Understanding the Socio-Economic Dynamics of Rural Households: Challenges Faced in the Adoption of Climate-Smart Practices in India and Myanmar

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Abstract
Climate change poses a growing threat to Asia, particularly impacting agriculture and prompting the exploration of adaptation strategies at the household level within farming communities. This study aims to enhance our understanding of the socio-economic status of households and their adoption of climate-smart agricultural practices to cope with climate change in Myanmar and India. The Yamane sampling technique was employed to select one district and three villages from each country, with 130 households from each village interviewed using a pre-tested schedule. Data collection methods included household questionnaire surveys, focus group discussions, and key informant interviews. The study findings indicate that the average age of households in Myanmar is 55, compared to 47 in India. In India, 17.6% of household heads lack literacy, while in Myanmar, only 1.5% of household heads are illiterate in the study area. Among small and marginal farmers, 82.3% are men in Myanmar, with an average farming experience of 36 years, while in India, 53.4% are men, and the average farming experience is 28 years. Both groups of farmers primarily rely on rainfed agriculture. The study's results indicated that factors such as education, age, health, social participation, farming experience years, and family size exhibited positive and significant associations with socio-economic status. The study discovered that insufficient information and knowledge significantly hinder the promotion of climate-smart practices in both study areas. The need for Climate Smart Practices is crucial to address challenges and promote sustainable livelihood development in response to climate change impacts.

Keywords: Climate Change, Adaptation Strategies, Climate Smart Practices, Sustainable Livelihoods Development

1. Introduction

Over the past forty years, there has been a substantial surge in agricultural production, with Asia playing a pivotal role as the driving force behind the sector's remarkable growth (ADB, 2023). The upsurge in agricultural output has not only bolstered the income of rural families, lifting millions out of poverty and alleviating hunger, but it has also contributed to the global effort to reduce food insecurity. Agriculture serves as a crucial source of livelihood for a significant portion of the rural population and given that nearly half of the Asian population resides in rural areas, its impact is substantial. Even though the agricultural sector's share of Asia's GDP has been steadily declining over time, it remains a vital pillar of the economy and employment, constituting 13.4% of GDP, 4.2% of total exports, and providing livelihoods for 570 million people.

Within Myanmar, the agricultural sector plays a significant role, contributing 58.5% to the country's GDP and employing a total of 59.1% of workers. Moreover, approximately 70% of people in remote region, predominantly involved in agricultural, livestock, and fishery activities as their primary means of livelihood (MOALI, 2021). Similarly, as verified by the Government of India (GoI, 2022), the agriculture sector contributes 18.3% to the nation's GDP, providing employment for a substantial 147.7 million in the labour force, according the Asian Development Bank (ADB, 2023). Additionally, as of 2021, 65% of the country's population resides in rural areas, and based on data from (To et al., 2023), 47 % of the population relies on agriculture for their livelihoods.

Prioritizing adaptation alongside global mitigation initiatives is crucial for combating climate change. Adaptation is a complex, multidimensional, and multi-level activity aimed at reducing societal susceptibility to environmental changes (Adger et al., 2007; Chambwera & Stage, 2010). The categorization of adaptation reactions is dependent on several aspects, such as the extent of their implementation, their purpose, the timing of the responses in relation to climatic stress, their duration, and their overall impact (Burton (Canada), B. Challenger (Antigua and Barbuda) & R.J.T. Klein (Germany/The Netherlands), 2018). The challenges posed by climate change and increasing food demand pose threats to overall global food security (IPCC, 2014). Farmers in impoverished nations, particularly smallholders, are highly susceptible to the effects of climate change. Despite being responsible for fulfilling 70% of the world's food requirements (Gitz et al., 2016), , these farmers are already grappling with the repercussions. Additionally, studies suggest that autonomous adaptation, while crucial, may not occur spontaneously; its realization is contingent upon the manner in which changes impact people's livelihoods (Rahman & Hickey, 2019).

Given that adaptation to the impacts of climate change is a primary focus on the development agenda in numerous developing nations, the implementation of genuinely practical measures in the field is of utmost importance. The Climate Smart Agriculture Strategy (MNREC, 2019) recently introduced in Myanmar underscores the significance of adaptive measures, encompassing crop types, agricultural techniques, risk management for disasters, and strategies for mitigating agricultural damage risks. Likewise, in 2011 the 'National Innovations in Climate Resilient Agriculture' (NICRA) network was launched by the Indian Council of Agricultural Research (ICAR), which functions under the Ministry of Agriculture and Farmers Welfare. NICRA is dedicated to the development of crop varieties that can withstand various climatic stresses, including floods, droughts, frost, inundation from cyclones, and heat waves (SAARC Agriculture Centre, Dhaka, 2019). Recognizing the efficiency and appropriateness of traditional knowledge, it is essential to consider locally adapted practices as the foundational elements when formulating new strategies for climate change adaptation, ensuring practical applicability in the field (UNFCCC, 2013).

Smallholder farm families in developing nations need resilient livelihoods to combat climate change. This requires well-planned adaptations, environmentally friendly management practices such as water, land, fisheries, and forestry. Enhancing resilience is crucial, necessitating the escalation of adaptation measures, effective risk management, and sustainable diversification and intensification (FAO, 2022). Because smallholder agricultural systems and livelihoods are so diverse and complicated, it is difficult to quantify how climate change will affect them because it is closely linked to particular local conditions. (Belay et al., 2022) recommended that indigenous knowledge, mindsets, and traditional practices is necessary to improve the awareness of the effects of global warming at the farm level. At the local level, there is currently little documentation describing the precise adjustments being used and how they are put into reality. Hence, this study aims to i) to identify the socio-economic characteristics of smallholder farmers ii) to measure the constraints challenged by smallholder farmers.

Beyond offering recommendations for potential enhancements in the region, an examination of the status of small and marginal farmers can yield a thorough understanding of the current challenges within the agricultural system. This understanding is crucial for the formulation of climate-smart practices that effectively address the issues faced by farm households.

2. Literature Review

The investigation conducted by (Rishi et al., 2023) explored the socio-economic factors influencing farmers' adaptive capacity in response to climate change, Rajasthan, India. The data collected from 175 farmers from six selected village under Bundi district, Rajasthan. Mean and standard deviation, coefficient of correlation method of statistics was used for interpretation of data. Measurement mechanism followed for the independent variables for this study. The study found that factors such as education, climate information access, social participation, farm knowledge, extension connection, exposure to the media, non-farm income, operational land holding, irrigation area, and knowledge about climate change significantly influence farmers' adaptive capacity. (Nishanth et al., 2023) studied 180 Pattanam Sheep farmers in Tamil Nadu, revealing a strong interest in maintaining current practices despite natural disasters. The study suggests that farmers believe in the viability and profitability of Pattanam sheep farming.

(Bali, 2023) examined the limitations faced by women in farming, considering measures in both irrigated and unirrigated agriculture, the data obtained from 120 households from 12 villages in Jammu District. The data were analyses by the Garrette Ranking Techniques (GRT) and descriptive statistics. The findings indicate that the most significant challenges for women in farming within the study area were low prices for agricultural outputs and a lack of timely access to financing. The constraints that smallholder farmers in Gondar Zuria Woreda, Northwest Ethiopia, face in the chickpea production network were examined by (Asegie et al., 2022). The data obtained from 140 sampled respondents utilizing a basic random sampling method. The data were analyses by the GRT. The findings indicate that the primary obstacles impeding the production of chickpeas by smallholder farmers are the limited availability of seeds, their short supply, high input prices, scarcity of resources, disease, pests such as insects, and the inability to obtain in-kind financing.

Researchers (Dupdal & Patil, 2019) looked at the many challenges farmers in the northern region of Karnataka experienced as a result of climate unpredictability. A sample consisting of around 240 farmers was gathered to reflect the population under investigation. The study found that sample farmers in the region face significant constraints, including inadequate understanding of climate change and strategies for adaptation, poor availability of climate forecasts, and a shortage of agriculture of agriculture supply.

3. Research Methodology

The KYAUK-PA-TAUNG township Central Dry Zone (CDZ) region of Myanmar's BIN-GA, SIN-TA-KYIN, and KYAUK-TA-GAR villages were the study's locations (refer to Figure 1). Additionally, the study covered Farsali Pali, Farsali Wali, and Ason villages situated under the Bageshwar Township in Uttarakhand, a part of the Himalayan Mountainous Region in India (refer to Figure 2). There were 130 houses in each region, which corresponded to the CDZ, Myanmar, and the Uttarakhand District of India. The selected research fields in both nations share commonalities, particularly in experiencing regular and protracted droughts, as well as facing challenges related to inadequate and belated rains. Furthermore, the research regions' dominant livelihood activity was found to be agriculture.

The CDZ includes around 35 percent of the farmland in Myanmar, with an average yearly rainfall of 600 to 1400 millimeters. In study area, crop such as sesame, groundnut, sunflower, rice, millet, cotton, and tobacco are cultivated (DMO & FD, 2009). Uttarakhand constitutes about 11.68 % of Indian’s cultivable land as reported by (ISFR, 2019). Dehradun is in Doon valley within the sub-Himalayan physiographic zone, has elevation of 640 m. The city has an average annual rainfall of 2091 mm along with an average maximum temperature of 31.6°C and lowest temperature of 10.7°C (ADB, 2021).

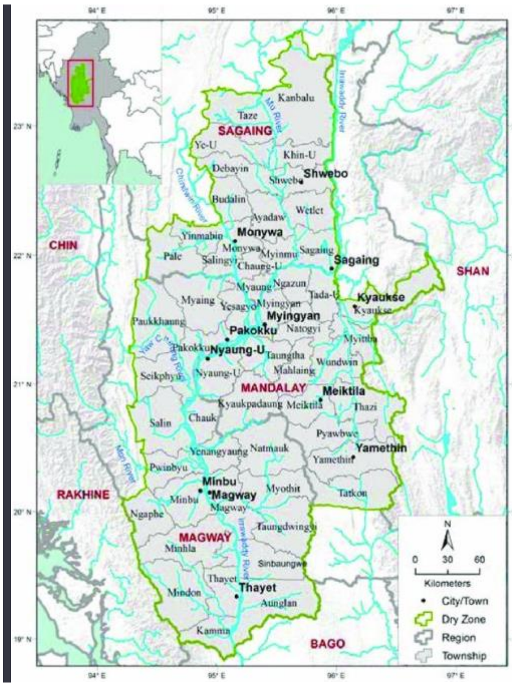

Figure (1) Location map of study area in Myanmar
Source; IWMI Report

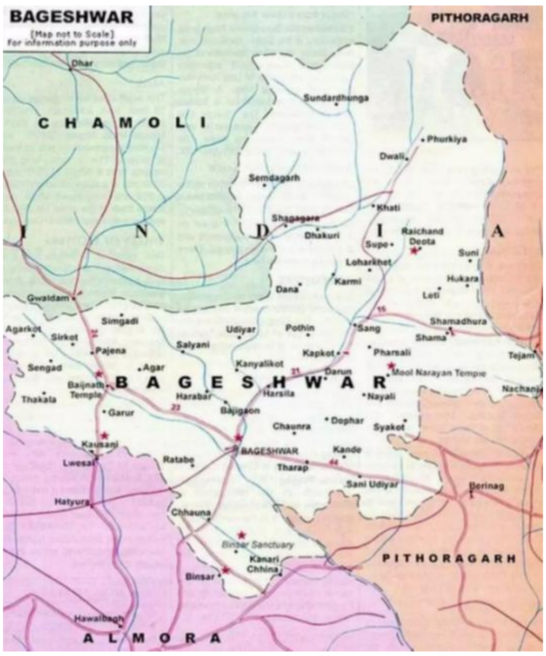

Figure (2) Location map of study area in India
Source; Uttarakhand tourist organization

3.1 Data Collection

This study used a combination of qualitative and quantitative methodologies, collecting primary and secondary data at both study sites using uniform data gathering techniques.

3.1.1 Data Collection- Primary

A Focus groups, a key informant interviews, and household questionnaire surveys were the main techniques for gathering data. At the household level, an organized questionnaire with both closed- and open-ended questions was employed. To ensure that the households in each area accurately represented the whole population, a minimum of 30% of the households were chosen using random selection. Thus, a total of 47 (36%), 44 (34%), and 39 (30%) households were selected from Palli, Walli , and Ason (in Bageshwar, Uttarakhand), Sin-Ta-Kyin, Bin-Ga, Kyauk-Ta-Ga (in CDZ, Myanmar) villages respectively. The questionnaire was used to conduct interviews with the heads of the sample houses. The purpose of the study was to learn more about farmers' views of climatic trends, their awareness of the causes and effects of climate change, and their methods for adaptation.

Focus groups were used to evaluate household questionnaire surveys and investigate, using checklist questions, farmers' perspectives on climate change and reactions to occurrences. It was conducted in villages through 5-10 participants aged above 60 to understand climate and cropping patterns. In order to gather information about climate-related events, farmers' responses, and the actions of the government and NGOs, interviews with key informants, farmers, NGO employees, and agricultural extension officers were done.

3.1.2 Data Collection – Secondary

Many published sources, including institutions, annual reports, and other relevant government documents, provided secondary data for the study.

3.2 Data Analysis

Both quantitative as well as qualitative techniques were used in the data analysis. Through the use of narration, justifications, and interpretation approaches, quantitative data were cross-verified with qualitative data collected from key informants and sampling households. A variety of basic descriptive statistical procedures were used to assess quantitative data, such as household characteristics, including means, percentages, a maximum, and minimum values. To address the primary focus of the study, Henry Garrett's Ranking System was used to identify the most important limitations and opportunities. Each respondent's ranks assigned to limitations were subsequently translated into score values using the described processes.

Step 1: Individual respondents ranked determining constraints' ranks within each category. Subsequently, based on how serious they thought each restraint was, respondents ranked them all.

Step 2: The calculation of respondents assigned to specific ranks for each constraint can be done using Microsoft Excel.

Step 3: Equation (1) presents the Henry Garrett formula for calculating the percent position as;

$$\text{Percent position} = \frac{100*(R_{ji}-0.5)}{N_j} \quad \text{Equation (1)}$$

where the total number of variable j^{th} respondent ranked is shown by N_j and R_{ji} is the rank that the j^{th} respondent provided for the i^{th} variable.

Step 4: Garrett Table (refer to table 1) is used to determine percentage position value, translating it into scores by multiplying the number of responders in a specific rank by the matching Garrett value.

Step 5: Add together scores from the previous fourth step to determine the total value for every limitation.

Step 6: Calculate the sum of the values by the entire amount of sampled households to get the averages.

Step 7: Arrange average values descending to determine constraint ranks, with higher values indicating more severe problems. As average values decrease, severity decreases. Similarly, opportunities rank respectively.

Table 1: Garrett's Ranking Table

Percentage	**Score**	**Percentage**	**Score**	**Percentage**	**Score**
0.09	99	20.93	66	80.61	33
0.2	98	22.32	65	81.99	32
0.32	97	23.88	64	83.31	31
0.45	96	25.48	63	84.56	30
0.61	95	27.15	62	85.75	29
0.78	94	28.86	61	86.89	28
0.97	93	30.61	60	87.96	27
1.18	92	32.42	59	88.97	26
1.42	91	34.25	58	89.94	25
1.68	90	36.15	57	90.83	24
1.96	89	38.06	56	91.67	23
2.28	88	40.01	55	92.45	22
2.63	87	41.97	54	93.19	21
3.01	86	43.97	53	93.86	20
3.43	85	45.97	52	94.49	19
3.89	84	47.98	51	95.08	18
4.38	83	50	50	95.62	17
4.92	82	52.02	49	96.11	16
5.51	81	54.03	48	96.57	15
6.14	80	56.03	47	96.99	14
6.81	79	58.03	46	97.37	13
7.55	78	59.99	45	98.72	12
8.33	77	61.94	44	98.04	11
9.17	76	63.85	43	98.32	10
10.16	75	65.75	42	98.58	9
11.03	74	67.48	41	99.82	8
12.04	73	69.39	40	99.30	7
13.11	72	71.14	39	99.22	6
14.25	71	72.85	38	99.39	5
15.44	70	74.52	37	99.55	4
18.69	69	76.12	36	99.68	3
18.01	68	77.68	35	99.80	2
19.39	67	79.12	34	99.91	1
				100	0

SOURCE: Henry, E. Garret's, Statistics in Psychology and Education, Feffer and Simans Private Limited, 1969, p.329

4. Results and Discussions

4.1 Sampled Respondent's Socioeconomic Characteristics in India

Table 2 displays the findings of the sample farmers' socioeconomic characteristics. The analysis of sample farmers' socioeconomic characteristics reveals that the medium age group (between 36 and 49) made up 47.7% of the questioned farmers, followed by the elderly age group category (40.0%) and the remaining young age groups (12.30%). The majority of farmers (36.20%) obtained a high school education, but only a very small percentage (17.70%) were able to graduate. The degree of education among farmers has a significant impact on the adoption and application of technology. The study found that the majority of farmers are marginal (93.1%) and small (6.9%) land holding category.

Table 2: The sampled respondent's socioeconomic characteristics in India

No	Variables	Group	Rate	Percentage
1.	Age	Young (below 35)	16	12.3
		Middle (36 ~ 49)	62	47.7
		Old (above 50)	52	40.0
2.	Sex	Male	71	54.6
		Female	59	45.4
3.	Education	Illiterate	23	17.7
		Primary	12	17.7
		Secondary	43	33.1
		Highschool	47	36.2
		Graduate	2	1.5
		Post graduate	3	2.3
4.	Farm experience	Low (up to 10 years)	16	12.3
		Middle (11 ~ 25 years)	54	41.5
		High (26 years above)	60	46.2
5.	Farm size	Marginal (1-9 Nali)	121	93.1
		Small (10- 29 Nali)	9	6.9
6.	Total family size	Small (1 to 3)	39	30.0
		Medium (4 to 6)	85	65.4
		Large (7 above)	6	4.6
7.	Water available everyday	Yes	130	100.0
		No	0	0.0
8.	Off-farm income	Yes	115	88.5
		No	15	11.5
9.	Participation on social	Yes	129	99.2
		No	1	0.8
10.	Health access	Yes	130	100.0
		No	0	0.0

Source; Author's field study (2023)

The majority of farmers (46.2%) have worked on farms for more than 25 years, and a higher percentage of farmers (99.20%) belong to social groups such as self-help organizations. Farmers' knowledge and awareness of current agricultural technology and projects can be improved by their increased interest in and participation in these social organizations. Over 88.5% of households with agricultural land work off the farm. Every household's access health care facility under government scheme. Table 2 makes it evident that the bulk of agricultural households 65.4 percent belongs to medium family households (4 to 6 family members) while 30 percentage belong to small family households (1 to 3 family members) and 4.6 percentage belong to large family households (above 7 family members). The majority of households head are male with 54.6 percentage.

In summary, when examining the socio-economic features of the studied region in India, it becomes apparent that individuals in the middle age group play a predominant role in agricultural activities. This demographic factor facilitates a better understanding and implementation of climate adaptive strategies. Conversely, although many household heads possess education and ample farming experience, their farm sizes remain marginal. The majority of households are compelled to engage in off-farm income activities for their Survival. Although there is easy availability of water for domestic use and drinking, regarding agriculture, the same cannot be stated. This lack of water availability for farming hinders the ability of most households to develop commercial skills for their agricultural products. As a result, the agricultural potential of these households is constrained, limiting their capacity to pursue more lucrative avenues for their products.

4.2 Sampled Respondent's Socioeconomic Characteristics in Myanmar

According to the statistics in Table 3, the majority of farm families—64.6%—fall into the age category of those over 50. In contrast, 28.5 percent of farm households belong to the age range of those over 36 to 49, and just 9 percent are younger than 35. It is observed that elder age were more involved in agricultural activities. This is the challenging of agriculture sector in developing countries as young and middle age are migrate to other districts and neighbor countries. Notably, 0.8 percent of farm households were illiterate, whereas 40.8 percent was primary, 30.8 percent was secondary, 20.0 percent were high school, 5.4 percent were Bachelor Degree and 2.3 percent were Master Degree. The heads of rural households tended to be less educated. It might be because to the fact that young, educated person wouldn't enjoy farming activities, and to earn more income from not depending climatic business.

It was found that 73.1 percent of farm households had been farming for more than 25 years, 18.5 percent had been farming for 16 to 25 years, and just 8.5 percent of respondents had been farming for less than 10 years. Consequently, it was determined that most of the respondents were old, as I mentioned in farm households' farming experience.49.2% of respondents owned 1.5 to 3 acre, followed by 38.5 % of respondents owned above 3 acre whereas 12.3 % of respondents owned 0 to 1acre. Therefore, study concluded that all respondents are small and marginal farmers. The respondents of family size were 49% with 4 to 6 family members, followed by 35.4 % with 1 to 3 family members, and only 17.7 % with above 7 family members. Most households head are male with 60.0 percentage. 61.5% of respondents accessed water everyday whereas 38.5 % of respondents did not access water every day. Similarly, 72.3 % of respondents accessed health facilities whereas 27.7 % of respondents did not access health facilities. 4.6 % of respondents were doing off-farm income sources whereas 95.4 % respondents were doing agriculture activities. 58.5 % respondents were participating in social networks whereas 41.5 % of respondents were not participating in social networks.

Hence, an analysis of the socio-economic characteristics of the examined region in Myanmar reveals that individuals in the elderly age group significantly contribute to agricultural activities. Concurrently, a considerable portion of the respondents exhibit a low educational status. Consequently, introducing climate adaptation strategies to these respondents might pose challenges due to the fixed mindset associated with their age and education level. Nevertheless, their extensive farming experience proves valuable, demonstrating an in-depth understanding of agricultural responses to the effects of climate change. Socio-economic barriers faced by the respondents also encompass issues related to water access, participation in social activities, and health concerns. Addressing these multifaceted challenges requires a nuanced approach that considers the interplay of age, education, and other socio-economic factors.

Table 3: Sampled respondent's socioeconomic characteristics in Myanmar

No	Variables	Group	Rate	Percentage
1.	Age	Young (below 35)	9	6.9
		Middle (36 ~ 49)	37	28.5
		Old (above 50)	84	64.6
2.	Sex	Male	78	60.0
		Female	52	40.0
3.	Education	Illiterate	1	0.8
		Primary	53	40.8
		Secondary	40	30.8
		Highschool	26	20.0
		Graduate	7	5.4
		Post graduate	3	2.3
4.	Farm experience	up to 10 years	11	8.5
		16 to 25 years	24	18.5
		Above 26 years	95	73.1
5.	Farm size	Marginal (0~1 acre)	16	12.3
		Small (1.5 ~3 acre)	64	49.2
		Large (3.5 ~ above)	50	38.5
6.	Total family size	Small (1 to 3)	46	35.4
		Medium (4 to 6)	61	46.9
		Large (7 above)	23	17.7
7.	Water available everyday	Yes	80	61.5
		No	50	38.5
8.	Off-farm income	Yes	6	4.6
		No	124	95.4
9.	Participation on social	Yes	76	58.5
		No	54	41.5
10.	Health access	Yes	94	72.3
		No	36	27.7

Source; Author's field study (2023)

4.3 Barriers for Adoption Climate Smart Practices in India and Myanmar

The study's findings demonstrate that Bageshwar's smallholder farmers have difficulties in adjusting to the phenomena of climate change and fluctuation. The farmers' adaption measures were ranked according to their barriers using Garrett's Ranking Technique (Table 4).

Table 4: Calculated Garette Value for Barriers of adaptative measure among sampled households

Factor	Score of Rank									Overall Value	Average Value	Rank
	I	II	III	IV	V	VI	VII	VIII	IX			
Bageshwar township in India N=130												
*F1	0	0	1054	672	0	0	836	930	931	4423	491.4	8
*F2	0	0	0	0	600	308	1748	1085	570	4311	479	9
***F3**	**9396**	**966**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10362**	**1151.3**	**1**
*F4	1134	7866	62	56	0	0	0	0	0	9118	1013.1	2
*F5	0	69	2914	3248	1200	0	0	0	0	7431	825.7	3
*F6	0	0	434	1008	3200	220	684	186	228	5960	662.2	5
*F7	0	69	1860	0	950	2288	912	124	0	6203	689.2	4
*F8	0	0	1736	1008	0	2068	456	558	133	5959	662.1	6
*F9	0	0	0	1288	550	836	304	1147	608	4733	525.9	7
Kyaukpadaung township in Myanmar N=130												
**F1	1377	69	0	0	0	2024	418	1674	19	5581	620.11	6
**F2	3726	4347	124	0	100	88	228	248	19	8880	986.67	2
**F3	0	0	0	168	3000	528	152	558	627	5033	559.22	9
**F4	0	0	372	56	1000	2508	1748	62	152	5898	655.33	5
**F5	0	0	2728	1848	150	132	38	992	266	6154	683.78	4
**F6	243	69	4402	2352	350	44	76	93	0	7629	847.67	3
****F7**	**5103**	**4071**	**62**	**56**	**0**	**0**	**228**	**0**	**0**	**9520**	**1057.78**	**1**
**F8	0	414	372	112	2300	352	418	310	779	5057	561.89	8
**F9	81	0	0	2688	100	44	1634	93	608	5248	583.11	7

Source; Author's field study (2023)

F1= Lack of information about landslide and related climatic issues, F2= Lack of appropriate crop variety, **F3*= Lack of information concerning appropriate climate smart practices**, F4*= Lack of credit access, F5*= Lack of suitable land for cultivation, F6*= Lack of irrigation for cultivation, F7*= Lack of storage facilities, F8*= Lack of marketing facilities, F9*= Transportation access

F1= Inadequacy research and development on climate smart practices, ** F2= Lack of extension service, **F3= Weak policies, **F4= Lack of infrastructure, F5= Lack of access to credit access, **F6= Lack of irrigation for cultivation, ****F7= Limited knowledge,** **F8= Lack of marketing facilities, **F9= Lack of storage facilities

Nine adaptive strategies (factors) were assessed, with the highest total value of 10,362 attributed to the lack of information, particularly regarding suitable climate-smart practices in India. In Myanmar, with the highest total value of 1057.78 attributed to the limited knowledge on climate-smart practices. According to Table 4, this became the main adaptation method smallholder farmers used to deal with climate change and variability. Following the deficiency in information, challenges related to access to credit, storage facilities, and irrigation for cultivation were identified as the next three significant constraints in Bageshwar. Following the lack of extension service, and lack of irrigation for cultivation were identified as the next two significant barriers in Myanmar (Table 3).

The sample respondents also proposed other noteworthy suggestions to alleviate constraints. These included addressing issues such as a lack of marketing facilities, limited transportation access, insufficient information about climatic conditions, and a dearth of appropriate crop varieties. In conclusion, the primary challenge to sample farmers in the research regions adopting climate-smart practices is the exchange of knowledge and information.

Hence, it is imperative for the government, local authorities, and the relevant governmental body, such as the Ministry of Agriculture, to disseminate knowledge to farmers. Concurrently, academic institutions should intensify research efforts focused on addressing socio-economic challenges induced by climate change in remote areas. The dissemination of information and knowledge can be facilitated through television and radio broadcasts. Furthermore, the government should implement a "train the trainer" program, establish demonstration farms showcasing Climate Smart Practices (CSP), and encourage the establishment of farmers' associations in each village or township. Additionally, the government must provide extension services aimed at enhancing income generation, particularly in the realm of livestock farming.

4.4 Socio-Economic Constraints in Agriculture

The key informant interviews revealed that farmers in both study areas find input costs to be a significant challenge due to unexpected price fluctuations. In Myanmar and India, obstacles to farming improvement include a lack of technical knowledge, absence of a suitable market, and insufficient capital for investing in necessary infrastructure. Despite financial assistance provided to cultivable landholding farmer families in India, many still grapple with financial issues in their farming endeavors. In response to these challenges, farmers in Myanmar have the option to access a government-sponsored loan program, with the requirement to repay within one year. Meanwhile, farmers face a serious issue of wildlife, such as monkeys and pigs, attacking their crops in Bageshwar. This has led to a reluctance to engage in cash crop cultivation. Additionally, delayed information about weather conditions in Bageshwar poses a barrier, as farmers need timely updates to plan and optimize their seed-saving practices for the next growing season. Furthermore, both study sites highlighted common issues, including seed quality concerns, pest and disease problems affecting crop yield. The pressing challenge of attracting youth to agriculture was emphasized, given the aging demographic of farmers and the inadequate support for intergenerational transitions in the land tenure system in Myanmar.

Myanmar's poor research dissemination is attributed to ineffective agricultural extension approaches and inadequate connections between government agencies, farmers, and academic institutions. Currently, there is no specialized weather forecasting channel tailored for agriculture, and farmers are voicing the demand for the establishment of such a system. Limited knowledge about climate change impacts and adaptation measures is a significant reason for farmers not adopting strategies.

Therefore, implementing region-specific adaptation technologies and enhancing agricultural extension services is crucial for successful climate change adaptation, requiring enhanced effectiveness of institutions and their extension services.

5. Conclusion

The study's results indicated that factors such as education, age, health, social participation, farming experience years, and family size exhibited positive and significant associations with socio-economic status. Conversely, a notable negative and significant association was observed between the lack of information and knowledge and the barriers hindering the CSP adoption in both study areas. CSP has proven successful among farming communities as effective responses to counteract the global warming’s effect removing barriers to the implementation of adaptive techniques in agriculture is crucial for promoting widespread engagement in climate-adaptive practices.

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