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Determinants of adoption of climate-resilient technologies among small and marginal farmers

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Abstract

Climate resilience is the ability of farmers to withstand the adverse effects of climate change and continue crop production. Technologies were introduced for increased and sustainable crop production among farmers. The adoption of such technologies aiming to enhance climate resilience is affected by various factors. The present study aims to examine the relationship between the socioeconomic profile of small and marginal farmers and their adoption of climate-resilient technologies, with a particular focus on those engaged in soybean or soybean-based cropping systems in the Marathwada region of Maharashtra State of India. Two districts, namely Parbhani and Hingoli, were randomly selected from the region based on their vulnerability to climate change. The study used Pearson's correlation coefficient to analyse the relationship between the socioeconomic variables and the level of adoption. The results showed that education, landholding size, annual income, social participation, extension contact, economic motivation, and risk orientation had a positive and highly significant influence on adoption. Mass media exposure and innovativeness showed a positive and significant relationship with adoption. On the other hand, age and farming experience exhibited a negative but non-significant relationship with the adoption of climate-resilient technologies. Variables such as source of irrigation, occupation, source of information, and institutional support were found to have positive but non-significant relationships. These results suggest that enhancing education, economic capacity, social and extension networks, and innovativeness can play a critical role in promoting the adoption of climate-resilient technologies among farmers.

Keywords: Resilience, climate change, climate resilient technologies, adoption, soybean

Introduction

Climate change directly threatens the food security and livelihoods of rural populations, with small and marginal farmers being the most vulnerable due to their limited landholdings, scarce resources, and heavy dependence on rainfall. In the Marathwada region of Maharashtra, particularly in districts such as Parbhani and Hingoli, frequent droughts, erratic monsoons, dry spells, heavy rains, and unseasonal rainfall have intensified agricultural distress. Soybean, a major oil seed crop and vital livelihood source for these farmers, is highly susceptible to climatic variability, often resulting in fluctuating yields and income instability. To address these challenges, climate-resilient agricultural technologies have been introduced, focusing on improved water and soil management, agronomic practices, and institutional support. While these technologies hold the potential to improve productivity and strengthen resilience, their successful implementation depends largely on farmers' adoption, both of which are influenced by their socio-economic and personal characteristics.

In this context, the present study titled "Relationship between the socioeconomic profile and the adoption of climate-resilient technologies among small and marginal farmers" was conducted in the climate-vulnerable districts

of Parbhani and Hingoli. The study aims to examine how farmers' profiles relate to their level of adoption of climate-resilient technologies, providing insights to guide targeted interventions and policy strategies. The study provides valuable insights for policymakers, researchers, and extension agencies to develop targeted strategies aimed at enhancing resilience among vulnerable farming communities.

Materials and Methods

The present study was carried out in the Marathwada region of Maharashtra, specifically in Parbhani and Hingoli districts, which were randomly selected for their high climate vulnerability, dependence on rainfed soybean cultivation, and a high proportion of small and marginal farmers. Using a multistage random sampling method, two tehsils were chosen from each district: Manwath and Parbhani tehsils in Parbhani district, and Sengaon and Hingoli tehsils in Hingoli district. From each tehsil, three villages were randomly selected, totalling twelve villages. In each village, ten small or marginal soybean farmers were selected using the nth sampling method, resulting in 120 respondents, a sample size. Primary data were collected through personal interviews. The study followed an ex-post-

facto research design. Pearson's Correlation Coefficient was employed to determine the relationship between socioeconomic and psychological profiles and the adoption of small and marginal farmers regarding climate-resilient technologies.

Results and Discussion

The relationship between various socio-economic and psychological variables and the adoption of climate-resilient agricultural technologies was assessed using Pearson's correlation coefficient, as depicted in Table 1.

Table 1: Coefficient of correlation between the profile of farmers with their Adoption of climate-resilient technologies (N=120)

S. No.	Independent Variables	Pearson's Correlation coefficient (r)
1	Age	-0.013 ^{NS}
2	Education	0.338**
3	Farming Experience	-0.149 ^{NS}
4	Source Of Irrigation	0.171 ^{NS}
5	Occupation	0.176 ^{NS}
6	Size Of Landholding	0.266**
7	Annual Income	0.418**
8	Social Participation	0.514**
9	Extension Contact	0.535**
10	Source of Information	0.045 ^{NS}
11	Mass Media Exposure	0.228*
12	Economic Motivation	0.395**
13	Innovativeness	0.222*
14	Risk Orientation	0.306**
15	Institutional Support	0.213 ^{NS}

(**significant at 1%, *significant at 5%, ^{NS}non-significant)

The results from Table 1 revealed that age had a negative but non-significant correlation with adoption ($r = -0.013$ NS), indicating that adoption was not influenced by the age of the farmers, consistent with findings by Islam *et al.* (2015) [4]. Education showed a positive and significant relationship ($r = 0.338$ **), suggesting that higher educational attainment facilitated better understanding and adoption of climate-resilient practices. This is in alignment with the studies by Mahesh (2022) [6] and Anseera (2018) [2]. Farming experience had a negative but non-significant correlation ($r = -0.149$ NS), implying that years in farming did not play a decisive role in technology adoption, similar to the findings of Islam *et al.* (2015) [4].

Source of irrigation was positively but non-significantly correlated with adoption ($r = 0.171$ NS), indicating that while irrigation access is important, it may not directly lead to adoption without complementary support. Occupation also showed a positive but non-significant relationship, suggesting that whether farming was a primary or secondary occupation had a limited influence on adoption levels. Landholding size exhibited a positive and significant relationship ($r = 0.266$ **), indicating that farmers with larger holdings were more likely to adopt, likely due to greater resources and capacity to invest in innovations. This result is supported by Jasna (2015) [5] and Mahesh (2022) [6]. Annual income had a strong positive and significant correlation ($r = 0.418$ **), showing that better financial capacity positively influenced adoption decisions. This finding aligns with those of Islam *et al.* (2015) [4] and Mahesh (2022) [6]. Social participation was also significantly and positively related to adoption ($r = 0.514$ **), highlighting the role of social networks and group interactions in facilitating information flow and confidence in new practices, consistent with Anseera (2018). Extension contact had the highest correlation with adoption ($r = 0.535$ **), underlining the critical role of timely and reliable advice from extension agents, as also observed by Mahesh (2022) [6].

On the other hand, the source of information had a non-significant relationship ($r = 0.045$ NS), suggesting that access to information sources alone is insufficient unless the content is relevant and actionable. Mass media exposure showed a positive and significant correlation ($r = 0.228$ *), demonstrating the role of media in awareness creation and behavioural change, especially through success stories and advisories. This is in line with Mahesh (2022) [6].

Economic motivation was positively and significantly associated with adoption ($r = 0.395$ **), indicating that farmers motivated by economic benefits were more likely to adopt climate-resilient technologies. Similarly, innovativeness showed a positive and significant correlation ($r = 0.222$ *), suggesting that farmers open to new ideas were more proactive in adopting such practices, as also found by Mahesh (2022) [6]. Risk orientation was positively and significantly associated with adoption ($r = 0.306$ **), showing that farmers willing to take calculated risks were more inclined to adopt innovations. This result supports the findings of Bhong (2019) [3] and Mundhe (2019) [7]. It was observed that institutional support exhibited a non-significant correlation with adoption ($r = 0.213$ NS).

Conclusion

The study revealed that variables such as education, landholding size, annual income, social participation, extension contact, economic motivation, innovativeness, and risk orientation of the small and marginal soybean growers had significant positive correlations with their adoption of climate resilient technologies. These findings suggest that improving educational outreach, strengthening extension services, enhancing economic incentives, and improving social and psychological readiness are critical to promoting the adoption of climate-resilient technologies.

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