Original Research Article

Empowering Farmers through Climate Resilience: A Socio-Economic Study of the Farmers to ~~analyze~~ Analyze the Impact of the National Innovations in Climate Resilient Agriculture (NICRA) Project in Jharsuguda District of Odisha, India

ABSTRACT

This study, titled "Empowering Farmers through Climate Resilience: A Socio-Economic Study of the Farmers to analyze the Impact of the National Innovations in Climate Resilient Agriculture (NICRA) Project in Jharsuguda District of Odisha, India" examines the socio-economic characteristics of farmers in the context of climate-resilient technologies, and the challenges they face in implementing these practices. Conducted in one of Odisha's most drought-affected districts, the research compared two villages; Tharkuspur (a NICRA village) and Telidihi (a non-NICRA village) using an ex-post facto design. A total of 120 respondents (60 from each village) were selected through purposive and random sampling, and the data were analyzed with statistical tools including mean, standard deviation, frequency, and percentage. The results indicate distinct differences between NICRA and non-NICRA farmers. Among NICRA farmers, 63.34% were middle-aged and 40% had completed high school. Farming was the sole occupation for 48.33% of these farmers, and 46.67% reported an annual income between Rs. 1.2 and Rs. 2.4 lakh. They demonstrated a medium level of diversification (55%) and irrigation status (46.67%), as well as moderate engagement in social participation (43.33%) and mass media exposure (51.67%). In addition, NICRA farmers exhibited a medium level of risk orientation (51.67%) and innovativeness (48.83%). In contrast, non-NICRA farmers were slightly different, with 53.67% being middle-aged and only 31% having completed high school. A higher proportion (70%) relied solely on farming for their livelihood, and 43.33% earned between Rs. 1.2 and Rs. 2.4 lakh annually. Their levels of diversification (41.66%) and irrigation status (51.66%) were lower, while social participation (41.67%) and mass media exposure (46.67%) were comparable to NICRA farmers. Additionally, non-NICRA farmers showed medium levels of risk orientation (45%) and innovativeness (43.33%). These findings suggest that NICRA interventions, which include technology demonstrations and training through KVKs, are associated with improved socio-economic outcomes and greater adaptive capacity among farmers. The study underscores the potential benefits of

scaling up such initiatives to promote sustainable agricultural practices and enhance climate resilience in vulnerable regions.

Keywords: *Climate-resilient Agriculture, Climate-resilient technologies, NICRA, NICRA farmers, Socio-economic attributes, Climate change, Sustainability.*

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1. INTRODUCTION

Life on Earth is supported by its special environment, yet 25% of economic losses in developing nations are attributable to agriculture, which is directly impacted by climate risks (Jasna *et al*., 2015). Particularly in India, where agriculture is a sizeable portion of the national economy; the Inter-governmental Panel on Climate Change (IPCC) warns that climate change has serious worldwide repercussions. The world is projected to hit 1.5°C of warming at the current emission levels between 2030 and 2052. In India, the forecasted temperature rise ranges from 0.88°C to 3.16°C by 2050, and from 1.56°C to 5.44°C by 2080. Severe droughts and floods cause a shortage of food, price increases, and inflation. It is necessary to capture traditional knowledge among farmers and implement new policies and better technologies to increase the climate change resilience of Indian agriculture (Mallick *et al*., 2023).

The agriculture sector needs strong infrastructure, climate-resilient technologies, and new practices to handle climate change. The Indian government is prioritizing research to help agriculture adapt to these risks (Babu, 2019). The National Initiative on Climate Resilient Agriculture (NICRA) is the largest outreach program in the country, 2 focusing on creating climate-resilient villages to address extreme weather events like drought (Medhi *et al*., 2018). The NICRA project was launched on the 2nd of February in the year 2011 by ICAR, with a budget of Rs. 650 crores. The project's second phase of the XII-year plan, National Innovations in Climate Resilient Agriculture (NICRA), uses technological demonstrations and strategic research and capacity development of stakeholders to enhance climate change resilience in Indian agriculture (NICRA, 2018). The aim is to improve the resilience of Indian agriculture to climate change by demonstrating technologies or adaptation of crop and livestock and thereby up-scaling technologies (Rao *et al*., 2016). The NICRA project enhances agricultural resilience to climate change through strategic research, technology demonstration, sponsored research, and capacity building. ICAR collaborates with KVKs to develop climate resilience strategies for agriculture, livestock, and fisheries (NICRA Annual Report, 2021). Strategic research involves 41 ICAR Institutes working on adaptation and mitigation, with funding for critical research gaps. Technology demonstrations in 151 vulnerable districts focus on natural resource management, climate-resilient crops, livestock and fisheries improvements, and institutional interventions like seed banks and weather-based insurance. Sponsored research funds specific studies, while capacity-building programs scale up interventions nationwide (Rahman *et al.,* 2021).

India faces severe consequences of climate change, making climate-resilient practices the most effective adaptation strategy. Increasing awareness and involving people from diverse backgrounds can help accelerate the adoption of these practices (Bodsa, 2021). The NICRA project has introduced various interventions through its Technology Demonstration Components (TDCs) to strengthen climate resilience in farming communities. However, existing challenges in these areas make it difficult for farmers to withstand climate change, impacting their socioeconomic progress. In Jharsuguda district, climate change poses multiple threats, including early-season droughts in rainfed areas, unpredictable rainfall, industrial hazards, and extreme weather events such as heatwaves, floods, and prolonged droughts. Farmers in this region struggle with low agricultural productivity and uncertain climatic conditions. To address these challenges, NICRA was implemented in Bhoimunda and Tharkaspur villages by KVK, Jharsuguda. This research focuses on evaluating the socioeconomic background of farmers, their awareness of climate-resilient technologies, and the sources they rely on for guidance in adaptation and mitigation strategies. The study aims to assess the extent of farmers' adoption of these technologies and examine how the NICRA project has influenced their livelihoods, food security, and overall resilience to climate change.

Existing research highlights various socio-economic attributes influencing farmers' resilience to climate change. Studies on age distribution (Raghuvanshi *et al*., 2018; Singh, 2020) show that most farmers fall within the middle-age group, which is crucial for adopting climate-resilient technologies. Education levels vary, with most farmers completing elementary or secondary education (Das & Rahman, 2018; Muthulakshmi & Rajkumar, 2018), affecting their ability to understand and implement new practices. Agriculture remains the primary occupation, though some engage in labor and agribusiness (Sivaraj *et al*., 2017; Malik *et al*., 2019; Thakor & Joshi, 2024), demonstrating the need for diversification to enhance income stability. Farming experience is mostly at a medium level (Pise *et al*., 2018; Bodsa, 2021), which suggests that while farmers possess practical knowledge, continued exposure to climate-resilient strategies is necessary. Income levels remain moderate for most, with NICRA beneficiaries experiencing slight improvements (Pabba *et al.,* 2021; Thakor & Joshi, 2024). Farm size is another determinant, with larger landholders benefiting more from climate-resilient technologies (Das & Rahman, 2018; Singh, 2020). Agricultural diversification has increased in NICRA villages, shifting towards high-value crops like spices, flowers, and medicinal plants (Kumar *et al*., 2018; Babu, 2019), indicating its role in risk mitigation. Irrigation access has improved under NICRA, with beneficiaries adopting efficient water management practices (Alam *et al*., 2016; Harikrishna *et al.,* 2019). Social participation varies, with NICRA farmers engaging more in community-based initiatives (Raghuvanshi *et al*., 2018). Mass media exposure, extension contact, and economic motivation are higher among NICRA farmers, positively influencing technology adoption (Charitha, 2017; Thakor & Joshi, 2024; Singh, 2020; Pradhan, 2021). Risk orientation and innovativeness are also higher among beneficiaries, showing their willingness to experiment with new methods (Thatikonda, 2017; Ahire & Kapse, 2017; Mahesh Babu, 2016; Pabba *et al.,* 2021).

Despite these insights, there is a research gap in understanding the long-term impact of NICRA on socio-economic attributes, particularly in Jharsuguda district. Drought and heatwaves have a direct impact, emphasizing the urgent need for climate-resilient training. Given that Jharsuguda is an industrial region, soil degradation is becoming a significant concern. Farmers receive firsthand knowledge through NICRA initiatives, and a post-impact study should be conducted to assess the effectiveness of these interventions. Limited studies compare NICRA and non-NICRA farmers in terms of resilience, adaptation strategies, and economic mobility. This study aims to bridge this gap by assessing how NICRA interventions have shaped farmers' livelihoods, providing retrospective insights to guide future resilience strategies.

2. METHODOLOGY

The present study was carried out in the Jharsuguda district of Odisha, employing a combination of purposive and simple random sampling techniques to select the block, gram panchayat, villages, and research participants. This region was deliberately chosen due to its high susceptibility to heat waves, droughts, and industrial pollution, which contribute to declining agricultural yields and pose a significant threat to future food security. Jharsuguda block was selected purposively as it hosts the NICRA project implemented by KVK, Jharsuguda. In contrast, the Kirmira block, where NICRA interventions were absent, was chosen as a comparative non-NICRA block. Furthermore, two villages Tharkuspur (NICRA village) and Telidihi (non-NICRA village) were purposefully selected for the study. A total of 120 respondents were chosen, with 60 participants drawn randomly from each village. The selection criteria mandated that respondents be above 18 years of age and possess three to five years of farming experience, particularly in climate-resilient agricultural practices. The gathered data were subjected to statistical analysis using frequency distribution, percentage, mean, and standard deviation.

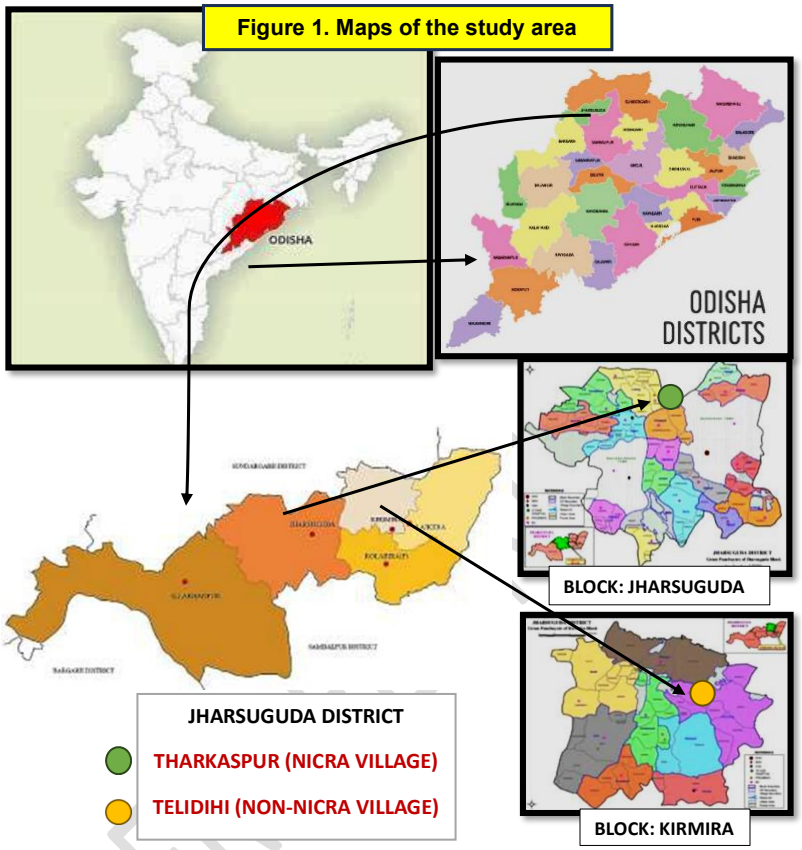
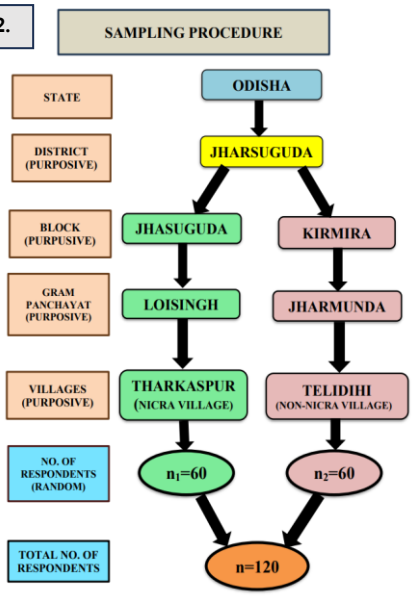
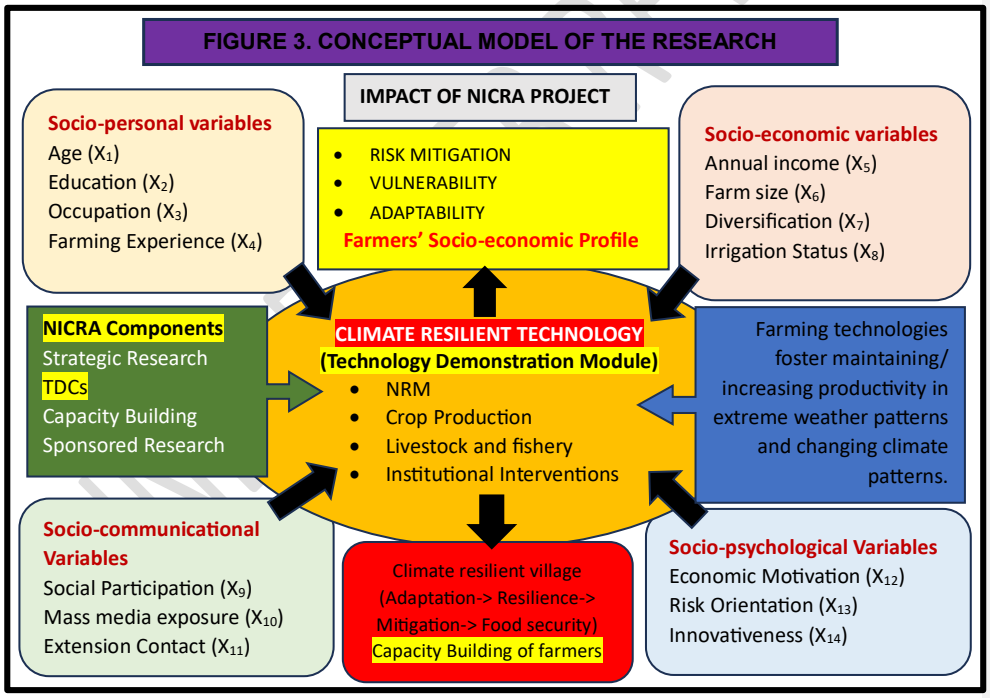


Figure 1. Maps of the study area

Figure 2.





To collect data for this study, a preliminary pilot test was conducted in Jharsuguda district to refine the variables and finalize the interview schedule. The researcher consulted experts, OUAT's College of Agriculture professors, and KVK scientists to develop the data collection tool. A structured interview schedule was constructed and served as the primary tool. It covered the respondents' socioeconomic background and general details. The interview schedule was pre-tested with 20 farmers from a non-sample village in Jharsuguda to ensure reliability and validity, leading to minor revisions before finalization. Data collection took place in July and August 2024, during which the researcher personally interviewed respondents at their homes, community centers, and fields, establishing rapport with farmers, local leaders, and Krushak Sathi for better accuracy. The study considered both independent and dependent variables, selected based on research objectives, literature review, and expert advice.

Table 1 Selection and measurement of variables for the present study

Variables	Measurement Tools
Socio-economic attributes of the respondents (NICRA and Non-NICRA Farmers)	
A. Socio-personal Variables	
Age	The Chronological age of the respondents
Education	Scale developed by Supe (2007) with slight modification
Occupation	A structured schedule was developed for the study.
Farming experience	No. of years completed in farming.
B. Socio-economic Variables	
Annual income	A structured schedule was developed for the study.
Farm size	Categorization of farmers according to agriculture census (2015-16), The MoA&FW, Govt. of India
Diversification	The structured schedule was developed by Babu (2019)
Irrigation status	The scale was developed by Nirban (2004) with slight ~~modification~~modifications.
C. Socio-communicational Variables	
Social participation	The scale was developed by Trivedi (1963) with slight ~~modification~~modifications.
Mass media exposure	The scale was developed by Nirban (2004) with slight ~~modification~~modifications.
Extension Contact	The scale was developed by Sawant (1999) with slight modification.
D. Socio-psychological Variables	
Economic motivation	The scale was developed by Supe (2007) with slight modification.
Risk orientation	The scale was developed by Supe (2007) with slight modification.
Innovativeness	Structured Schedule was developed by Nagaraj (2013) with slight modifications.

2. RESULTS AND DISCUSSION

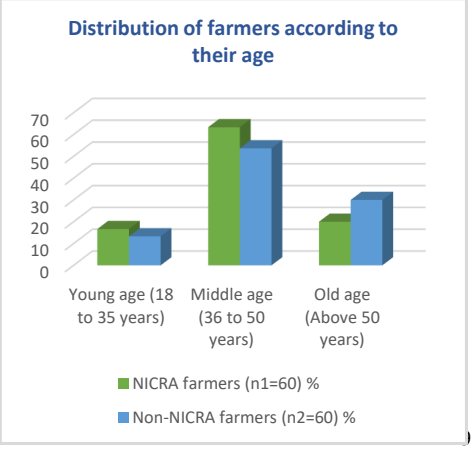
3.1 Socio-personal status of respondents in the study area

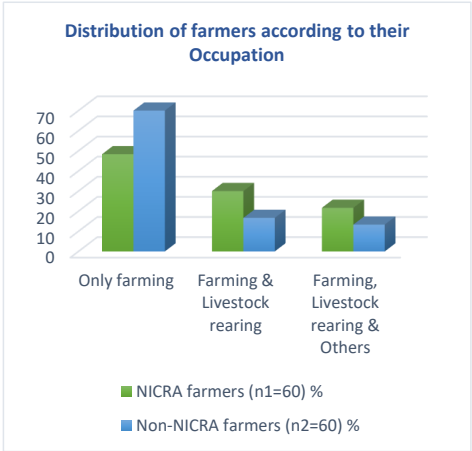
Table 2 presents the age distribution of respondents, revealing that the majority of farmers in both NICRA and non-NICRA villages (63.34% and 53.67%, respectively) belonged to the middle-aged category,

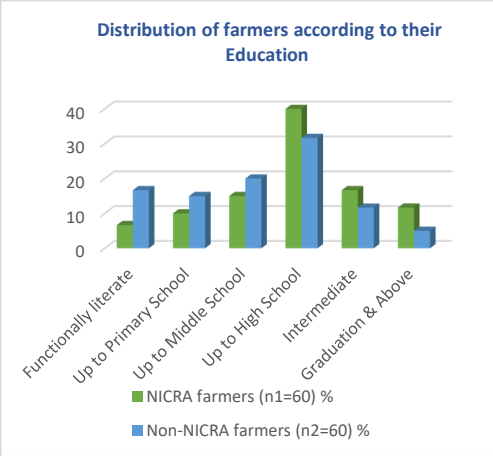
followed by older farmers (20.00% and 30.00%) and younger farmers (16.66% and 13.34%). The findings suggest that middle-aged and older farmers were more actively engaged in farming, whereas younger individuals tended to seek non-agricultural careers due to lower education levels and the perception of agriculture as an unprofitable venture. These observations align with the conclusions of Charitha (2017), Harikrishna *et al*. (2019), Babu (2019), and Bodsa (2021).

TABLE 2. Distribution of respondents according to their socio-personal characteristics (Age, Education, Occupation, Farming Experience)

Variables	Categories	Total Respondents (N=120)	
		NICRA Farmers (n=60)	Non-NICRA Farmers (n=60)
		f (%)	*f* (%)
A. Socio-personal Variables			
Age (X_1)	Young (18 to 35 years)	10 (16.66)	08 (13.33)
	Middle (36 to 55 years)	38 (63.34)	34 (53.67)
	Old (55years and above)	12 (20.00)	18 (30.00)
Education (X_2)	Functionally literate	04 (06.66)	10 (16.67)
	Up to Primary School	06 (10.00)	09 (15.00)
	Up to Middle School	09 (15.00)	12 (20.00)
	Up to High School	24 (40.00)	19 (31.67)
	Intermediate	10 (16.67)	07 (11.66)
	Graduation or above	07 (11.67)	03 (05.00)
Occupation (X_3)	Farming	29 (48.33)	42 (70.00)
	Farming+ Livestock rearing	18 (30.00)	10 (16.67)
	Farming+ Livestock rearing + Others	13 (21.67)	08 (13.33)
Farming Experience (X_4)	Low	15 (25.00)	14 (23.33)
	Medium	26 (43.33)	24 (40.00)
	High	19 (31.67)	22 (36.67)
	Mean	**28.61**	**25.81**
	S.D.	**11.10**	**11.51**







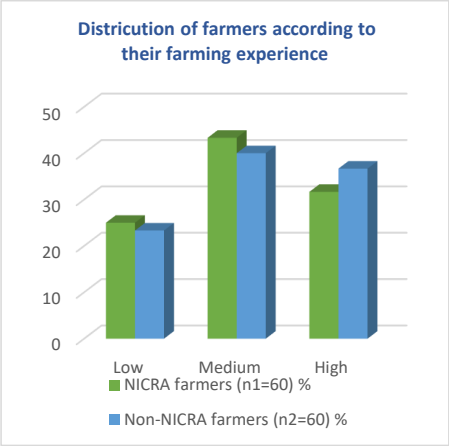


Figure 4 Distribution of respondents according to their socio-personal characteristics (Age, Education, Occupation, Farming Experience)

Table 2 illustrates the education levels of respondents, indicating that the majority of farmers in both NICRA and non-NICRA villages had attained high school education (40% and 31%, respectively), followed by middle school (15% and 20%), intermediate (16.67% and 11.66%), primary school (10% and 15%), and functional literacy (6.66% and 16.67%). A smaller proportion of farmers had completed graduation (11.67% in NICRA villages and 5.00% in non-NICRA villages). While there is a gradual improvement in education levels, higher studies require migration to cities, posing a challenge. Initiatives such as adult education and functional literacy programs in villages are recommended to bridge this gap. These findings are consistent with those of Raghuvanshi et al. (2018), Harikrishna (2018), and Pabba et al. (2021).

Table 2 categorizes respondents based on their primary occupation. In NICRA villages, 48.33% of farmers relied solely on farming, while 30% combined farming with livestock rearing, and 21.67% engaged in farming, livestock, and other occupations. In contrast, a higher percentage (70%) of non-NICRA farmers depended solely on farming, with 16.67% involved in farming and livestock rearing, and 13.33% in multiple occupations. The data indicate that NICRA farmers adopted more diversified agricultural practices, incorporating livestock and poultry due to exposure to climate-resilient technologies. These findings corroborate the studies of Sivraj *et al*., (2017), and Harikrishna *et al*. (2019).

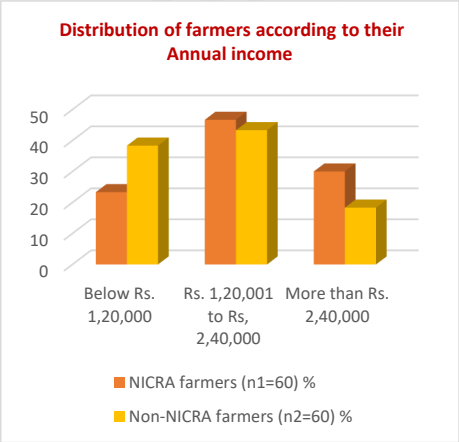
Table 2 highlights farming experience levels among respondents. In NICRA villages, 43.33% had medium farming experience, followed by high (31.67%) and low (25.00%). Similarly, in non-NICRA villages, 40.00% had medium experience, followed by high (36.67%) and low (23.33%). The findings suggest that most farmers, belonging to the middle-aged group (36–50 years), came from agricultural backgrounds and

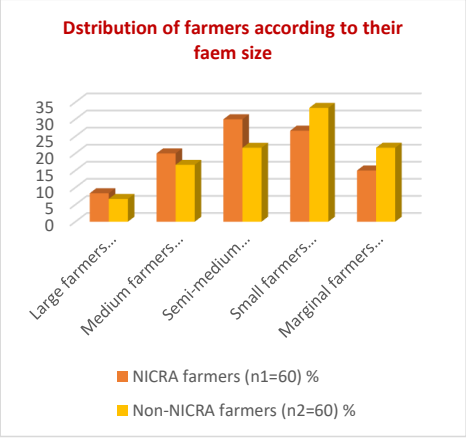
began farming early, leading to a moderate level of experience. These results align with the studies of Thatikonda (2017), Pise *et al.* (2018), Singh (2020), and Bodsa (2021).

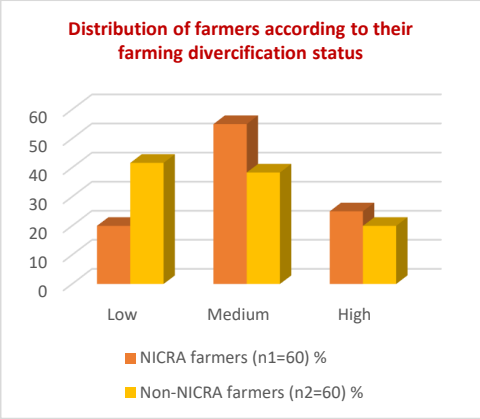
3.2 Socio-economic status of respondents in the study area

TABLE 3. Distribution of respondents according to their socio-economic profile (Annual income, farm size, diversification, irrigation stats)

Variables	Categories	Total Respondents (N=120)	
		NICRA Farmers (n=60)	Non-NICRA Farmers (n=60)
B. Socio-economic Variables		***f* (%)**	***f* (%)**
Annual Income (X_5)	Up to Rs. 1,20,000	14 (23.33)	23 (38.34)
	Rs. 1,20,001 to Rs. 2,40,000	28 (46.67)	26 (43.33)
	Above Rs. 2,40,000	18 (30.00)	11 (18.33)
Farm size (X_6)	Marginal farmers (up to 1 ha.)	09 (15.00)	13 (21.67)
	Small Farmers (1.01 to 2 ha.)	16 (26.67)	20 (33.34)
	Semi-medium farmers (2.01 to 4 ha.)	18 (30.00)	13 (21.66)
	Medium farmers (4.01 to 10 ha.)	12 (20.00)	10 (16.66)
	Large farmers (10 ha. and above)	05 (08.33)	04 (06.67)
Diversification (X_7)	Low	12 (20.00)	25 (41.66)
	Medium	33 (55.00)	23 (38.34)
	High	15 (25.00)	12 (20.00)
	Mean	**2.65**	**2.11**
	S.D.	**0.81**	**1.04**
Irrigation Status (X_8)	Low	11 (18.33)	31 (51.66)
	Medium	28 (46.67)	19 (31.66)
	High	21 (35.00)	10 (16.67)
	Mean	**3.53**	**2.80**
	S.D.	**1.56**	**1.44**







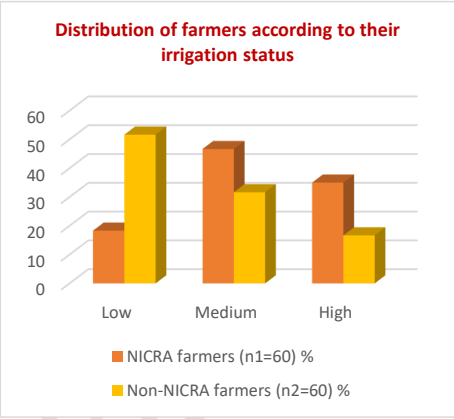


Figure 5. Distribution of respondents according to their socio-economic profile (Annual income, farm size, diversification, irrigation status)

The study examined the annual income, diversification, and irrigation status of farmers in both NICRA and non-NICRA villages, highlighting the impact of climate-resilient interventions.

Table 3 illustrates that in NICRA villages, the majority of respondents (46.67%) had an annual income between Rs. 1,20,001 and Rs. 2,40,000, followed by those earning above Rs. 2,40,000 (30.00%) and below Rs. 1,20,000 (23.33%). In contrast, among non-NICRA farmers, 43.33% fell within the Rs. 1,20,001–2,40,000 income bracket, 38.34% earned below Rs. 1,20,000, and only 18.34% had an income exceeding Rs. 2,40,000. The higher income levels among NICRA farmers can be attributed to the adoption of intercropping, crop diversification, livestock rearing, and low-cost fish farming under the project, which supplemented their earnings. Conversely, most non-NICRA farmers relied solely on traditional farming. These findings align with those of Charitha (2017), Pise *et al*. (2018), and Thakur and Joshi (2024).

The distribution of respondents based on landholding revealed that in NICRA villages, the majority (50.00%) had medium-sized landholdings (1.01–2.00 ha), followed by small (30.00%, 0.51–1.00 ha) and large landholders (20.00%, above 2.00 ha). In contrast, among non-NICRA farmers, a higher percentage (55.00%) had small landholdings, followed by medium (35.00%) and large (10.00%) landholdings. The prevalence of medium landholdings among NICRA farmers was attributed to improved agricultural practices and resource-sharing within nuclear families, whereas non-NICRA farmers primarily managed smaller land parcels. These findings align with those of Das and Rehman (2018), Singh (2020), and Bodsa (2021).

Table 3. presents the level of diversification among farmers. A majority (55.00%) of NICRA respondents exhibited medium diversification, followed by high (25.00%) and low (20.00%). In non-NICRA villages, however, most farmers (41.66%) had low diversification, with medium (38.34%) and high (20.00%) levels being less prevalent. The study highlights differences in cropping patterns, where NICRA farmers cultivated maize, sweet corn, fodder grasses, and horticultural crops due to improved water availability. This was facilitated by KVK and agricultural department initiatives, which provided training and demonstrations on water-saving technologies, leading to moderate cropping intensity. In contrast, non-NICRA farmers, with limited exposure to these interventions, exhibited low to medium cropping intensity. These findings corroborate those of Kumar *et al.* (2018) and Babu (2019).

Table 3. indicates that in NICRA villages, the majority (46.67%) of farmers had a medium irrigation status, followed by high (35.00%) and low (18.33%). Conversely, in non-NICRA villages, a significant proportion (51.66%) had low irrigation status, with medium (31.66%) and high (16.67%) levels being less common. Under the NICRA project, KVK and ICAR scientists, along with SAUs, undertook initiatives such as check dam renovation and farm pond construction through community participation. This contributed to improved groundwater levels, enabling the adoption of drip and sprinkler irrigation among NICRA farmers. Some progressive farmers even implemented drip irrigation in vegetable cultivation. However, non-NICRA farmers, with minimal training and limited interactions with KVK scientists, had lower exposure to water-saving technologies. Similar findings have been reported by Alam *et al.* (2016), Harikrishna *et al.* (2019), and Babu (2019).

3.3 Socio-communicational status of respondents in the study area

TABLE 4 Distribution of respondents according to their socio-communicational profile (Social Participation, Mass media exposure, and Extension Contact)

Variables	Categories	Respondents (N=120)	
		NICRA Farmers (n=60)	Non-NICRA Farmers (n=60)
		f (%)	*f* (%)
A. Socio-communicational Variables			
Social Participation (X_9)	Low	18 (30.00)	24 (40.00)
	Medium	26 (43.33)	25 (41.67)
	High	16 (26.67)	11 (18.33)
	Mean	**15.08**	**12.85**
	S.D.	**1.63**	**1.32**
Mass media Exposure (X_{10})	Low	15 (25.00)	21 (35.00)
	Medium	31 (51.67)	28 (46.67)
	High	14 (23.34)	11 (18.34)
	Mean	**14.90**	**12.06**
	S.D.	**1.71**	**1.89**
Extension Contact (X_{11})	Low	17 (28.33)	23 (38.33)
	Medium	28 (46.67)	25 (41.67)

	High	15 (25.00)	12 (20.00)
	Mean	**19.00**	**15.48**
	S.D.	**2.31**	**2.44**

Figure 6. Distribution of respondents according to their socio-communicational profile (Social Participation, Mass media exposure, and Extension Contact)

Table 4 revealed that 43.33% of NICRA village respondents exhibited a medium level of social participation, followed by low (30.00%) and high (26.67%) participation. Similarly, in the non-NICRA village, 41.67% of respondents had a medium level of social engagement, while 40.00% had low and 18.33% had high social participation. The findings indicate that farmers from NICRA villages were more engaged in social organizations, as KVK scientists preferred members of such groups for implementing NICRA interventions and fostering technology adoption. To enhance awareness, non-NICRA farmers should be

encouraged to participate in social organizations for access to agricultural innovations, government schemes, and subsidies. These findings are consistent with those of Pise *et al.* (2018), Harikrishna (2019), and Bodsa (2021).

Table 4 revealed that 51.67% of NICRA village respondents had a medium level of mass media exposure, followed by low (25.00%) and high (23.34%) exposure. In contrast, 46.67% of non-NICRA farmers had medium exposure, while 35.00% and 18.34% had low and high exposure, respectively. The higher mass media exposure among NICRA farmers was attributed to their participation in training programs where they were educated on utilizing mobile applications, toll-free numbers, and farm broadcasts through television and radio. These initiatives enhanced their access to agricultural information, positioning them in the medium to high exposure category compared to non-NICRA farmers. These findings align with those of Charitha (2017), Thatikonda (2017), Babu (2019), and Malik *et al.* (2019).

Table 4 indicated that 46.67% of NICRA village respondents had medium extension contact, followed by low (28.33%) and high (25.00%) levels. Among non-NICRA farmers, 41.67% had medium,38.33% had low, and 20.00% had high extension contact. The higher extension contact among NICRA respondents was attributed to regular interactions with KVK scientists, Village Agricultural Workers (VAWs), agriculture department officials, and Krushak Sathees through field visits and demonstrations. This trend aligns with the findings of Charitha (2017), Singh (2020), and Bodsa (2021).

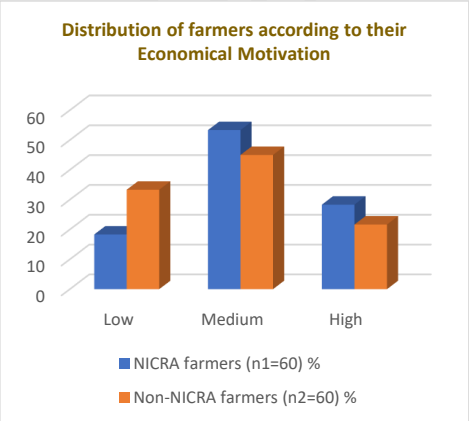
3.4 Socio-psychological Sstatus of Rrespondents in the Sstudy Aarea

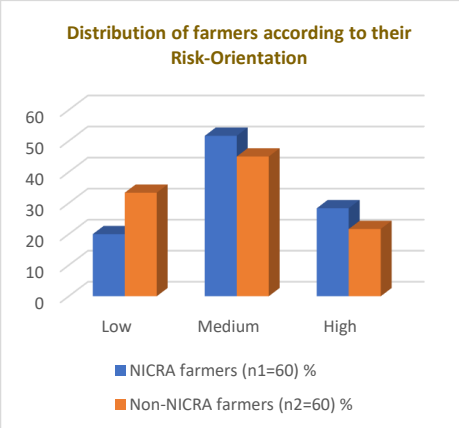
Table 5 indicated that a majority (53.34%) of respondents from NICRA villages exhibited a medium level of economic motivation, followed by 28.33% with high and 18.33% with low motivation. In comparison, 45.00% of respondents from non-NICRA villages had a medium level of economic motivation, while 33.34% had low and 21.67% had high motivation. This disparity can be attributed to the influence of KVK scientists, agricultural frontline workers, and agriculture line departments. Through capacity-building programs, NICRA village farmers gained awareness of climate-resilient technologies, leading them to invest in farm ponds, micro-irrigation, dairying, and crop diversification. Conversely, farmers in non-NICRA villages struggled to adopt these innovations due to limited exposure, resulting in medium to low levels of economic motivation. These findings align with the studies of Charitha (2017), Harikrishna (2019), and Babu (2019).

Table 5 illustrates that most respondents (51.67%) from NICRA villages had a medium level of risk orientation, followed by 28.34% with high and 20.00% with low-risk orientation. Among non-NICRA village farmers, 45.00% exhibited medium-risk orientation, while 33.34% had low and 21.66% had high-risk orientation. The willingness of NICRA farmers to accept and experiment with new agricultural ideas contributed to their higher risk orientation. In contrast, non-NICRA village respondents exhibited lower levels of social participation, limiting their inclination toward adopting innovative practices. These findings are ~~in accordance with~~by Charitha (2017), Pise *et al*. (2018), Harikrishna (2019), Bodsa (2021), and Pabba *et al*. (2021).

TABLE 5 Distribution of respondents according to their socio-psychological profile (Economic motivation, Risk Orientation, and Innovativeness)

Variables	Categories	Total Respondents (N=120)	
		NICRA Farmers (n=60)	Non-NICRA Farmers (n=60)
A. Socio-psychological Variables		***f* (%)**	***f* (%)**
Economic Motivation (X_{12})	Low	11 (18.33)	20 (33.34)
	Medium	32 (53.34)	27 (45.00)
	High	17 (28.33)	13 (21.67)
	Mean	**19.83**	**15.16**
	S.D.	**2.81**	**2.92**
Risk Orientation (X_{13})	Low	12 (20.00)	20 (33.34)
	Medium	31 (51.67)	27 (45.00)
	High	17 (28.34)	13 (21.66)
	Mean	**20.60**	**16.26**
	S.D.	**3.05**	**3.02**
Innovativeness (X_{14})	Low	14 (23.34)	22 (36.67)
	Medium	29 (48.83)	26 (43.33)
	High	17 (28.33)	12 (20.00)
	Mean	**14.56**	**12.31**
	S.D.	**2.23**	**1.74**





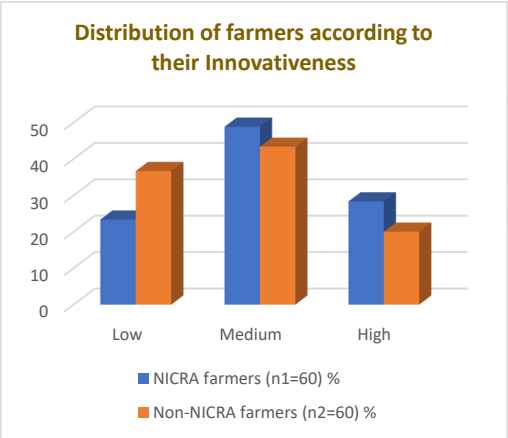
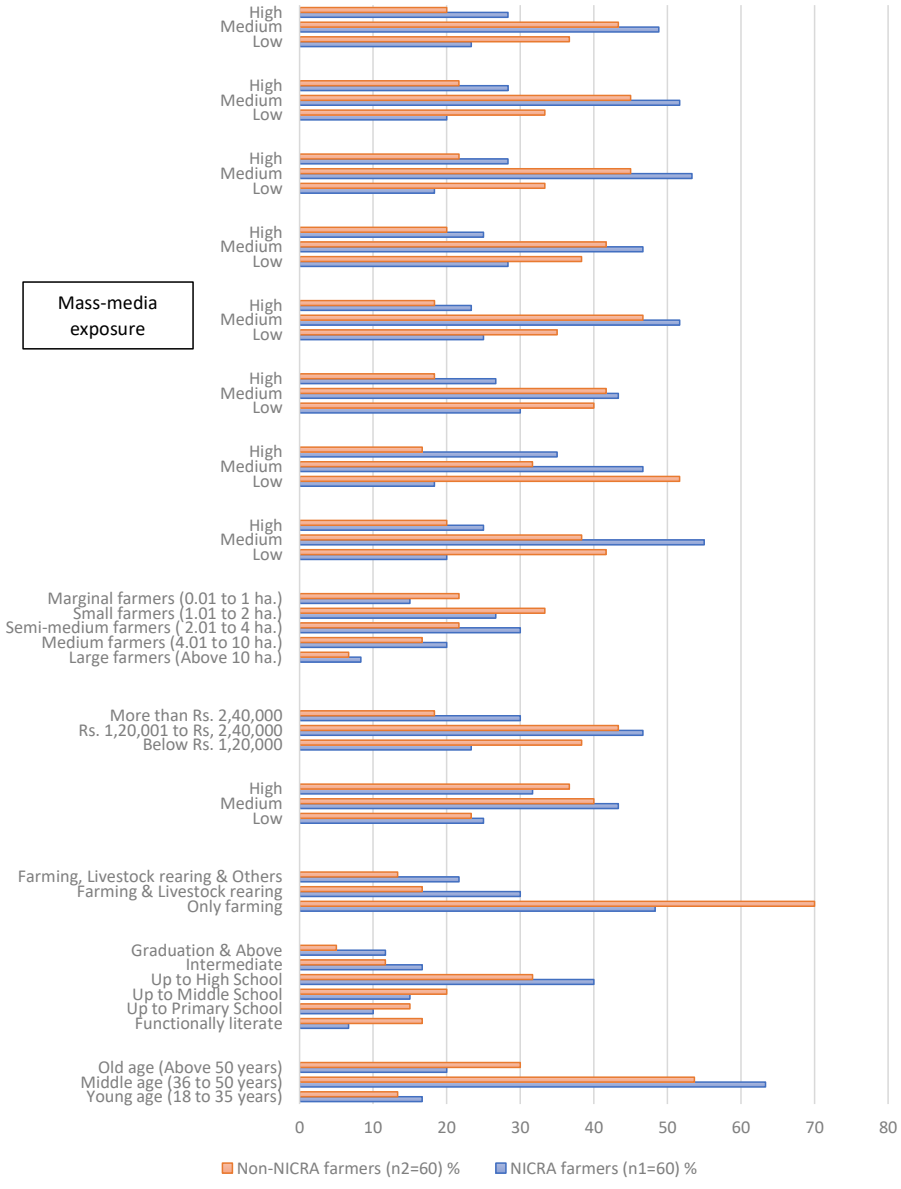


Figure 7. Distribution of respondents according to their socio-psychological profile (Economic motivation, Risk Orientation, and Innovativeness)

Table 5 highlighted that 48.83% of NICRA village farmers had a medium level of innovativeness, followed by 28.33% with high and 23.34% with low innovativeness. Among non-NICRA village respondents, 43.33% demonstrated a medium level of innovativeness, while 36.67% had low and 20.00% had high innovativeness. Farmers from NICRA villages were more inclined to experiment with new technologies and adopt them if they proved beneficial to others. On the other hand, non-NICRA farmers exhibited lower risk-taking behavior and limited social engagement, which hindered their innovativeness. These findings are consistent with the conclusions of Charitha (2017), Pise *et al*. (2018), Harikrishna (2019), Bodsa (2021), and Pabba *et al*. (2021).

Figure. 8. Distribution of respondents according to their over all socio-economic profile



CONCLUSION

The study indicates that the NICRA project has had a substantial positive impact on the agricultural resilience of farmers in Jharsuguda district. By comparing NICRA and non-NICRA farmers, the research found that those involved in the project achieved higher annual incomes, managed larger and more efficiently utilized landholdings, and adopted more diversified income strategies. The adoption of climate-resilient practices, such as intercropping, improved water management, and the integration of livestock rearing primarily drove these improvements. Moreover, NICRA farmers benefited from enhanced access to extension services and mass media, which facilitated the adoption of innovative agricultural practices. This increased exposure improved their technical capabilities and bolstered their social participation, economic motivation, and risk orientation, making them more adaptable to climate-related challenges. The overall findings suggest that scaling up such interventions through robust policy measures such as increased investment in irrigation infrastructure, comprehensive capacity-building programs, and strengthened community engagement could significantly enhance agricultural resilience. These strategies offer a promising pathway for policy engagement aimed at ensuring food security and sustainable development in climate-vulnerable regions.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests ~~OR~~ non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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