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Adoption of Climate-Smart Rice Production Practices and Technologies: A Tool Towards Rice Production Efficiency and Agricultural Sustainability

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Abstract. Climate change and high rice imports pose significant threats to local rice production, food security, and the livelihoods of rice farmers. This study examines the potential of climate-smart rice practices and technologies to enhance domestic production and adapt to environmental changes in major rice-producing municipalities within South Cotabato, Region 12, focusing on the clusters of Norala, Santo Niño, and Banga. Using surveys from 189 farmers and interviews with technical personnel, the study identified synchronous planting, alternate wetting and drying (AWD), and direct seeding as the most commonly adopted practices. Conversely, rainwater catchment facilities and Rice Crop Manager (RCM) technology had lower adoption rates. Cost and return analyses demonstrated increased yields and net income for farmers employing the most adopted practices. The findings suggest that higher adoption rates for climate-smart practices can be achieved through training programs, financial assistance, and community demonstrations. The study recommends collaboration between the Department of Agriculture and other stakeholders to enhance farmer awareness, develop agricultural education programs, and provide vocational training on sustainable practices to attract young farmers. Financial and technical support for farmers is also essential. Replicating the study in other regions and with different farmer groups will strengthen its findings. By empowering farmers to achieve higher yields, secure income, and environmental protection, climate-smart rice production offers a sustainable path toward national rice security.

Keywords: Climate Change; Rice production; Smart technologies; Agricultural sustainability.

1.0 Introduction

Climate change disrupts traditional rice production, threatening food security for billions who rely on this vital crop. While climate-smart rice production practices and technologies offer a glimmer of hope, its adoption by farmers remains a hurdle. Since 1800, human activities had been the main driver of climate change, primarily due to burning fossil fuels like coal, oil, and gas. These activities generate greenhouse gas emissions like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures (UN, 2020). According to Lipper et al. (2014), many current farming practices damage the environment and source (19–29%) of anthropogenic greenhouse gas (GHG) emissions.

The specter of climate change hangs heavy over agriculture, casting a long shadow on the future of food security. Intensifying human activities that contribute to greenhouse gas emissions disrupt weather patterns and temperature cycles in unprecedented ways. These disruptions are creating a domino effect, threatening agricultural production on a global scale. Farmers, the backbone of our food systems, are particularly vulnerable. Climate change disrupts food markets, putting food supply in danger for the entire population. Threats can be mitigated by boosting farmers' adaptive capacity, resilience, and resource usage efficiency in agricultural production systems (Thornton et al. 2014).

The Philippines has 4,815,813 hectares devoted to rice. SOCCSKSARGEN Region has 338,689 hectares of rice areas, which can produce 1 256,406 metric tons of play or 6 % of the total production of the country in 2023 (PSA, 2023). Favorable weather conditions are one of the main factors affecting rice production in order to attain optimum yield and to be able to feed the millions of Filipinos in the country, particularly in Region 12. Farmers' awareness of and resilience to climate change will be crucial in achieving one of the Sustainable Goals: ending world hunger.

In addition, the study of Raj and Garlapati (2020) claimed that there is a high need to prevent the agriculture sector from being prey to climate change as it intensifies threats like hunger, malnutrition, diseases, and poverty, thus affecting the world's progress. They added that Agriculture is the most vulnerable sector affected by climate change as it is highly dependent on local climatic parameters, such as rainfall, temperature, and soil health, yet the primary cause of climate change. They also emphasized that it is time for agriculture to be "climate-smart" to sustainably achieve productivity and incomes, reduce greenhouse emissions wherever possible, and be resilient to climate change. Climate-smart agriculture (CSA) is an integrated approach that can address several challenges interlinked with climate change.

Another challenge in the agriculture sector, particularly in the rice industry, is Rice Importation. The Philippines was the world's top rice importer in 2023, with an anticipated more than 3 million metric tons of imports (MMT) to augment its 13.43 MMT tons of domestic production. In 2023, the Philippines' import volume more than doubled that of Indonesia, the second-biggest importer in ASEAN (Congressional Policy and Budget Research Department, 2024). The Bureau of Plant Industry (BPI) reported that 3,607,038.495 metric tons of rice entered the nation in 2023. (BPI- NPQSD, 2024). On the other hand, the Economic Research of the United States Department of Agriculture (USDA) outlined an estimated 3.8 million metric tons of rice imports for the Philippines in 2024.

Hence, this study explored how climate-smart rice production and technologies can address the challenges of Climate Change and Rice Importation in Philippine Agriculture and how these practices and technologies could help increase rice production to suffice the nation's need to feed its population while adapting to the changing environment.

2.0 Methodology

2.1 Research Design

The study utilized the Sequential Research Method which is characterized by an initial qualitative phase of data collection and analysis, followed by a phase of quantitative data collection and analysis, with a final phase of integration or linking of data from the two separate strands of data (Berman 2017)

2.2 Research Participants

The total population is 2,628. Using Slovin’s Formula, with 7% margin of error and 93% confidence interval, the recommended minimum number of samples is 189 farmer-respondents. The research study’s population includes rice farmers from the lead cluster of the top 3 major rice-producing municipalities of South Cotabato. Key Informant Interviews (KII) with other stakeholders were conducted with the Local Farmer Technicians (LFTs), Agricultural Technicians, and the Municipal Agriculturists of each concerned municipality to gather data and information on the implementation and the factors impeding the adoption of climate-smart rice production practices and technologies

2.3 Research Instrument

This study used a validated questionnaire to collect primary data. Paper-based survey questionnaires were deployed to determine the level of adoption of climate-smart rice production practices and technologies among the farmer respondents. It also determined the factors that impede and encourage the respondents’ adoption.

For the qualitative method, a validated interview guide was utilized to determine the challenges in the adoption, the potential solutions, and the recommendations for promoting climate-smart rice production practices and technologies.

2.4 Data Gathering Procedure
This study used specific steps to ensure the efficient conduct of the research. The researcher requested permission for ethical approval from the Ethics Committee of Mindanao State University, General Santos City Campus. After the ethical clearance was released, the researcher sent a letter request to the concerned municipalities through the Office of Municipal Agriculturists and asked permission to allow the researcher to visit the area, to conduct the survey and the interview.

2.5 Ethical Considerations
This research followed ethical guidelines provided by Mindanao State University to ensure ethical research practices. Preserving the privacy, dignity, and overall well-being of the participating farmers was given first importance in this study. Informed consent procedures were followed to guarantee that every respondent gave their consent voluntarily. This involved clearly explaining the research objectives, data collection methods, potential risks and benefits, and the right to withdraw from the study at any time.

Measures were taken to ensure that every bit of information collected remained private. As part of this process, any personal information that might be used to identify particular respondents was disclosed. No information was shared without the participants' prior consent. Steps were taken to minimize any potential harm. The research employed appropriate methodological approaches to address the specific research questions and contribute meaningfully to the existing body of scientific knowledge. Transparency was maintained throughout the research process, ensuring the accuracy and reliability of the data collected.

3.0 Results and Discussion
3.1 Adoption of Climate-smart Rice Production Practices and Technologies

Table 1. Frequency distribution of adoption of climate-smart rice production practices and technologies

Variable	Never	Rarely	Sometimes	Often	Always
Cultivation of high-yielding varieties	151	3	29	0	6
Minimum Tillage/Direct Seeding	2	4	5	17	161
Crop Rotation	161	4	19	1	4
Rainwater Catchment Facility	189	0	0	0	0
AWD	65	1	17	5	101
IPM/Synchronous Planting	47	1	0	0	141
Nutrient Management/Soil Analysis	189	0	0	0	0
RCM	189	0	0	0	0

As shown in Table 1, eighty-five percent (85%) or 161 respondents said that they always practice direct seeding, 1% admitted that they never use the practice on their farm, and the remaining 14% practiced direct seeding infrequently. The high adoption of direct seeding is linked to the use of inbred rice varieties. Inbred rice variety seeds are typically cheaper than hybrid rice. On the other hand, there was a slight difference between the level of adoption and non-adoption of AWD among the respondents. The data shown in Table 1 shows that 53% of the respondents have adopted the AWD technique while 34% have never used it on their farms. However, there were some who sometimes and rarely used the said technology. AWD was commonly practiced by the respondents because they belonged to a major cluster of each municipality. The release of the water to irrigate their fields was scheduled, which enabled them to practice AWD technology.

Synchronous planting was another farm practice widely adopted by the respondents. 74% of the respondents said that they adopted synchronous planting. NIA's scheduled release of irrigation water to farming communities contributed to the adoption of this IPM technique. Table 1 also depicts that a mere 3% of the participants utilized high-yielding rice varieties, whilst the remaining 80% did not adopt this method. However, 17% have used the aforementioned method on occasion. It is more likely that the respondents did not use this kind of technology. Unlike direct seeding, synchronous planting, and AWD, which the respondents generally accepted, it was also observed that Crop Rotation, Rainwater Catchment Facility and RCM were not likely adopted. The reason for not adopting rainwater catchment facilities was that the respondents were from each municipality's lead cluster and relied on NIA for irrigation water for their crops. NIA, however, used a diversion dam rather than a small water impounding project.

Overall, Table 2 shows that only 3 of climate-smart rice production practices and technologies were adopted by the respondents. Among these practices and technologies were Direct Seeding, Alternate Wetting and Drying and Synchronous Planting. Generally, the adoption of climate-smart production practices and technologies has a grand mean of 2.24, which is described as “Rarely." This implies that the respondents did not fully adopt climate-smart production practices and technologies; only a few practices and technologies were adopted by the respondents.

Table 2. Descriptive statistics of the extent of the adoption of climate-smart rice production practices and technologies

Indicators	Mean	Interpretation
Cultivation of high-yielding rice varieties	1.5	Never
Minimum tillage and direct seeding	4.8	Always
Crop Rotation	1.3	Never
Use of Rainwater Catchment Facility	1.0	Never
Alternate Wetting and Drying	3.4	Sometimes
IPM/Synchronous Planting	4.0	Often
Nutrient Management	1.0	Never
Precision Farming (Rice Crop Manager)	1.0	Never
Grand Mean	**2.24**	**Rarely**

3.2 Profitability of Adopting Climate-Smart Rice Production and Technologies

Table 3. comparative cost and return analysis figure for 1-hectare rice field

Particular	Farmer’s Practice	With Technology
Seeds	7,200.00	10,000.00
Fertilizers	16,000.00	24,000.00
Pesticides	5,000.00	4,000.00
Transplanting		12,000.00
Land Preparation	5,800.00	5,800.00
Harvesting	8,000.00	8,000.00
Postharvest (drying and hauling)	3,000.00	4,700.00
Total Cost of Production	45,000.00	68,500.00
Gross Income	90,620.00	149,500.00
Net Income	45,620.00	81,000.00
Return on Investment (%)	101.38	118.25
Cost to Produce 1 kg (PhP/Kg)	11.42	10.54
Break-even yield	1,956.52	2,978.26
Break-even price	11.42	10.54

As presented in Table 3, using hybrid rice varieties is more costly for farmers. Its variety costs 52% more than the inbred varieties. Also, respondents tend to apply higher fertilizer rates when using high-yielding varieties than inbred. With crop rotation and synchronous planting, pesticide application is due to reduced pest incidence. Crop rotation breaking the rice cycle with other crops effectively reduces insect pests, especially those with extended life cycles, a limited host range, and a limited ability to disperse. Removing the pests' food source and reversing their population increase are achieved by rotating rice with a crop other than rice (Islam, 2001)

Hybrid rice varieties yield higher than inbred varieties. Climate-smart rice production practices increase gross income by 65% compared to non-adopting farms, indicating increased crop yield. Farmers' practices have a 34% advantage in lower production costs due to direct seeding and fewer fertilizers. Despite higher costs, adopting climate-smart rice technologies boosts net income by 78%. Overall, the adoption of climate-smart rice production practices, particularly hybrid varieties, led to higher gross and net incomes, compared to traditional farming methods. Factors like fertilizer rates and planting methods also affected production costs.

3.3 Sustainability of Adopting of Climate-Smart Rice Production Practices and Technologies

Environmental Sustainability

The respondents in their respective municipalities observed the detrimental effects of climate change on the environment, as shown in Figure 1. Of the 189 respondents, 151 cited crop damage due to climate change, and 141 thought climate change also caused drought or water shortage. Thirty-six (36) respondents, or 19%, observed the occurrence of pests, and 32 respondents observed flooding.

The climate and weather have a significant impact on agriculture. Due to the effects of climate change, particularly rising temperatures and longer dry spells (Singh et al., 2013). Further, the spread of pests and their potential for harm has grown due to climate change, improving durability and enabling insect pests to be more adaptable. Changes in the temperature, movement, and behavior of insect pests are being brought about by altered precipitation patterns, shifting gaseous composition of the atmosphere, and rising temperatures (Shrestha, 2019).

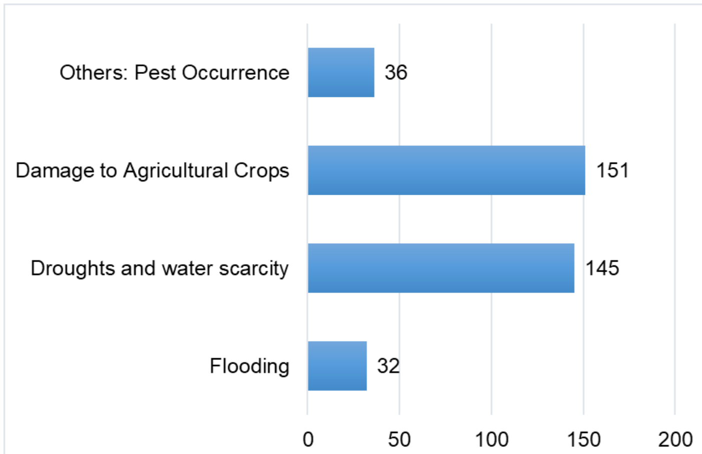

Figure 1. Observed negative impacts of climate change in respondents' respective municipalities

Figure 2 shows the important things that could be done to mitigate these negative impacts caused by climate change. The majority of the respondents cited that AWD could mitigate the negative impacts of climate change, followed by synchronous planting, crop rotation, and the use of high-yielding varieties.

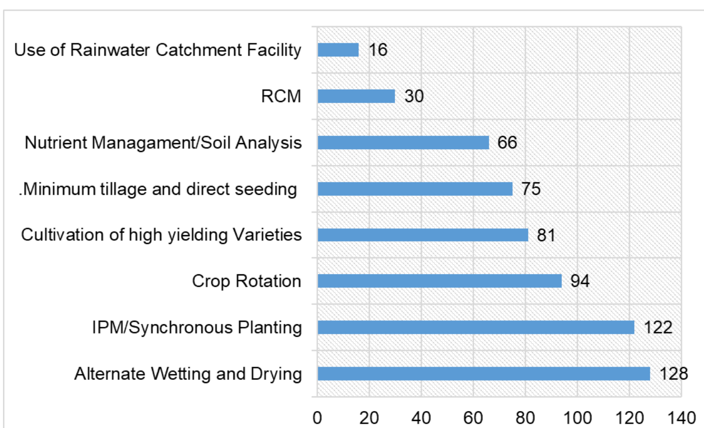

Figure 2. Climate-smart rice production practices and technologies that could mitigate the impact of climate change

The alternate wetting and drying (AWD) irrigation system is a potential substitute for the conventional continuous flooding system of rice production. It is more economical, water-efficient, and environmentally viable than continuous flooding, which requires a large amount of water input and poses a severe threat to the ecosystem due to the emission of greenhouse gases (GHGs) and the accumulation of heavy metals. It can lower the overall water inputs (25–70%) and CH4 emissions (11–95%) and restrict the accumulation of As (13–90%) and Hg (5–90%) in rice grains (Ishfaq et al., 2020).

Synchronous planting, where planting times of neighboring fields are not staggered beyond an interval of 3 to 4 weeks, is one of the IPM approaches that prevent the high population levels of insect pests that cause great losses in farm communities. Staggered planting extends the progressive availability of the host plant; it increases the likelihood that rice pests will survive the entire year. (Islam, 2001). This method potentially results in efficient water distribution. Water allocation can be optimized when all fields require water at similar times, minimizing waste and ensuring all farmers have access during the vital growth stage of the crop. Synchronous planting after a fallow or rest period enables efficient use of irrigation water and avoids overlapping incidences of insect pest and disease populations, thus preventing yield loss (Philrice, 2022). If incidences of pests and diseases are low, excessive use of pesticides can be avoided. Thus, there will be no negative effects on the soil health. Crop Rotation is another way of preventing the spread of pests, weeds, and diseases where the inclusion of breaking phases decreases its population (Ouda et al., 2018).

Using some high-yielding varieties lowers water consumption and greenhouse gas emissions (Myrteza, 2012). Hybrid varieties have increased vigor that can compete with weeds and increased resistance to pests and diseases (IRRI, 2018). Inbred varieties, which are often used by farmers, also have promising yields. Though these varieties do not exceed the performance of hybrids in terms of yield, they can withstand extreme weather conditions. Farmers may grow NSIC Rc 194 (Submarino 1), a cultivar that can withstand up to 14 days of submersion in water while in the vegetative phase. PSB Rc 68 is water-resistant as well. Even though the rainy season is approaching, several provinces in the nation are still impacted by the prolonged El Niño. Farmers may select drought-tolerant varieties, such as PSB Rc 10, Rc 14, NSIC Rc 192, and Rc 222, in places where water is limited or irrigation is delayed (PhilRice, 2019).

Table 4 depicts that direct seeding has become the dominant practice in South Cotabato's rice production, favored for its lower labor cost. Direct seeding promotes reduced tillage, improves soil health, and boosts soil structure and organic matter content (Farooq et al., 2011). This leads to healthier soil and increased resilience to drought.

Table 4. Current practices and technologies used in the community to manage natural resources and environmental issues

Variable	Yes	No	Total	% Yes	% No
Minimum Tillage/ Direct Seeding	137	52	189	72.49	27.51
Alternate Wetting and Drying	126	63	189	66.67	33.33
Integrated Pest Management	120	69	189	63.49	36.51
Cultivation of high yielding Varieties	104	85	189	55.03	44.97
Crop Rotation	81	108	189	42.86	57.14
Rice Crop Manager	21	168	189	11.11	88.89
Nutrient Management/Soil Analysis	19	170	189	10.05	89.95

Initiatives that promote climate-smart rice production practices within farming communities influenced farmers to use the techniques. The adoption of climate-smart rice production technologies promotes more sustainable rice production. These practices and technologies lessen the environmental footprint of rice cultivation while ensuring continued production to meet food demands

Social Sustainability

This section presents the level of social sustainability of climate-smart rice production practices and technologies and how these practices and technologies meet the needs of the community, change the behavior of respondents to achieve bio-physical environmental goals, and the acceptance of these practices and technologies by the community (Vallance et. al, 2011).

Figure 3 shows that the respondents are highly aware of climate-smart rice production. 137 respondents, or 72%, acknowledged that they were familiar with the concept, and the majority learned this from the extension services. As shown in Figure 4, a total of 96 respondents, or 50% of them, were motivated to adopt climate-smart rice production practices and technology because such practices boosted yield; 39% of respondents, or 73 of them, have done so to increase income. A significant number of respondents (88) were urged to adopt it since it is the community's practice.

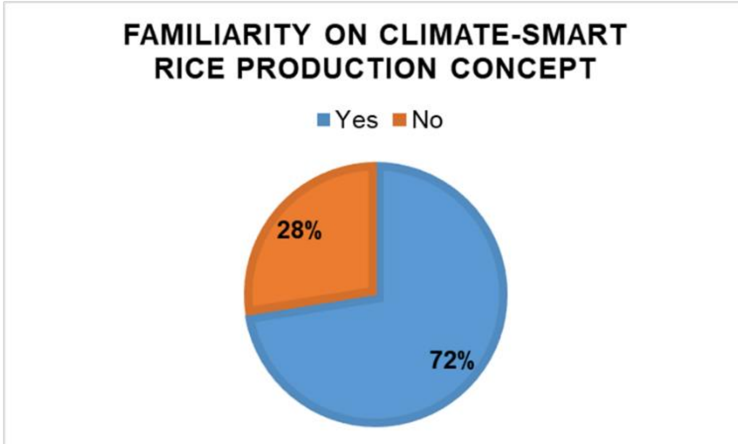

Figure 3. Comparative Figure on the familiarity of respondents with the concept of climate-smart rice production

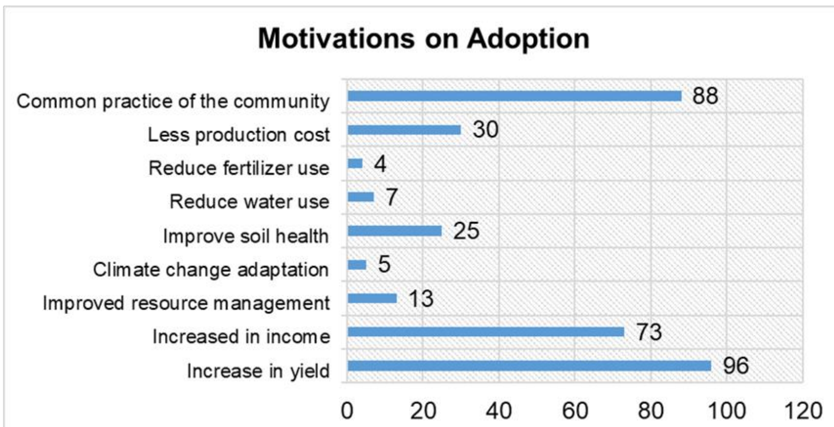

Figure 4. Motivations of respondents in adopting climate-smart rice production practices and technologies

While farmers see potential benefits from climate-smart rice practices, like increased yield and income, there are significant hurdles to widespread adoption. Figure 5 depicts that a key challenge is the lack of knowledge among farmers, particularly smallholders, regarding the advantages and implementation details of these practices. Limited access to information due to language barriers, poor internet, or weak extension services further complicates this issue. Even interested farmers may struggle to find the specifics needed to put these methods into action. Additionally, financial constraints due to high initial costs, concerns about the effectiveness of the practices, and limited access to financing all act as barriers to adoption. Finally, a lack of support from institutions or extension services can further discourage farmers from implementing climate-smart rice production methods.

Climate-smart rice production practices and technologies like hybrid seeds, inorganic fertilizers, and even establishing a Small Water Impounding Project (SWIP) often require higher upfront costs than traditional methods (see Table 2). Farmers also cited that these practices, especially the use of hybrid varieties, require labor for transplanting. This method incurs additional labor costs, unlike the direct seeding method. Higher production costs can be a significant financial burden for small and medium-sized rice farmers with limited financial capacity. Farmers were also reluctant to adopt new practices and technologies because many farmers prioritize immediate production and income security. Farmers rely on dependable results to make a living from farming. Their primary concern is increasing or even maintaining their yield, if new practices or technology are introduced, farmers are likely to be cautious; they cannot afford to sacrifice their harvest for an uncertain future benefit.

Since the adoption of climate-smart rice production practices and technologies requires higher costs, and most farmers, especially small-medium rice producers, have limited financial resources, they need access to financing to help them acquire start-up capital to adopt the technologies. Government support such as incentives, subsidies, and financial assistance programs can also help to offset the costs that may be incurred in the adoption of these practices and technologies.

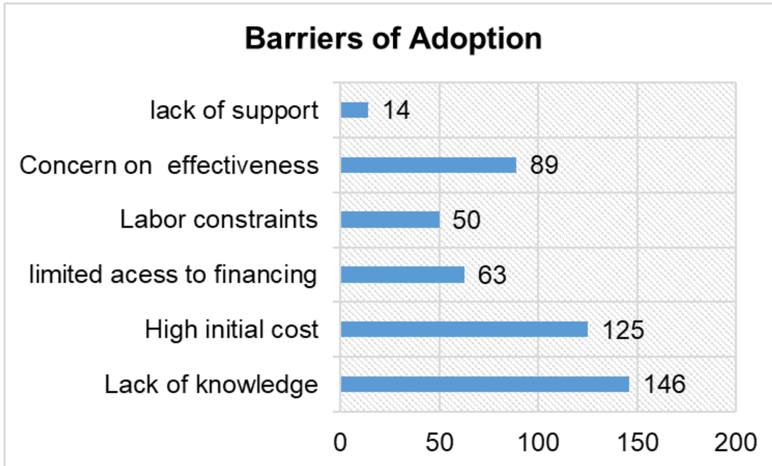

Figure 5. Barriers to the adoption of climate-smart rice production practices and technologies

Figure 6 depicts the perceived support or assistance needed by the respondents/community to be encouraged to adopt climate-smart rice production practices and technologies. One hundred fifty-one (151), or most respondents, said that "More Training and Education Programs" enable farmers to adopt climate-smart production practices and technologies. This implies that through intensive information dissemination and training on the advantages of these practices and technologies, farmers will be encouraged to adopt them. One hundred seven (107) respondents thought that "Financial Incentives" would be helpful for farmers and make them adopt the said practices and technologies. On the other hand, 94 and 80 respondents believed that "Improved Access to technology and inputs" and the establishment of "Community-based demonstration projects" would enable them to adopt the said practices and technologies. "Strengthening farmer associations and cooperatives" and "Providing marketing opportunities" were also listed by 63 and 42 respondents, respectively. These data show that farmers' acceptance and willingness to adopt climate-smart rice production practices and technologies is evident. Increased government and organizational support for rice farmers, through initiatives like education, financial assistance, and access to new technologies, can encourage wider adoption of these improved practices.

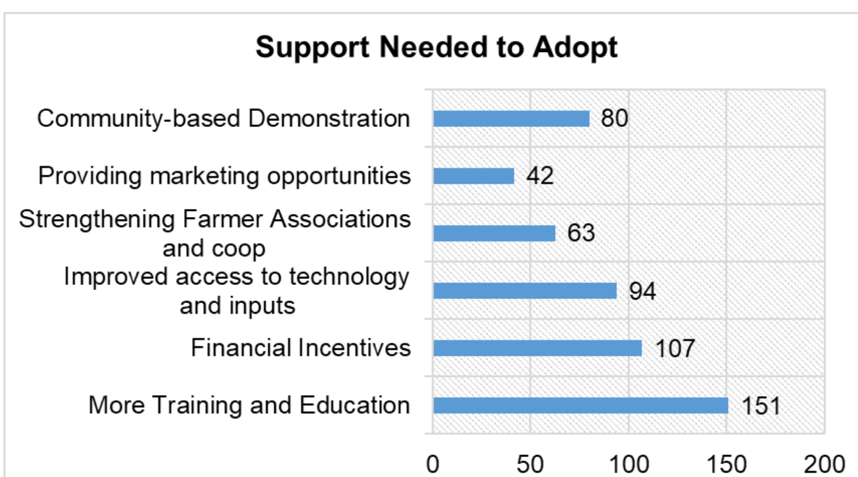

Figure 6. Support needed by the respondents to adopt climate-smart rice production practices and technologies

The adoption of climate-smart rice production practices and technologies has empowered and promoted the development of the farming communities of Norala, Sto. Nino, and Banga, South Cotabato. Rather than posing threats, these innovative practices and technologies have motivated farmers to enhance their yields and significantly increase their income levels.

Economic Sustainability

Table 5. Respondents' perspective on the result of adopting climate-smart rice production practices

Variable	**Yes**	**No**	**Uncertain**	**% Yes**	**% No**	**% Uncertain**
Increase in yield	153	7	29	80.95	3.70	15.34
Increase production Cost	50	102	37	26.46	53.97	19.58
Increased Profit margin	101	31	57	53.44	16.40	30.16
Increased market access	40	85	64	21.16	44.97	33.86

The core requirement of sustainability is that current economic activities should not result in an excessive burden on future generations (Foy, 1990). Table 5 shows that 153 (81%) respondents believed that adopting climate-smart rice production practices and technology had improved their yield. However, 7 (4%) respondents thought there had been no significant change in yield from the practices, and 29 (15%) respondents were uncertain. Among the respondents, 50, or 26%, believed that the said practices and technologies had increased their production costs, 102 respondents, or 54%, observed that their production costs had not increased, and 37 respondents, or 20%, were unsure. In terms of the profit margin, 101 (53%) respondents thought it had increased through the adoption of climate-smart rice production practices and technologies, 31 (16%) respondents disagreed, and 57 (30%) respondents were uncertain. Likewise, 40 (21%) respondents believed that the use of climate-smart rice production practices and technologies had increased market access, while 85 (45%) respondents disagreed, and 64 (34%) respondents were uncertain.

Compared to their prior farm practices, most respondents believed that their yield had increased with the introduction of climate-smart rice production practices and technologies. The majority of respondents claimed that the said practices and technologies had not increased their production costs, even though few would agree that it had. The said increase in production costs may have been caused by the cultivation of hybrid varieties, which require a higher fertilization rate and higher labor costs for transplanting. Most of the respondents have also concurred that the adoption of climate-smart production practices and technologies has increased their profit margin. The cultivation of high-yielding varieties ultimately caused higher yields and thus incurred higher income.

3.4 Presentation and Analysis of Qualitative Data

Figure 7 illustrates how the abovementioned themes are interconnected. Each theme played a crucial role in implementing climate-smart production practices and technologies that address challenges in rice production and gear toward rice production efficiency and agricultural sustainability.

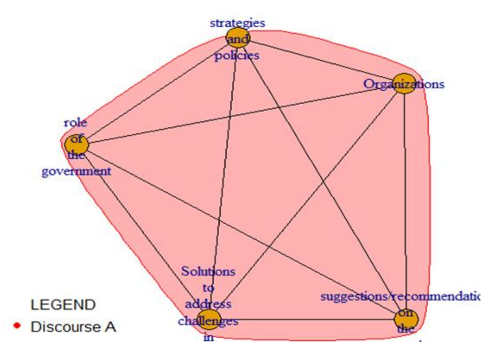

Figure 7. Plotting of thematic codes

The “Role of the Government” refers to the initiatives and programs that the government is expected by the key informants to carry out for the efficient implementation and adoption of climate-smart production practices and technologies. “Organizations” are local organizations or Non-government Organizations (NGOs) that facilitate and support the community and enable them to adopt climate-smart rice production practices and technologies. These organizations support and encourage the rice farmers in the community to adopt such practices and technologies. “Suggestions and Recommendations” are the initiatives and programs the key informants perceive to be effective for rice farmers in the community to adopt climate-smart production practices and technologies. “Strategies and Policies” are policies and strategies the key informants thought would lead to adopting climate-smart rice practices and technologies. “Solutions to Address Challenges in Rice Production” are the actions to address the issues and challenges in rice production.

Based on the qualitative data gathered private and public partnerships in promoting climate-smart production practices and technologies are crucial in the adoption and implementation, especially the role of the government in promoting these practices and technologies. To encourage rice farmers to adopt these practices and technologies, the respondents suggested and recommended Intensive Information Dissemination, Reward and Incentive system, Conduct of Needs Assessment, Subsidy and Financial Assistance, and Establishment of community-based demonstration projects during the key informant interview.

To address the factors that impeded the adoption and implementation, policy on imposing the adoption of climate-smart production practices and technologies, especially synchronous planting should be formulated. Imposing of fines and sanctions on farmers who will not follow the climate-smart rice production practices and technologies and the policy on "RED FLAGGING" which means no planting when the red flag is on to promote synchronous planting were among the various strategies and policies recommended by the respondents.

According to the study conducted by Sanogo et. al (2023) the key barriers to effective adoption of Climate-smart Agricultural (CSA) practices included limited input availability, lack of control over technologies, insufficient labor availability, insufficient availability and high cost of seedlings, lack of information on developed technologies, and limited land access for women and youth. In another study by Zakaria et. al in 2020, revealed that the intensity of farmers’ adoption of climate-smart agricultural technologies is positively influenced by farmers’ experience in rice cultivation, access to mass media, training, and perceived decrease in the amount of rainfall.

4.0 Conclusion

The influence of the farmers’ association and initiatives of various stakeholders on promoting climate-smart rice production practices and technologies are crucial in the adoption of a single farmer. Community practice is one reason for the adoption of the farmers, aside from the increase in yield and income as well as lower production costs. Though results revealed that farmer-respondents are familiar with climate-smart rice production practices, they still need a deeper knowledge of its importance and advantage in agriculture. Activities and programs that promote awareness of these technologies will still be helpful to rice farmers. Also, according to their demographic profile, most respondents are over 60 years old. Older farmers often have more experience and knowledge about their land and local conditions. This experience can be valuable in adapting climate-smart practices to their specific needs. However, many farmers—especially the older ones—may have deep ties to customs handed down through the ages. Even if the new techniques provide long-term advantages, they might be less open to altering their well-established habits.

While farmers reported increased yields and income with the adoption of climate-smart rice production practices and technologies, a lack of baseline data makes it difficult to definitively assess their profitability. Despite this, the positive impact on the livelihoods of farmers who adopted these practices and technologies hold promise for the community. Increased government support, including training programs, financial assistance, and community demonstration projects, can address farmer resistance to climate-smart rice production practices and technologies. By providing farmers with the knowledge, resources, and ability to witness the effectiveness firsthand, these initiatives can encourage wider adoption. Farmers themselves have indicated a willingness to embrace these practices when more when equipped with the necessary support. Climate-smart rice production offers a sustainable solution for rice farmers. It empowers them to achieve higher yields and income while safeguarding the environment for future generations.

5.0 Contributions of Authors

Ma. Rosa Prada Allera. – encoding, data analysis and interpretation, writing.
Leonard Villanueva Flores. – editing, supervising, recommendation

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7.0 Conflict of Interests

All authors declare that they have no conflicts of interest.

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