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An Intercultural Analysis on Farmers' Opinions and Intentions Regarding Global Warming

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Abstract

The relationship between and consequences of agricultural operations in various areas in India on global warming were investigated in this research. In order to build outgrowth and policymaking strategies according to the results, this study intends to establish farmer knowledge concerning climate change and its implications, and to assess farmer adaptability skills in various regions. Farmers throughout the provinces in which the research was done were surveyed face-to-face to gather data. A random sampling assessment of farmers was done in this situation. The t-test and factor analysis (FA) were used to the data that had been gathered. The results show that farmers link precipitation to global warming, and the impact of precipitation and the threats it poses on boosting or lowering agriculture production seem to be of significant concern. Compared to farmers in the Northern region, farmers throughout the Southern region are much more worried with drought and high temperatures. Farmers also think that economic growth and human-caused elements have a bigger influence on climate change than do farming operations. Farmers in study regions are worried that climate change may lead to a rise in rural exodus as well as the extinction of many animal and plant species. So, it's crucial to use modern technology in remote communities to boost individual awareness. To increase their usage, farmers must become more aware of modern, ecologically friendly agriculture techniques.

Keywords: Agriculture, production, global warming, economic growth

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1. Introduction

The phenomenon of global warming is described as a rise in the temperature of the earth's surface and seas due to the greenhouse impact produced by human emissions of greenhouse gases into the environment [1]. The sunlight's rays warm the land surface of earth. These rays are reflected into the atmosphere by the world, although some are prevented by a covering generated over the planet by molecules such as liquid, carbon dioxide, and methane. This phenomenon, known as the greenhouse effect, maintains the earth's environment. Global warming is the worrying trend of a continuous rise in global surface and ocean levels caused by the buildup of CO2 in the atmosphere, which traps the IR radiation heated by the Earth after it absorbs sunlight [2]. However, the quantity of atmospheric greenhouse gases has recently increased due to factors such as the burning of fossil fuels, deforestation, fast population expansion, and excessive consumerism. Climate change is an area of concern in today's technology society. Climate changes on Earth are a result of excessive human consumption. Weather change is occurring as a result of an imbalance in both in and outgoing rays in the atmosphere, which has influenced both human and natural ecosystems. Weather change poses a major danger, especially to life-sustaining water resources, and has lowered the quantity of water obtainable for agricultural use, placing global food security at risk [3].

Weather change is defined as an alteration in climate resulting from human activities that damage the atmospheric composition, in addition to the organic climate change recorded over a similar time span. As a consequence of climate change, people's living situations are getting more complicated. It reduces the availability of food globally by reducing agricultural output. Agriculture-related activities (energy consumption etc.) produce greenhouse gases such as CO2, and N2O. Thus, one of the factors contributing to climate change is agricultural productivity. Climate change may have a severe influence on the production of pollinatordependent crops, resulting in serious consequences for world food security. Pressures from the environment, the economy, and society have intensified nations' quest for answers. It is now required to assess the situation using scenarios related to climate change to avoid these adverse climate change effects [4].

Enhanced respiration and greater developmental rates caused by higher temperatures outside the ideal range ultimately diminish crop output while promoting the spread of disease, pests, and weeds. To realize how predicted climatic changes may impact the pattern of agricultural output, it is thus vital to investigate farmers' and agencies' attitudes towards to weather change, global warming and new crop production. Two general methods can be used to assess how the climate affects agriculture. Agronomic and economic simulator models are created using the "scientific-modeling technique" after controlled scientific studies are conducted to determine how the climate affects crops. The "cross-sectional" technique starts with cross-sectional data and uses empirical analysis across space to assess the impacts of climate. Both methods have different benefits as well as drawbacks. The virtue of the scientific method is its strict controls and clear processes. The findings may not be accurate since it is pricey. The effectiveness of the scientific method depends on the model. The researcher has a huge duty to consider every important issue. Since such methods already exist in all environments, the cross-sectional method immediately incorporates unseen methods caused by climate [5].

The cross-sectional method, in particular, includes much farmer behavior and how farmers adapt to the local environment. Due to the fact that empirical data is frequently collected in the study's focus areas, the cross-sectional technique also has a tendency to be fair. The scientific method's stringent safeguards are absent from the cross-sectional approach, and the processes are often unclear. Moreover, the cross-sectional technique is unable to evaluate phenomena like carbon dioxide levels that are constant in space [6]. We encourage the employment of both approaches since they provide various insights. Both approaches also act as useful cross-examinations, able to alert both the scientist and the public servant to potential issues when they differ and to greater confidence when they consent. Maintaining ecological equilibrium is essential to ensuring human survival [7].

The objective of this study is to compare how climate change affects agricultural activities in India's northern and southern regions. It also aims to evaluate farmer awareness of the impacts of climate change, recognize farmer adaptation capacities to climate change across various regions, and contribute to the agricultural extension and policy tools that will be implemented in light of the findings.

2. Related works

Article [1] has investigated farmers' assessments of weather change as well as adaptation to learn more about how perceptual and collected information regarding processes shape farmers' plans for the adaptation. Using the theoretical Basis of Private Proactive Adaptation to weather Change, semi-structured surveys with 29 farmers in two agricultural districts of Austria were undertaken.Farmers view the risks and opportunities associated with climate change differently, according to this paper [2], and they hold quite diverse beliefs about it. Farmers' perspectives on their obligations to take action and their own ability to adjust and mitigate differ similarly. Understanding farmers' attitudes, beliefs, and worldviews is crucial for the effectiveness of agricultural mitigation and adaptation.

In this article [3], the factors that influence farmers' acceptance of environmentally friendly agricultural practices in Vietnam coffee farms. They used the grounded theory method to expand the fundamental planned behavior theory to take into account social trust and other contextual factors they believed to be crucial for the case study under consideration.Arthur [4] finds, Only 51% of farmers showed a favorable attitude toward climate change adaptation. This indicates that a sizably substantial proportion of farmers lack the behavioral intention to adapt to climate change. Given that the region is highly vulnerable to droughts and that malnutrition is already widespread, this is very concerning. Results from the organized logit model demonstrate that the gender of the head of the household goes to visit extension staff, connects directly to weather pattern information, experience with drought, and membership in a small-scale farmers' social group all have an impact on farmers' behavioral intentions toward adaptation to climate change.

Paper [5] looked at the variables affecting Pakistani households' food production and economic hardship as a result of the practices they choose to adapt to climate change. Farmers in Pakistan are utilizing a variety of adjustment strategies to fight the harmful impacts of global warming. Arthur [6] examines socio-psychological factors influencing small-scale farmers' perceptions of seasonal climate anomalies in the KZN midlands, one of South Africa's CC hotspots. Two dominantly perceived 31 seasonal climate changes have been identified, according to a main component analysis of survey data: I abnormally cold and drier winters and warmer and drier summers; and (ii) humid winters and abnormally warmer and drier summers.

Weather change situations in their simulation, ALSA methods should take into account the effects of weather change on agricultural production and area in the present and the future. Arthur's [7] review found that there has been relatively little research in this area.The paper [8] aimed to conduct a systematic analysis of the literature on Asian farmers' weather change adaptation strategies. To decrease the effects of weather change and seize potential opportunities, adaption strategies must be put into practice. The findings show that Asian farmers have used a variety of techniques.

3. Materials and methods

3.1 Materials

The information used in the study was primarily acquired through farmers of Indian provinces. According to the population of producers and farmers in each province, the number of polls was determined. The overall number of farmers who have registered with the Agricultural and Forest Directorate general of provinces was used to compute the population size. The number of polls was decided using the proportionate sample size.

$$s = \frac{S * V(1-V)}{(S-1)\sigma_V^2 + V * (1-V)} \quad (1)$$

In the equation, s is the size of the sample, S is the size of the population, V is the prediction rate, and v2 is the rate variance (with a 95% confidence interval and a 5% error margin). The formula produced a sample group of 380, but the analysis was carried out using 418 formers by giving out 10% more surveys overall. Based on the number of farmers in each province, the analysis outcome was given to them accordingly. In this situation, general facts concerning farmers and their businesses have been established. In order to ascertain farmers' perspectives on climate change, reactions to weather events by farmers were also evaluated. In addition, the research examined the causes of climate change, its implications for agricultural activities, expectations related to it, necessary (individual and state) actions, and difficulties in addressing it. We utilized both open-ended and closed-ended queries to evaluate the farmers' general knowledge. The Likert scale (quinary) was applied to climate change-related difficulties. In addition to secondary data, research and reports on climate change from organizations and institutions were also available.

3.2 Methods

The study's raw data were put into a computer and processed for analysis. The database was then prepared as an Excel file and imported into the SPSS program, where descriptive statistical analysis (mean, standard deviation), confirmatory factor, and the t-test for independent samples were utilized.Farmers' perceptions of the factors leading to climate change, in addition to their beliefs of its effects, were examined using factor analysis. Factor analysis decreases the number of variables, which has advantages like making the study easier to see and explain. The appropriateness of the scales employed for factor analysis was checked using the KMO (Kaiser-Maier-Olkin) and Barlett tests. The KMO value for the producers was found to be 0.725, the Barlett sphericity value was found to be 0, the KMO value for the conceptions of the effects of weather change was found to be 0.678, and the scale and data were found to be appropriate for factor analysis as an outcome of the evaluation of the factors that cause climate change. To evaluate whether there was a significant variation in the factors acquired between the research regions, the t-test for independent samples was utilized.

4. Results and Discussions

Although the annual mean temperature has climbed in the majority of provinces over the last 50 years, there has been a decline in recent years. The county-level average yearly temperature from 2003 to 2012 for each sample county is shown in fig. To analyze the history of the annual mean temperature within every county, a simple linear regression model was utilized. Thirty of the 37 sample counties (from 2003 to 2012) showed a trend in declining temperatures.

4.1 Farmers' views of temperature change and the way they correspond to the meteorological data

Farmers (72%) saw a rising temperature trend during that time even though the majority of research counties indicated dropping temperatures over the preceding 10 years (Table 1). Southern India had a greater proportion of farmers who noticed the trend of rising temperatures than northern India did. Noticed a warming trend, although these percentages were lower in in northern India. Just 8% of farmers reported that temperatures had decreased during the previous ten years (Table 1). Farmers in the northernmost province reported the largest percentage of a declining trend, while those in the southernmost province recorded the lowest percentage (9.6%). In total, 16.6% of farmers believed that there had been no change in temperature during the previous ten years. Only 3.2% of farmers claimed to be unaware of the annual temperature trend during the previous ten years.

After that, the perceived temperature changes by farmers were compared with the matching real temperature information shown in the preceding subsection. After excluding the farmers (3%) who responded "didn’t know," and had 3235 valid household responses. With this comparison, we divided all farmers into two groups: (1) those who conformed to their respective counties' current temperature record patterns, and (2) those who didn't. Only 17.7% of the 3235 farmers reported their impressions of the temperature to be accurate (Table 2). Such poor consistency is not unexpected given that the actual data revealed declining patterns.

Table 1: Farmers perceived changes in yearly temperatures during the previous ten years by province

Region	northern China		southern China	
	Shandong	Anhui	Yunnan	Guangdong
increasing	73.3	68.2	82.6	79.9
decreasing	4.8	7	5.2	2.6
unchanged	19.6	21.5	9.6	14.2
Unkown	2.2	3.3	2.6	3.3

Table 2: Farm assets, social networks, and consistency of farmers' perspectives

Factors		percent of farmers whose views matched real weather
Mean		17.5
Social networks	Farmers' association village	
	Yes = 1 No = 0	19.6** 16.6
	the number of relations within three generations	
	Sample from the upper half (≥12) Sample from the lower half (<12)	18.7** 16.5
	Village leader as relative Yes = 1 No = 0	9.4 18.9***
Farm assets	Size of the farm(ha),	
	Tiny (≤0.) Average (0.3−0.7) Big (≥0.7)	17.4 16.0 19.6*
	Wealth (RMB),	
	Short (≤61 450) Middle (61 450−156 300) Tall (≥156 300)	21.2 18.8* 13.1***

Table 3: Farmers' perspectives on the effects of climate change, broken down by area

	Cost of production	Product excellence	variety of products	amount of production	manufacturing technology	Public health
t	2.641	4.909	2.969	0.508	2.766	6.434
p	0.009	0.000	0.003	0.612	0.006	0.000

Table 4: Results of factor analysis about climate change's effects

Cronbach's alpha	X-Square	KMO	P
0.812	2042.6	0.799	0.000

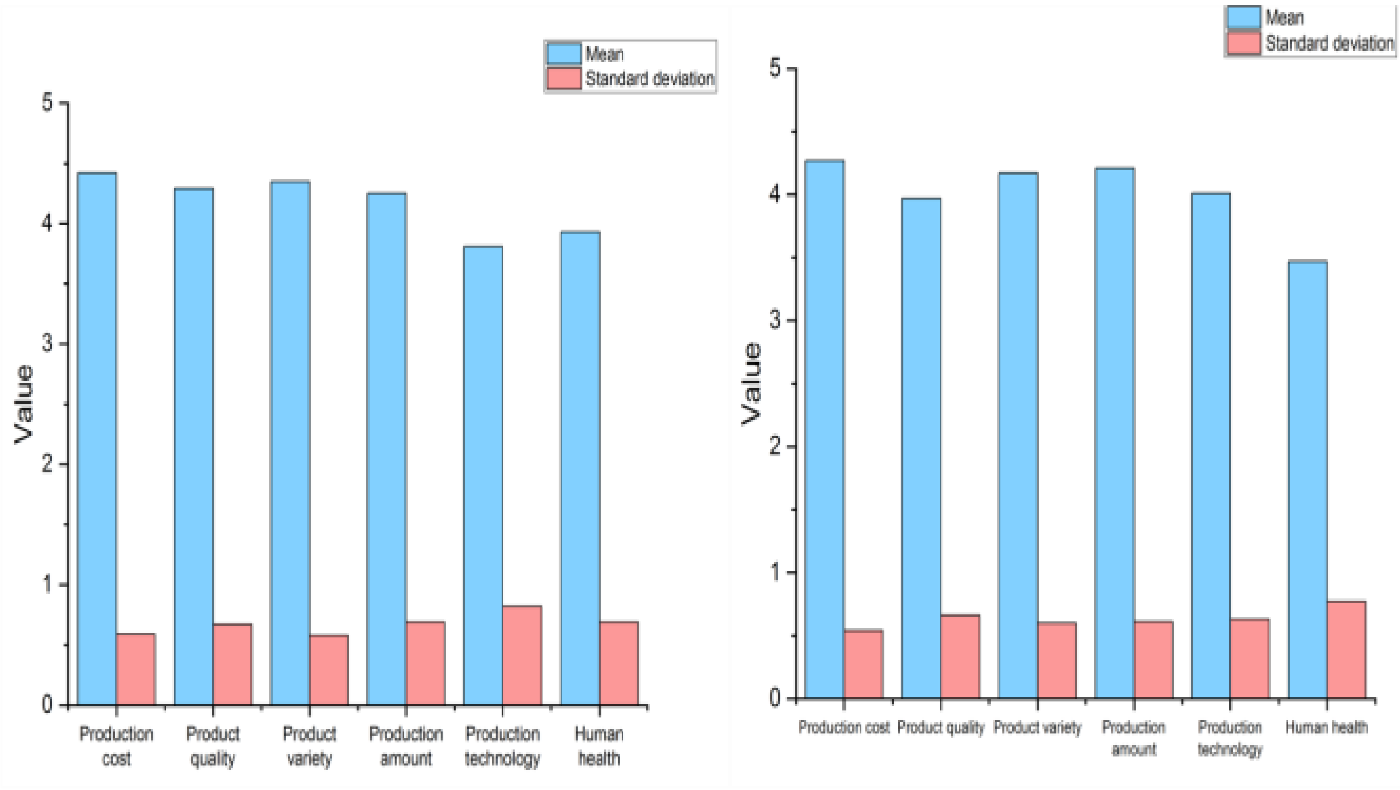

Figure 1: Farmers' perspectives on the effects of climate change

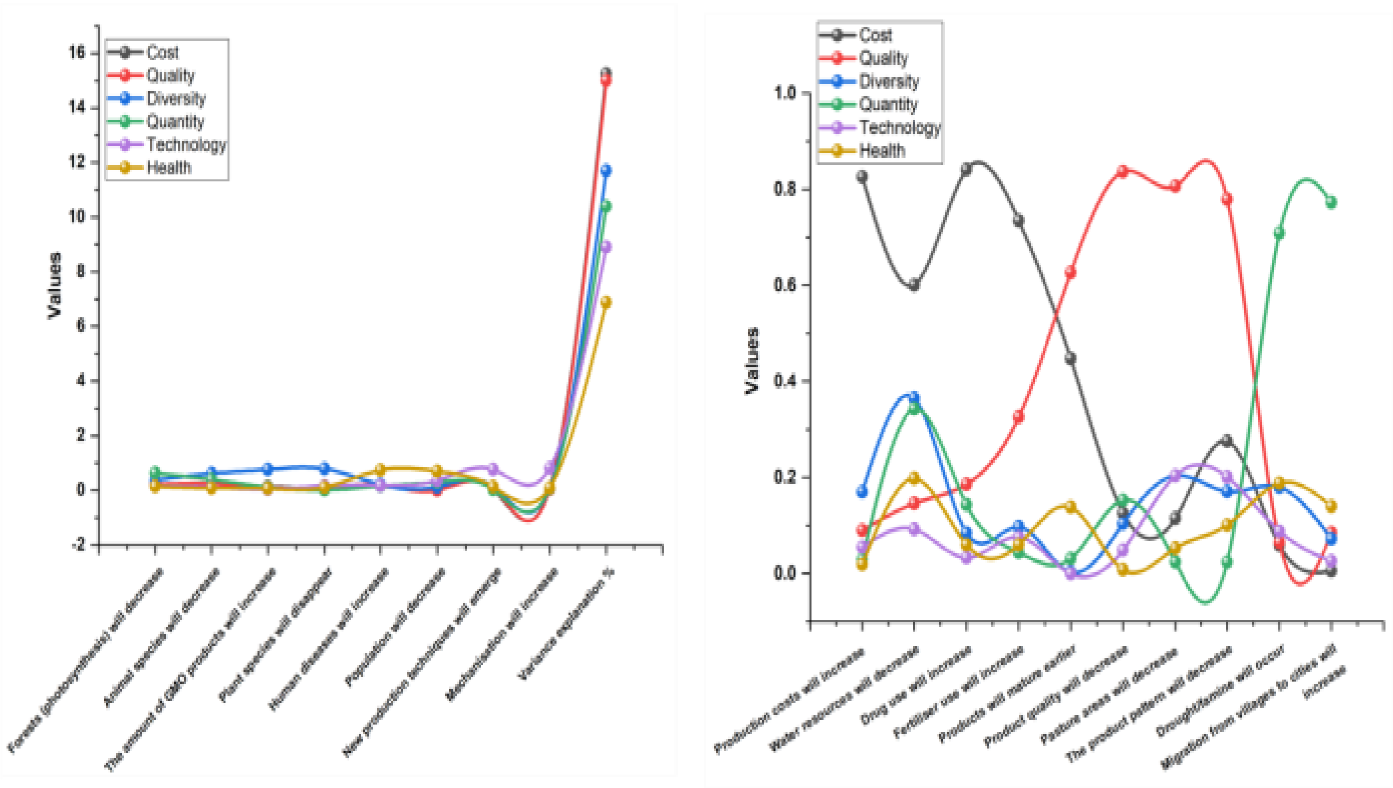

Figure 2: factor analysis regarding the effects of climate change.

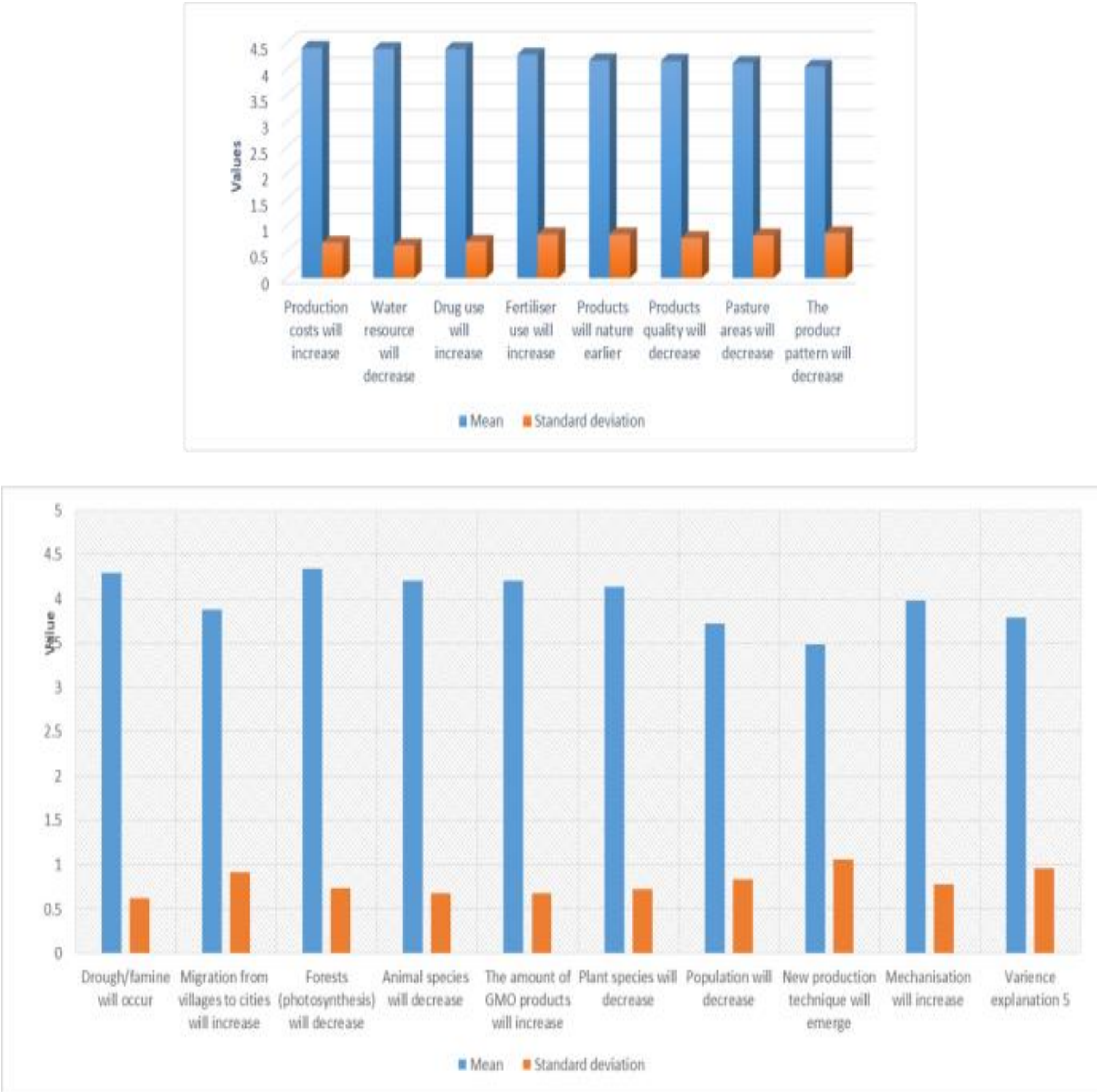

Figure 3: Mean and standard deviation regarding factor analysis

Table: 5: Farmers' strategies for reducing the consequences of climate change and adapting to them by region.

Measure	Northern area	Southern area	Mean	t
save water	3.14±1.21	3.30±1.07	3.21±1.15	1.323
use of recycled materials	3.92±0.94	2.90±0.93	3.48±1.06	11.015**
the support of environmental causes	3.54±1.11	3.36±0.98	3.46±1.10	1.653
Climate change warnings to the environment	4.14±0.63	3.41±0.86	3.82±0.83	9.617**
diversity of products	3.81±1.21	3.05±1.12	3.48±1.14	6.592**
utilizing alternative energy	3.86±0.89	2.88±0.93	3.43±1.03	10.934**
Avoiding harming agricultural lands	4.10±0.73	3.63±0.96	3.89±0.87	5.468**
fewer farmlands or animals being used for production	3.50±1.15	2.86±1.22	3.22±1.22	5.471**
Adjusting the planting or sowing timing	3.97±0.95	3.55±0.94	3.79±0.97	4.522**
reducing use of vehicles	3.62±1.04	2.50±0.87	3.13±1.11	11.874**
development of financial instruments	4.03±1.15	3.39±1.02	3.75±1.14	5.949**
preventing damage to the environment	3.85±0.91	3.81±0.77	3.83±0.86	0.461
Insurance for agriculture	2.34±1.42	2.92±1.25	2.53±1.42	0.962*
minimizing the usage of fertilizers and pesticides	3.20±1.21	2.67±1.02	2.97±1.16	4.782**
Mean	3.72±0.50	3.15±0.46	3.47±0.55	11.848**

4.2 Farm assets, social networks, and farmers' perspectives

Farmers with more established social networks should be better able to detect temperature changes that are in line with current data. As shown in Table 2 farmers (19.6%) in villages with farmers' organizations believed the temperature to be in line with the data from the weather record, compared to farmers (16.6%) in villages formers without organizations (p-value is less than 0.05). This difference indicates those farmers' possibilities to get accurate real - time weather information may be increased by the availability of and participation in events hosted by farmers' associations. Also, having more relatives in the community broadens the networks of farmers, enabling them to access more information. The consistency of the farmers' views was greater (18.7%) and statistically significant (p-value 0.05) when they had a larger number of relatives in their family (defined as more than 13 relatives within three generations). the standardization rate for homes in which there was a relative who served as a village leader was substantially lower (9.4%) than the consistency rate for households in which there was no village leader (18.9%) (P-value less than 0.01). The descriptive study of agricultural assets confirms that farmers with more substantial assets are more likely to have perceptions that are in line with actual facts. As shown in Table 2 Only small farm (17.4%) owners and medium farm (16%) owners reported having impressions that were compatible with weather conditions, compared to farmers (19.6%) who maintained large farms. It may be inferred from this that bigger farms are more worried about temperature variations. Yet, Compared to 21.2% of the least wealthy farmers and 18.8% of fairly wealthy farmers respectively, more wealthy farmers were less likely to hold consistent views (13.1%). It's possible that rich and powerful farmers are in a managerial position and spend less time outdoors in the open, making them less sensitive to temperature change. Those farmers may also have better means of reducing the effects of high temperatures on personal comfort.

4.3 Views of farmers on the impact of climate change

In fig.1 six factors with eigen values larger than one were identified by the factor analysis, the first factor having four things, the second having four items, the third having three items, the fourth having three items, the fifth having two items, and the sixth having two items. The total variation explained by all covariates was calculated to be 68.1% (Table 3). In figs. 2 and 3, northern Indian producers have greater perspective levels than southern Indian farmers in terms of rising production costs, lower product quality, decreased product variety, and human health problems. Considering the aspect of production technological development, it was established that farmers in the southern china Region had greater perspective levels than farmers in the northern china Region (Table 4). Although it is anticipated that climate change will negatively affect agricultural activities, it is also anticipated to have an impact on adaption strategies such product development and diversification, land management, increasing use of technologies, and irrigation management. In our study, the adaptation/reduction dependent variable was created by averaging the responses to the 14 research-used variables to assess the steps farmers took to combat global warming and the factors influencing those actions towards reducing the causes that cause climate change. Using a Likert scale with five points, the mean of the aforementioned variables was found to be 3.47, and its standard deviation, which was found to be fairly low at 0.55 (Table 5). Table 5 demonstrates a substantial difference in views towards reducing the impacts of global warming and/or adapting to them in all variables, with the exception of refraining from causing environmental harm, supporting environmental initiatives, and conserving water. In terms of these three factors, it is hoped that farmers' sentiments in both regions will be comparable. All other variables, with the exception of agricultural insurance, were significantly different between areas at the threshold of 0.01 and farmers' sentiments were greater in the north India.

5. Conclusions

The majority of the producers who took part in the study believe that weather change will cause hunger and drought, according to the conclusions of this research, which was carried out in two locations crucial to India's agricultural production. Because precipitation has a significant impact on agricultural productivity and quality, farmers tend to see climate change as causing drought and famine. Farmers in the research regions believe that human-induced variables (such as forest fires and stubble burning) are the most important ones contributing to weather change. On the other side, it was found that both regions had low perceptions of the impact of animal breeding and irrigation on weather change. Farmers in the study areas are most concerned about a rise in cost of production and input utilization as well as a decline in water resources due to the impacts of global warming. So, for farmers in both locations, the strain of climate change on irrigation and expenses trumps environmental concerns. According to research, farmers in the north India are particularly worried about how weather change may negatively affect their crops and people's health. In contrast, due to climate change, farmers in the South India Area are more enthusiastic about new production methods and mechanization. Farmers in both regions lack sufficient knowledge about how to adjust to weather change, and very few of them adopt effective adaptation and mitigation strategies including using alternative energy sources, conserving water, using fewer chemicals, and getting crop insurance. The impact of agricultural practices on weather change, rainwater harvesting, and the use of renewable energy sources, sustainable agriculture, and adaptation to climate change must be made more widely known to farmers. More deterrent measures are seen to be necessary to stop agricultural activities that waste water and utilize excessive amounts of inputs, which result in stubble burning and forest fires.

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