poverty. Consequently, decisions regarding the use of multiple farming practices are complex and multifaceted; focusing solely on one variable would overlook valuable economic insights into the interplay and simultaneous application of these climate-smart practices.

### **Efficiency vs. annual family income**

The analysis from Table 1 reveals that the correlation coefficient ( $r = 0.223$ ) between annual income and the efficiency of custom hiring centers exceeds the critical value of 'r' at the 0.05 significance level. Consequently, the null hypothesis is rejected, and the empirical hypothesis is accepted. This suggests a positive and significant relationship between annual income and the efficiency of custom hiring centers (Kohisatani *et al.*, 2018 and Rajyalakshmi, 2019, Kisku & Singh, 2022).

Farm mechanization enables farmers to perform agricultural tasks more efficiently and on schedule, which results in higher productivity and profitability. The increase in farmers' income due to improved operational efficiency directly contributes to the effectiveness of custom hiring centers. Additionally, the ability to

complete tasks in a timely manner reduces labor costs and minimizes crop losses, further enhancing the economic benefits and overall performance of these centers.

In consistent with the concise survey, it can be stated that Climate-smart agricultural practices improve adaptability by optimizing resource use and building agricultural systems that withstand climate change. These practices are classified as climate-smart if they sustain or boost productivity while achieving at least one other goal, such as adaptation or mitigation. Farming decisions are intricate and depend on the specific context. They are driven by the principles of utility maximization or rational choice theory, which shape the adaptation strategies in agricultural decision-making (Hailemariam *et al.*, 2019).

### **Efficiency vs. management orientation**

The analysis from Table 1 revealed a correlation coefficient ( $r = 0.236$ ) between management orientation and the efficiency of custom hiring centers, surpassing the critical value of 'r' at the 0.01 significance level. Consequently, the null hypothesis was rejected, affirming the empirical hypothesis and indicating a positive and significant relationship between management orientation and the efficiency of custom hiring centers (Hiremath *et al.*, 2015, Rajyalakshmi, 2019)

Customers of custom hiring centers exhibited a strong management orientation, especially in the planning and execution of crop production technologies that incorporate mechanization. This strategic approach to managing agricultural activities contributed to the improved efficiency of custom hiring centers. By effectively coordinating mechanized practices, these customers were able to maximize the use of available resources and technologies, thereby enhancing overall productivity and operational outcomes of the centers. Additionally, their proactive engagement in adopting advanced mechanization techniques further reinforced the centers' effectiveness.

In the synoptic study, the perception of the CHSCs operators accentuates that the climate-smart agriculture (CSA) practices and Custom Hiring Centers (CHCs) can collaborate to boost farmers' income, enhance crop diversity, and improve resilience to climate change. CHCs offer affordable access to essential agricultural machinery such as sprayers, tillers, and harvesters, enabling farmers to implement CSA practices that need specialized equipment can be made accessible through the CHSCs (Tekeste, 2021).

### **Efficiency vs. accessibility**

The correlation coefficient ( $r = 0.241$ ) between accessibility and the efficiency of custom hiring centers exceeded the table value of 'r' at the 0.01 level of significance, as evident from Table 1. Thus, the null hypothesis was rejected, and the empirical hypothesis was accepted. This implies a positive and significant relationship between accessibility and the efficiency of custom hiring centers (Kohisatani *et al.*, 2018, Rajyalakshmi, 2019).

A likely reason for this trend is that a considerable number of respondents benefit from increased accessibility to custom hiring centers (CHCs), as these centers cater to the needs of users from nearby villages within a 5-7 kilometer radius. This proximity allows farmers to easily access mechanization services, reducing travel time and costs, which contributes to the improved operational efficiency of the CHCs. Moreover, serving a concentrated geographic area enables CHCs to optimize their service delivery and resource allocation, further enhancing their overall effectiveness.

As for now, the CSA technologies and practices are not thoroughly available to the farmers but the farmers are positive and enthusiastic with the idea of the availability and adoption in the CHSCs near them, as per the comprehensive survey (Loevinsohn *et al.*, 2013).

### **Efficiency vs. innovativeness**

The analysis from Table 1 indicates a correlation coefficient ( $r = 0.265$ ) between innovativeness and the efficiency of custom hiring centers, surpassing the critical value of 'r' at the 0.01 significance level. Consequently, the null hypothesis was rejected in favor of the empirical hypothesis. Thus, it can be inferred that there exists a positive and significant relationship between innovativeness and the efficiency of custom hiring centers (Kohisatani *et al.*, 2018, Rajyalakshmi, 2019).

Individuals with a high degree of innovativeness are more likely to actively pursue and adopt new technologies related to farm mechanization. This proactive approach to embracing cutting-edge tools and practices can significantly enhance the operational efficiency of custom hiring centers. By incorporating the latest advancements in mechanization, these individuals contribute to the optimization of resource use and the overall performance of the centers, fostering a more dynamic and efficient agricultural environment.

In agreement with the above, as underscored in the snapshot survey, the farmers' perceive the idea of the adoption of CSA technologies and practices as novel and sustainable in the long run with greater profitability prospective.

### **Efficiency vs. extension contact**

The data from Table 1 clearly demonstrate a coefficient of correlation ( $r = 0.295$ ) between extension contact and the efficiency of custom hiring centers, exceeding the table value of 'r' at the 0.01 level of significance. Consequently, the null hypothesis was rejected, and the empirical hypothesis was accepted. Thus, it can be concluded that there exists a positive and significant relationship between extension contact and the efficiency of custom hiring centers (Kohisatani *et al.*, 2018, Rajyalakshmi, 2019).

Farmers who interact with extension functionaries are able to access dependable and up-to-date information on agricultural practices. As a result, those who frequently engage with extension services and utilize custom hiring centers are better informed and more likely to influence the operational efficiency of these centers positively. This increased contact with extension professionals allows them to adopt best practices and leverage new technologies more effectively, thereby enhancing the performance and productivity of the custom hiring centers.

From the synoptic studies, it is featured that farmers are more likely to adopt climate-smart agricultural practices (CSAPs) when they receive support from experts such as extension agents. These agents are crucial in disseminating information about CSAPs and can integrate training into climate change and agricultural projects. Institutional extension services are essential for enhancing CSAP adoption because they facilitate knowledge transfer to farmers. The effectiveness of extension services in climate-smart agriculture (CSA) depends on several factors, including the complexity of the extension messages, the characteristics and distribution of the target population, the available technology, the type of data to be collected, and the financial resources allocated for extension activities.

### **Efficiency vs. mass media exposure**

The data from Table 1 indicate a correlation coefficient ( $r = 0.249$ ) between mass media exposure and the efficiency of custom hiring centers, surpassing the table value of 'r' at a 0.01 level of significance. Consequently, the null hypothesis was rejected, and the empirical hypothesis was accepted. This suggests a positive and significant relationship between mass media exposure and the efficiency of custom hiring centers (Kohisatani *et al.*, 2018, Rajyalakshmi, 2019).

The observed result may be due to regular exposure to mass media, which provides individuals with timely access to information on the latest advancements in farm mechanization technologies. This continuous flow of knowledge helps them stay informed about innovative practices and equipment, ultimately leading to improved efficiency of custom hiring centers. Moreover, the ability to quickly learn about and adopt new technologies fosters a more dynamic and effective approach to agricultural operations within these centers.

In alignment with the synoptic study conducted, the extension resource person brought out that the mass media exposure is essential in enhancing the reach and impact of climate-smart agriculture technologies by educating, informing, and engaging various stakeholders, ultimately supporting broader adoption and effective CSA implementation practices.

### **Efficiency vs. economic orientation**

The results depicted in Table 1 highlight a correlation coefficient ( $r = 0.278$ ) between economic orientation and the efficiency of custom hiring centers, surpassing the table value of 'r' at the 0.01 level of significance. Consequently, the null hypothesis was dismissed, while the empirical hypothesis was upheld. Thus, it can be deduced that there exists a positive and significant relationship between economic orientation and the efficiency of custom hiring centers (Rajyalakshmi, 2019, Kisku & Singh, 2022).

The observed outcome may be explained by farmers with a stronger economic orientation who aim for higher crop yields and increased financial returns. This drive encourages them to adopt the latest technologies in farm mechanization, which in turn fosters a positive and significant relationship with the efficiency of custom hiring centers. By continuously seeking to optimize their agricultural practices and maximize profitability, these farmers contribute to the enhanced performance and effectiveness of the custom hiring centers. Additionally, their focus on economic gains aligns with the centers' goals of providing efficient and modern farming solutions.

Corresponding to the opinion of the resource person and CHSC operator, it is stated that the custom hiring services advance climate-smart agriculture (CSA) by offering cost-effective access to specialized machinery, thereby enhancing operational efficiency and productivity. This enables the adoption of CSA practices, optimizes resource use, and reduces labor costs, leading to increased crop yields and improved income (Loevinsohn et al., 2013).

### **Efficiency vs. achievement motivation**

The data presented in Table 1 reveal a correlation coefficient ( $r = 0.259$ ) between achievement motivation and the efficiency of custom hiring centers, surpassing the table value of 'r' at the 0.01 level of significance. Consequently, the null hypothesis was dismissed, while the empirical hypothesis was upheld. Hence, it can be inferred that there exists a positive and significant relationship between achievement motivation and the efficiency of custom hiring centers (Kohisatani *et al.*, 2018, Rajyalakshmi, 2019, Kisku & Singh, 2022).

The noted result can be attributed to the inherent drive of achievement motivation, compelling individuals to strive toward goals and acquire knowledge of the latest technologies. This motivation consequently exerts a positive influence on the efficiency custom hiring centers.

Through the snapshot survey conducted in the research area, the farmers are positively inclined and motivated towards adoption of CSA technologies and practices under CHSCs (Loevinsohn et al., 2013).

**Table 1. Correlation analysis of profile characteristics and the performance of Custom Hiring Centres**

(n=140)

Variable No.	Independent variables	Correlation coefficients ('r' values)
X1	Age	0.028NS
X2	Gender	0.059NS
X3	Education	0.188 *
X4	Farm size	-0.163NS
X5	Farming experience	0.005NS
X6	Social participation	0.208**
X7	Attitude	0.381**
X8	Annual family income	0.223*
X9	Management orientation	0.236*
X10	Accessibility	0.241**
X11	Innovativeness	0.265**
X12	Extension contact	0.295**
X13	Mass media exposure	0.249**
X14	Economic orientation	0.278**
X15	Achievement motivation	0.259**

\* : Significant at 0.05 level

\*\* : Significant at 0.01 level

NS : Non-significant

#### 4. Summary and Conclusions

Correlation analysis indicated that certain independent variables, such as, education, social participation, attitude, management orientation, annual family income, accessibility, innovativeness, extension contact, mass media exposure, attitude, achievement motivation and economic orientation, exhibited a positive and significant relationship with the adoption of recommended maize cultivation practices. Conversely, farm size showed a negative and significant relationship, while age, gender, farming experience demonstrated a non-significant relationship with the adoption extent. Therefore, emphasis should be placed on enhancing those independent variables that positively and significantly correlate with the efficiency of custom hiring centres. Custom Hiring Centers (CHCs) facilitate the adoption of climate-smart agriculture technologies by offering agricultural equipment for rent at affordable prices. By providing access to costly machinery at reasonable rates, CHCs enable small-scale farmers to implement

climate-resilient practices and technologies. By examining these influences through the comprehensive study, policymakers and agricultural extension services can more effectively customize their strategies to promote the widespread adoption of climate-smart agriculture (CSA) practices. This approach will ultimately strengthen the resilience and productivity of smallholder farming systems in response to climate change. Enhancing agricultural extension services is crucial, particularly by providing smallholder farmers with relevant information, guidance, and technical support related to climate-smart practices and sustainable land management. Marginalized groups often face limited access to resources and markets, which can hinder their adoption of Climate-Smart Agriculture (CSA). To counter this, it is suggested that establishing institutions such as self-help groups that enhance economic participation is crucial, along with ensuring that CSA information is distributed equitably. Additionally, addressing gender disparities is vital, which can be achieved by empowering women farmers through improved decision-making opportunities, education, and access to resources. Forming farmer organizations and cooperatives can also improve resource and market access, facilitate information exchange, and promote collective action. Additionally, expanding the number of Custom Hiring Centers and service providers can enhance inclusivity by fostering competition. In summary, advancing sustainable agricultural development requires the creation and implementation of laws and policies that encourage the adoption of climate-smart farming techniques under CHSCs.

### **Disclaimer (Artificial intelligence)**

#### **Option 1:**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

#### **Option 2:**

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

#### **1. ChatGPT**

**2.**

**3.**

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