

The Impacts of Climate Change, Livelihood Assets and Farming Strategies on Paddy Farmers Livelihood in Malaysia

Nur Suzana Agus Salim¹, Rozana Samah¹, & Roslina Kamaruddin¹

¹School of Economics, Finance and Banking, Universiti Utara Malaysia 06010 Sintok Kedah, Malaysia

Abstract

Climate change has a negative impact on planting schedule due to its disruption of weather patterns, prolonged periods of drought, and occurrence of extreme rainfall events. Consequently, it leads to higher costs related to cultivating paddy, reduced paddy yield, and decreased income for farmers. The decline in income worsens poverty, whereas temporary unemployment therefore results in unfavourable livelihood conditions. In order to combat climate change, Malaysian paddy growers utilise several farming strategies including the cultivation of heat-resistant rice varieties, modifications to planting schedules and the implementation of water-conserving irrigation systems. The implementation of farming strategies is impeded by various problems including a lack of education, financial limitations, restricted resources, inadequate infrastructure, insufficient acceptance of modern agricultural technologies, and fragmented land ownership arrangements. The objective of this study is to identify the degree of the impacts of climate change based on farmers perception. And to measure the livelihood assets factors that influence paddy farmers perception on the impacts of climate change. This study employed a method of stratified random sampling. It utilized descriptive analysis to outline the socio-demographic characteristics of paddy farmers in Malaysia and percentages in descriptive analysis were applied to assess paddy farmers' perceptions of climate change impacts. Multiple regression analysis was subsequently employed to investigate the livelihood assets that affected these impacts, encompassing socio-demographic factors, technology readiness index (TRI) and farming management. The perception on the impact of climate change had a significant influence on the adaptation of farming strategies in the sample of farmers analysed. Farming experience, total farm size, KADA, IADA BLS, technology readiness index (TRI) and farming management are factors that significantly affecting farmers perception on climate change and were shown to affect the farmers' perception on decision- making process considerably, leading to the adoption of diversified farming strategies.

Keywords: climate change, livelihood assets, farming strategies, livelihood, paddy farmers

1.0 Introduction

Climate change is a global phenomenon with far-reaching effects on ecosystems, economies, and ways of life. Climate change has an effect on agricultural output, particularly the paddy industry in Malaysia, therefore, it is essential to comprehend how paddy farmers perceive the effects of climate change in order to improve the paddy industry in Malaysia. The effects of climate change are especially pronounced in Malaysia, a nation renowned for its robust agricultural sector. Agriculture sector is essential to Malaysia's economic prosperity and development as a whole. Before industrialization, this industry was essential to the Malaysian economy. It produced agricultural goods both domestically and internationally. In 2020, agriculture exports totaled RM118,607,000,000 and imports totaled RM97,978,000,000

(Indicators, 2020). In terms of economic impact, agriculture ranks third, behind only mining and construction. The Malaysian Department of Statistics (DOSM) reports that the service sector contributed 56.7%, the manufacturing sector contributed 24.4%, and agricultural contributed 8.2% to the country's GDP. Agriculture contributes to the economy of Malaysia by ensuring food security (Siwar et al., 2013).

Rice is a staple in Malaysia, and paddy is essential for food security. This endeavor has socioeconomic and political effects, including the reduction of destitution. Rice is an important commodity crop that the overwhelming majority of Malaysians consume. 2019 paddy production in Malaysia is anticipated to reach RM2,643,010. In 2019, 2,352,870 tonnes of paddy and 1,503,340 tonnes of rice were produced. On 672,084 hectares of land, Malaysia cultivated 35,000,000 tonnes of rice. In contrast, rice cultivation has decreased by 27,896 hectares. Despite efforts, paddy and rice production in Malaysia continues to fall short of domestic demand. In 2017, Malaysia required 2.75 million tonnes of rice but only produced 1.8 million. One million tonnes of locally produced rice is inadequate to meet demand. These climatic variations present paddy farmers with significant challenges has not been immune to the escalating effects of climate change, which have manifested as erratic weather patterns, rising temperatures because they have a direct impact on crop yield, land use patterns, and the general ecosystem.

Climate change is one of the threats to the rice and agricultural economies of Malaysia. The impact of climate change on paddy's cultivated area, productivity, value, and long-term viability is projected for 2020. It would impede development and put food security at risk (M. Alam et al., 2019). Climate change will reduce the income of farmers (M. M. Alam et al., 2012). According to MOSTE (Alam et al. 2019), paddy agriculture revenue varies with temperature and precipitation. If precipitation declines by 0.4%, income and paddy output will decrease for decades. According to a study that utilised the DSSAT crop simulation model, the rice crop in Malaysia is particularly susceptible to climate change, specifically increasing temperatures and decreasing precipitation. The inability of small-scale paddy producers to acclimatize to climate change would worsen their financial situation. The effects of climate change on farmer income and food security will be negative. Malaysia is plagued by food insecurity, destitution, and hunger (Firdaus et al., 2020). This vital industry not only sustains the livelihoods of numerous paddy farmers, but also contributes significantly to the agricultural output of Malaysia. It is therefore essential to comprehend how paddy producers in this region perceive and experience the effects of climate change.

Understanding the delicate relationship between environmental changes, livelihood security, and the sustainability of rice production is contingent on paddy farmers perceptions of climate change's consequences. The perspectives of farmers provide crucial insight into their adaptation strategies, resilience, and capacity to manage the adverse effects of climate change. This study aims to examines the perceptions of paddy producers regarding climatic change in the primary granary area ecosystem and its associated components. It will uncover the complexities of rice farmers' experiences, obstacles, and responses to climate change by investigating their perceptions. It also compares the perspectives of paddy producers regarding the effects of climate change on three dimensions: the environment, their livelihoods, and their productivity. Through a comprehensive comprehension of these issues, this research aims to contribute to the development of targeted adaptation methods and policy initiatives that will strengthen the sustainability of paddy production in Malaysia.

The remaining sections of the paper are organized as follows. In the subsequent section, we provide a literature review of past studies, followed by a description of the research methodology. In the fourth section, we will discuss the most significant findings from research on paddy farmers' perceptions of the effects of climate change on the environment, their livelihoods, and their yields. In addition to a thorough analysis of the data and the empirical estimates associated with them. The concluding section contains a few insights and policy suggestions.

2.0 Literature review

Historically, climate change research has utilized quantitative climatic data and models to assess the consequences and adaptability of climate change. However, comprehending climate change extends beyond mere climatic parameter values; it includes variations and extreme weather events, as well as local farmers' perceptions of these changes. According to Abas et al., (2022), the study's findings indicate that the majority of farmers have a strong awareness of climate change and its impact on their paddy crops. Farmers are acutely aware of the environmental changes occurring as a result of climate change, and they are cognizant of the potential implications for their rice cultivation. Gbemavo et al.'s (2022), study revealed that farmers' perceptions of climate change were characterized by unpredictable weather patterns, reduced or irregular rainfall, the depletion of irrigation sources, the emergence of diseases and pests, decreased snowfall, shorter winters, and sudden, intense rainfall. These perceptions prompted farmers to implement adaptation strategies for climate change. This knowledge provides valuable insights into the specific concerns and requirements of farmers, which can inform government initiatives intended to strengthen their resilience. In addition, farmers' propensity to adapt to climate change was substantially influenced by their perception of climate variability and change relative to historical climatic patterns. As indicated by Ricart et al.'s (2022), factors such as the level of education among household heads, the availability of water resources and agricultural inputs, and the overall economic conditions of households were found to be crucial determinants of farmers' decision-making processes and their adoption of diverse adaptation strategies.

3.0 Methodology

This study was conducted in three of the main granary areas in Malaysia which are MADA, KADA and IADA BLS. The Main Granary Areas in Malaysia, including MADA, KADA, and IADA BLS, are strategically important regions for rice cultivation and play a crucial role in the nation's agricultural production. Each of these areas has distinct characteristics, geographical locations, and challenges that influence their agricultural practices and management. MADA is the biggest granary area in Malaysia followed by KADA. Meanwhile IADA BLS chosen due to its high productivity among another granary area. MADA, located in the northern part of Peninsular Malaysia in the state of Kedah, is the largest and most productive among the three. It is located in the northwest and comprises 125,555 hectares. Northern Kedah encompasses 10,581 hectares, while the southern region of Perlis covers 20,304 hectares, as reported by (MADA, 2015). These regions are situated within the expansive, flat, alluvial Kedah-Perlis Plain, which extends over 20 kilometres in width and 65 kilometres in length, nestled between the foothills of the Central Range and the Malacca Straits. The geographical coordinates of this area fall between 5°45'-6°30'N and 100°10'-100°30'E, as indicated in the 2013 data. This vital agricultural hub is administratively divided into three zones and is supported by twenty-seven district farmer groups. Its extensive and well-developed irrigation system, notably the Muda Irrigation

Scheme, provides a reliable water source for rice cultivation. Challenges in MADA include susceptibility to climate-related issues like droughts and floods, making effective water management vital for sustaining its agricultural productivity. MADA is overseen by the Muda Agricultural Development Authority, a government agency dedicated to managing and developing the region's agriculture sustainably.

The Kemubu Agricultural Development Authority (KADA) was established by the Kemubu Agricultural Development Authority Act of 1972 on March 30, 1972. The authority's primary responsibilities are to promote, stimulate, facilitate, and carry out economic and social development in the Kawasan Kemubu, as well as to plan and carry out agricultural development within the Kawasan Kemubu, Kelantan, in accordance with the State of Kelantan's directives. Situated in the north-eastern part of Peninsular Malaysia, primarily in Kelantan, KADA is the second-largest granary area in the country. The thickly populated KADA granary region dominates the plain of northern Kelantan. According to the 2011 rice beginning list summary, there are 9334 paddy farmers under KADA (KADA, 2014). With 31,464 hectares of paddy, the irrigation system allowed for two planting seasons every year. Similar to MADA, KADA has a well-structured irrigation system that draws water from the Kelantan River and multiple reservoirs. Challenges in KADA include the risk of flooding and droughts, emphasizing the importance of effective water resource management. The Kemubu Agricultural Development Authority manages KADA, working towards enhancing agricultural productivity and development.

IADA (Integrated Agriculture Development Area) or IADP (Integrated Agriculture Development Project) was founded on the premise of integrated agricultural development. IADA BLS, located in the western part of Peninsular Malaysia across Selangor and Perak, covers a relatively smaller area compared to MADA and KADA. IADA BLS development focuses on all agricultural infrastructure development activities in the 19,057-hectare rice-growing region, which encompasses the Kuala Selangor and Sabak Bernam Districts. There are ten thousand households farm paddy, and 285 farmers are spread throughout eight Pertubuhan Peladang Kawasan under IADA BLS. Its irrigation system includes the Bernam River Irrigation Scheme and the Sekinchan Irrigation Scheme, which provide essential water resources. Challenges include water scarcity, soil erosion, and salinity, which require sustainable management practices. The Integrated Agriculture Development Authority oversees IADA BLS, promoting agricultural development and sustainability in the area.

These three granary areas are pivotal for Malaysia's rice production and contribute significantly to the nation's food security. Each area has its unique characteristics, from location and size to irrigation infrastructure and specific challenges. While all three focus on rice cultivation, they adapt to their regional contexts, emphasizing the need for customized strategies for sustainable agricultural development.

3.1 Research Sampling

For sampling, a technique called stratified random sampling was used for this study. It is a method of sampling that involves the division of a population into smaller subgroup known as strata. In stratified random sampling, or stratification the strata are formed based on member's shared characteristics. In this study, 788 respondents were chosen from this three-granary area which are MADA, KADA and IADA BLS. The distribution of respondents in Malaysia's key granary areas MADA, KADA, and IADA BLS is shown in Table 1. MADA had the highest percentage of respondents 39.97%, followed by KADA 37.34%. IADA BLS accounted for the remaining 22.59%.

Table 1: Distribution of respondents by granary area

Granary Area	Frequency (number)	Percentage (%)
MADA	315	39.97%
KADA	295	37.44%
IADA (BLS)	178	22.59%

3.2 Data analysis

In the descriptive analysis mean, standard deviation, minimum and maximum were used to describe socio demographic of paddy farmers in these three-granary areas. The descriptive analysis percentage was used to measure the paddy farmers perception on the impact of climate change to environment, livelihood and production using four divided scale, high impact, moderate impact, low impact and no impact. Multiple regression then used to analyze the factors influenced paddy farmers perceptions on the impact of climate change. The factors may consist of socio demographic variables, technology readiness index (TRI) variables and farm management variables. It is then used to analyze paddy farmers perception on the impact of climate change.

4.0 Results and discussion

Table 2 shows that 93% of the respondents are male, as revealed by the demographic analysis. This suggests that males are the predominant paddy farmers in the region, reflecting traditional gender roles in agriculture. The age distribution ranges from 19 to 86 years, with a mean age of 52.15 years, indicating that paddy cultivation is practiced by multiple generations. This diversity in age groups suggests a mix of older and younger farmers, which may have implications for the transmission of knowledge and adaptation to changing agricultural practices.

Table 2: Variable Description and Descriptive Statistic

Variable	Obs	Mean	Standard Deviation	Min	Max
Gender (1 = Male, 0 = Female)	788	0.93	0.25	0.00	1.00
Age (years)	788	52.15	14.38	19.00	86.00
Education (1 = No Education, 2 = No Formal Education, 3 = Primary School, 4 = Lower Secondary School), 5 = Upper Secondary School, 6 = STPM/Certificate/Diploma, 7 = Degree and Above	788	4.36	1.14	1.00	7.00
Farming Experience (years)	788	19.74	13.68	0.00	65.00
Total Household Size (#)	788	4.67	1.98	1.00	13.00
Total Farm Size (Hectare)	788	3.54	4.59	0.29	63.60
Own Land Allocated to Paddy (Hectare)	788	0.79	1.19	0.00	12.00

Rented Land Allocated to Paddy (Hectare)	788	2.74	4.16	0.00	51.60
Total Income (RM)	788	1936.84	4102.20	0.00	76500.00
BLS (Location)	788	0.23	0.42	0.00	1.00
KADA (Location)	788	0.38	0.48	0.00	1.00
MADA (Location)	788	0.40	0.49	0.00	1.00

The dataset contains individuals with varying levels of education, with an average level equivalent to "Lower Secondary School." The education options extend from "No Education" to "Degree and Above." The diversity of paddy farmers' educational contexts, which may influence their decision-making and adaptability, is indicated by the disparity in their levels of education. The average number of years of farming experience is 19.74 years, making it a crucial factor. However, the variety of experience, ranging from newcomers to those with decades of experience, indicates a dynamic and diverse farming community. This diversity of experience can influence the adoption of innovative agricultural techniques. The average size of a household varies from modest to relatively large, with 4.67 members. Understanding the social and economic dynamics of rice producers and their reliance on family labour necessitates knowledge of the composition of their households. The average measure of a farm is 3.54 hectares, but farm sizes vary considerably. This broad range, from small to large holdings, indicates disparities in land ownership as well as possible differences in resource management and productivity. The average amount of paddy-allocated land owned by respondents is 0.79 hectares, whereas the average amount of paddy-allocated land rented is 2.74 hectares. Variations in land ownership and rental may have implications for diversification of income and strategies for subsistence. The average income of respondents is RM 1,968.84. Respondents' income levels differ significantly, with a mean income of RM 1,968.84. Farmers with no reported income and others with comparatively high incomes are included in the dataset, indicating income disparities that may affect their access to resources and resilience to economic shocks.

The data presented in Figure 1.0 indicate that a significant number of paddy producers 31.3%, consider climate change issues to be quite serious. An additional 15.9% of producers consider these issues to be of the utmost importance. This suggests that a substantial fraction of the farming community in the study area is aware of the gravity of climate change issues, which may be indicative of their concerns regarding the impact of climate change on paddy cultivation. Only a small percentage 5.2% of paddy producers do not consider climate change issues to be of grave concern. This demonstrates that producers are generally aware of the challenges posed by climate change. Figure 2.0 depicts the impact of climate change on the reduction of paddy yield over the past five years. A substantial plurality 30.8% of farmers report a reduction in output of 25%, while 28% report a reduction of 50% or greater. This suggests that a significant number of producers have experienced decreased paddy yields, which may have implications for food security and economic prosperity. It also indicates that climate change is having a significant impact on paddy production in the region. In addition, 16% of paddy producers report no change in yield, which may be attributable to a number of factors, such as adaptation measures or variations in local climate impacts.

Figure 3.0 illustrates the effects of climate change on paddy cultivation cost increases over the past five years. According to the data, the majority of farmers 29.4% have experienced a 25% increase in expenses, which is a considerable financial burden. Significantly, 28.7% of producers report a 50% increase in expenses, further highlighting the economic obstacles

posed by climate change. In addition, 2.7% of farmers have experienced a 1000% increase in costs, illustrating the severe financial consequences of climate change. Due to efficient resource management or limited climate-related cost impacts, only 9.1% of farmers report no change in expenses.

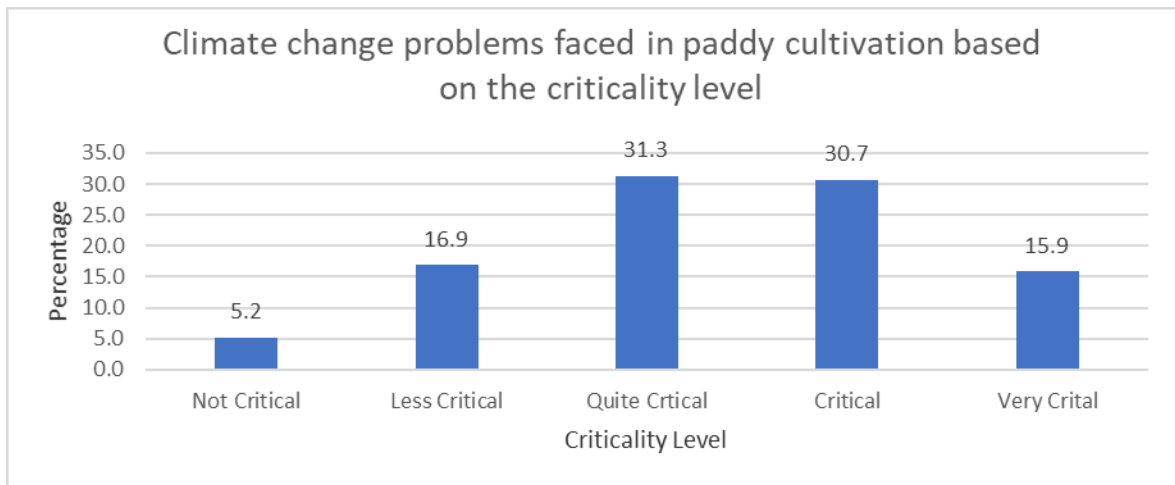


Figure 1.0: Climate change problems faced in paddy cultivation based on the criticality level

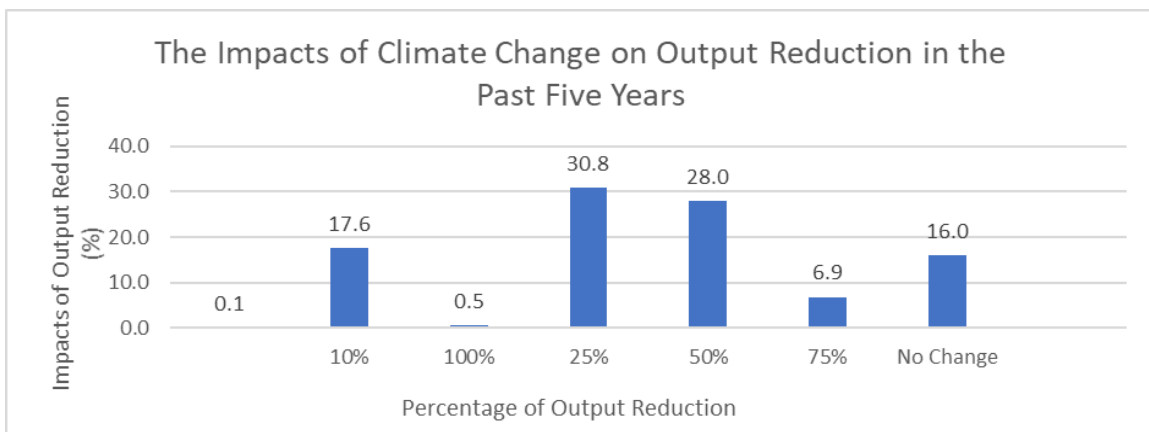


Figure 2.0: The Impacts of Climate Change on Output Reduction in the Past Five Years

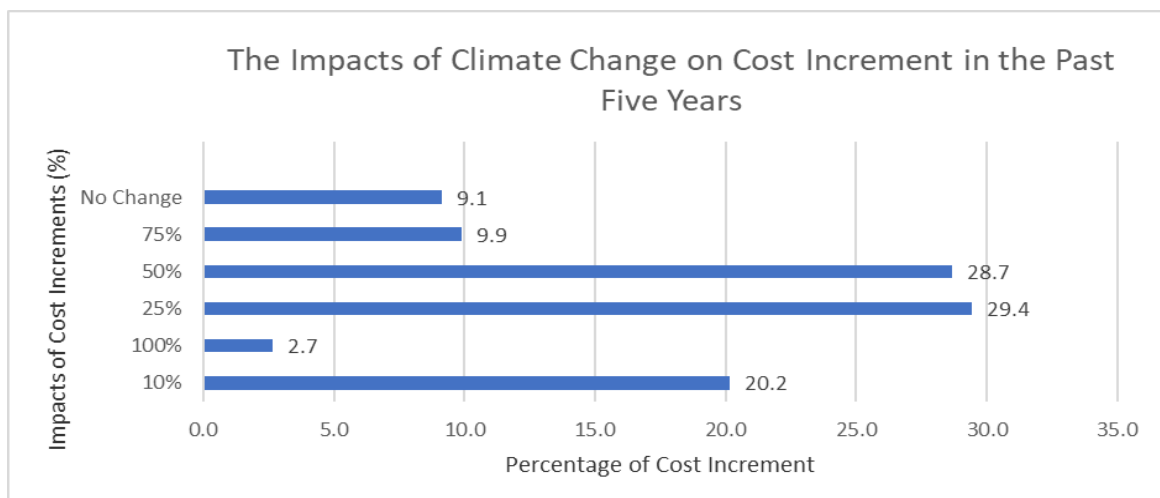


Figure 3.0: The Impacts of Climate Change on Cost Increment in the Past Five Years

Table 3 show the impact of various factors on the environment, farmers' livelihoods, and rice production. The survey classified these impacts as having a high, moderate, low, or no impact, with percentages to match.

Table 3: Perception of Farmer on the Impact of Climate Change based on three-dimension, Environment, Livelihood and Production (%)

NO.	Dimension	Variables	High Impact	Moderate Impact	Low Impact	No Impact	Results (Majority)
1	Environment	Deterioration of soil fertility due to floods and droughts	141 17.89%	281 35.66%	240 30.46%	126 15.99%	Moderate Impact
		Erosion of paddy fields due to floods	86 10.91%	212 26.90%	274 34.77%	216 27.41%	Low Impact
		Paddy fields are barren	130 16.50%	225 28.55%	265 33.63%	168 21.32%	Low Impact
		Abundance grows of weeds	140 17.77%	298 37.82%	247 31.35%	103 13.07%	Moderate Impact
		The cost of food is increasing	250 31.73%	282 35.79%	165 20.94%	91 11.55%	Moderate Impact
		Poverty rate among farmers increased	146 18.53%	297 37.69%	234 29.70%	111 14.09%	Moderate Impact
2	Livelihood	Disruption to repay the loan	116 14.72%	222 28.17%	222 28.17%	228 28.93%	No Impact
		Reduction of current assets (pawn jewellery)	89 11.29%	157 19.92%	235 29.82%	307 38.96%	No Impact
		Financial savings are affected	172 21.83%	223 28.30%	222 28.17%	171 21.70%	Moderate Impact
		Reduction in rice production	182 23.10%	273 34.64%	233 29.57%	100 12.69%	Moderate Impact
		Reduction in the quality of rice produced	124 15.74%	311 39.47%	269 34.14%	84 10.66%	Moderate Impact
		Lossess due to floods and droughts	208 26.40%	299 37.94%	200 25.38%	81 10.28%	Moderate Impact
3	Production	Pest attacks and diseases are getting worse	212 26.90%	283 35.91%	213 27.03%	80 10.15%	Moderate Impact
		Paddy collapsed due to strong winds	193 24.49%	284 36.04%	216 27.41%	95 12.06%	Moderate Impact
		Production cycle changes	98 12.44%	290 36.80%	297 37.69%	103 13.07%	Low Impact

Floods and droughts were found to have a moderate impact on soil fertility for 35.66% of respondents, indicating that a sizable proportion of farmers confront challenges related to soil quality, possibly as a result of extreme weather events. Flood-caused erosion of paddy fields had a minimal effect, affecting only about 26.9% of respondents. This suggests that soil fertility issues are more prevalent than erosion concerns. Insignificantly impacting 28.55% of respondents was the presence of barren paddy fields. 37.82% of farmers were moderately affected by the abundance of weeds in paddy fields, indicating that vegetation management is a significant issue for many. In general, environmental concerns appear to have varying degrees of impact, with soil deterioration and weed abundance being of greater concern to a sizeable proportion of paddy producers. The rising cost of food was a significant concern, having a moderate impact on 35.79% of respondents. This indicates that rising food prices have economic implications for a large number of producers. Approximately 38% of respondents also cited the increasing poverty rate among producers as a significant issue. This demonstrates the socioeconomic precariousness of a substantial proportion of paddy producers. Nevertheless, the survey revealed that the disruption to repay loans had no significant impact on approximately 28.93% of farmers, and that the diminution of current assets (such as pawned jewellery) also had no significant impact on 38.96% of respondents. While some financial aspects, such as loan repayment and asset reduction, do not significantly affect a substantial portion of respondents, the overall economic well-being and rising poverty rates remain pressing concerns, according to these findings. Affected financial savings had a moderate effect on 28.3% of farmers, indicating that savings are susceptible to a variety of factors. Reduction in rice production had a moderate effect on 34.64% of respondents, indicating that production yields are a major concern for a substantial proportion of producers. Similarly, the decline in rice quality was a significant issue that had a moderate effect on 39.47% of producers. 37.94% of respondents were also moderately concerned about losses due to floods and droughts, indicating that these environmental factors substantially impact production. Pest infestations and the worsening of diseases had a similar effect on 35.91% of producers, as did the collapse of paddy due to strong winds. Approximately 37.69% of respondents were affected by changes in the production cycle, indicating that the timing of production cycles is not a significant concern for the majority of farmers.

Table 4 shows parameter estimates the results of a regression analysis in which the perceptions of paddy producers regarding climate change served as the dependent variable. Several independent variables were investigated, and the results provide insightful information regarding the factors that influence these perceptions. The effect of "Education" on farmers' perceptions of climate change was found to be statistically insignificant, indicating that farmers' levels of education do not substantially affect their perceptions. However, the coefficient for farming experience was negative -0.09 and statistically significant $p = 0.04$, suggesting that as farmers acquire more experience in agriculture, their perception of climate change becomes more negative. This could be attributable to a greater exposure to climate-related difficulties. The lack of statistical significance for "Household Size" indicates that the size of a farmer's household has no significant effect on their perception of climate change. In contrast, "Total Farm Size" demonstrated a positive coefficient 0.28, as well as statistical significance $p = 0.02$, indicating that as farm size increases, producers tend to have a more optimistic outlook on climate change. Greater adaptability and optimism towards climate change impacts may be associated with larger farm sizes. The impact of location was considerable. Farmers in the "KADA" region had a highly significant and negative coefficient -7.47, indicating a substantially more pessimistic outlook on climate change. Similarly, farmers in the "IADA BLS" region had a negative coefficient -4.05, which was statistically significant $p = 0.01$, indicating a more pessimistic

perception of specific climate-related obstacles in these regions. The "Technology Readiness Index" exhibited a positive and statistically significant coefficient 13.49, $p = 0.02$, indicating that farmers with a higher level of technology readiness tend to hold a more optimistic view of climate change. This emphasises the role that technology plays in enhancing resilience and adaptation. Farm Management showed a positive coefficient 8.48 with marginal significance $p = 0.05$, indicating that effective farm management practises may contribute to a more positive perception of climate change, although this relationship was not as strongly significant as the relationships between other variables. The findings suggest that a variety of factors influence producers' perceptions of climate change. While education and household size do not appear to have a significant effect on these perceptions, agricultural experience, total farm size, regional context (KADA and IADA BLS), technology readiness, and to a lesser extent farm management practises play crucial roles.

Table 4: Estimates of Factors Affecting Paddy Farmers Perception of Climate Change

Independent Variable	Paddy Farmers Perception of Climate Change (Dependent Variable)	
	Parameter Estimates	Significant
Constant	56.75	0.00
Education	0.24	0.64
Farming Experience	-0.09	0.04
Household size	0.27	0.32
Total Farm Size	0.28	0.02
KADA	-7.47	0.00
IADA BLS	-4.05	0.01
Technology Readiness Index	13.49	0.02
Farm Management	8.48	0.05

Table 5 shows the effects of education, agricultural experience, household size, and the technology readiness index on paddy farmers' environmental perceptions are insignificant. Total farm size has a positive and marginally significant effect $p = 0.054$, suggesting that larger farms tend to result in a more positive perception of the environment. The "KADA" location variable has a highly significant and negative effect -8.352, indicating that farmers in this region have substantially more negative environmental perceptions. Similarly, "IADA BLS" has a significant negative effect -4,607, suggesting that farmers in this region have a more negative perception of environmental impact. These results demonstrate the predominance of location in paddy producers' environmental perceptions. As for the livelihood dimension, education, agricultural experience, household size, and the technology readiness index have little effect on paddy farmers' perceptions of the impact on their livelihood.

Total farm size has a positive effect $p = 0.056$, suggesting that larger farms tend to correlate with a more favourable perception of the impact on livelihood. The location variables "KADA" and "IADA BLS" have highly significant and negative effects on perceptions of livelihood, indicating a more negative perception of the impact on livelihood in these regions. In addition, "Farm Management" demonstrates a positive effect with marginally significant results $p = 0.032$, indicating that effective farm management practises may contribute to a more positive perception of the impact on one's livelihood. As for the production dimension education and household size have little effect on paddy producers' perceptions of production. The negative effect of farming experience $p = 0.011$ suggests that as farming experience

increases, farmers tend to have a more pessimistic view of production impact. Total farm size has a positive and statistically significant effect $p = 0.023$, indicating that larger farms are associated with a more favourable perception of production impact. The "KADA" and "IADA BLS" location variables exhibit highly significant and negative effects, indicating that perceptions of production impact are more negative in these regions. The "Technology Readiness Index" has a positive and statistically significant effect $p = 0.023$, indicating that greater technology readiness tends to correlate with a more favourable perception of production impact. In summary, the analysis reveals that location is the most influential factor on the perceptions of paddy producers across all three dimensions. Farmers in the KADA and IADA BLS tend to have a more pessimistic view of the environment, livelihood, and production. Additionally, the scale of farms and their technological readiness influence perceptions. Effective farm management practises have a positive effect on perceptions of livelihood, while extensive farming has a positive effect on perceptions of both livelihood and production.

Table 5: Estimates of Factors Affecting Paddy Farmers Perception of Climate Change in Three Dimension Environment, Livelihood and Production

Independent Variable	Environment		Livelihood		Production	
	Parameter Estimates	Significant	Parameter Estimates	Significant	Parameter Estimates	Significant
Constant	57.288	0.000	53.871	0.000	59.103	0.000
Education	-0.265	0.686	0.253	0.672	0.716	0.175
Farming Experience	-0.105	0.057	-0.128	0.011	-0.026	0.553
Household size	-0.012	0.972	0.573	0.070	0.237	0.398
Total Farm Size	0.298	0.054	0.27	0.056	0.283	0.023
KADA	-8.352	0.000	-7.509	0.000	-6.538	0.000
IADA BLS	-4.607	0.013	-1.675	0.320	-5.874	0.000
Technology Readiness Index	18.165	0.011	9.225	0.155	13.081	0.023
Farm Management	7.748	0.172	11.062	0.032	6.627	0.147

5.0 Conclusion

In conclusion, the findings of this study provide valuable insights into the complex dynamics of climate change perceptions among paddy farmers in the region. The study reveals that numerous factors have a substantial impact on these perceptions, with regional context playing a central role in determining how producers perceive climate change's effects on

environmental, livelihood, and production dimensions. Farmers in the KADA and IADA BLS regions are consistently more pessimistic, highlighting the unique challenges these regions face. Furthermore, farm size and technological capability influence these perceptions, with effective farm management practises positively influencing perceptions of livelihood. On the basis of these findings, a number of recommendations can be made to aid paddy producers in the Main Granary Area in navigating the challenges of climate change. To address the unique challenges encountered by farmers in KADA and IADA BLS, regionally-tailored adaptation and mitigation strategies for climate change should be developed before anything else. To cultivate a more optimistic view of climate change and improve resiliency, it is crucial to provide resources and training to improve technology readiness and promote sustainable farming practises. In addition, knowledge-sharing platforms and initiatives that facilitate the exchange of best agricultural practises among producers can be beneficial for enhancing their adaptability. In addition, policies and interventions should consider the complexity of paddy farmer perceptions. Recognising that education and household size may not be substantial determinants, strategies should focus on farm management and the well-being of farming communities in general. To further bolster these recommendations, ongoing research and monitoring of the effects of climate change on paddy cultivation are required to ensure that strategies remain adaptable and responsive to evolving challenges. It is essential to engage with the farming community, acknowledge their distinct regional contexts, and provide the necessary support to enable them to adapt and thrive in the face of ongoing climate change challenges.

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