International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 8, 2025
https://theaspd.com/index.php

"Salome" As Farmers' Effort To Face Climate Change In South Central Timor

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Abstract
Most farmers in South Central Timor reside in mountainous regions and engage in agricultural activities. Agriculture is the primary driver of the community's economy and is essential for supporting farmers' livelihoods; however, improvements are necessary to address the challenges of uncertain climate change conditions. Climate instability is the primary factor contributing to challenges in farmers' livelihoods, which poses risks to economic resilience and the sustainability of agricultural regeneration. This study investigates the agricultural practices employed by farmers in South Central Timor in response to uncertain climate conditions. The qualitative approach employs case study methodology to elucidate the characteristics of the incident. The data collection process is conducted via interviews. Informants for interviews were chosen using purposive sampling techniques, which involve intentionally selecting participants based on specific criteria aligned with the research objectives. The interviews were subsequently analyzed utilizing QDA Miner 6 software. The findings indicate that farmers primarily respond to climate change through alterations in cropping patterns and diversification of income sources. This procedure is referred to as Salome. Farmers engage in Salome to generate income from agriculture despite the challenges posed by climate change. This study is confined to the practices employed by farmers in response to climate change. The social, cultural, and economic influences that underpin their practices in addressing climate change remain to be elucidated; thus, additional research is necessary to achieve comprehensive insights into the resilience of farmers' livelihoods in South Central Timor.

Keywords: *Salome, weather, farmer, climate, poverty*

INTRODUCTION

Climate change is a global issue that significantly impacts the sustainability of agriculture, especially in developing countries where farming systems rely heavily on traditional practices. Extreme weather events—such as droughts, floods, and shifting planting seasons—disrupt food systems and increase the vulnerability of smallholder farmers worldwide. According to various global reports, these farmers are often the most affected due to their limited access to climate information, technology, and financial resources.

In the Indonesian context, agriculture remains a central pillar of rural livelihoods. However, in eastern regions such as East Nusa Tenggara, farmers face additional challenges due to erratic rainfall, poor irrigation infrastructure, and limited institutional support. National statistics have shown stagnant or declining agricultural productivity in many parts of eastern Indonesia, despite ongoing policy interventions.

At the local level, South Central Timor in East Nusa Tenggara is a predominantly rural area characterized by dry plains and uneven rainfall distribution. The population is largely dependent on agriculture, plantations, and livestock. However, research shows that farming is not the sole livelihood activity. Farmers in South Central Timor often engage in supplementary activities such as livestock rearing to cope with economic hardship, which reflects their vulnerability to systemic poverty (Meka & Nahak, 2022). Their poverty is a result of limited access to technology, markets, and capital, and this condition is further exacerbated by the growing instability of the climate.

The effects of climate instability in South Central Timor are severe. Farmers face unpredictable rainfall, extreme temperatures, increased pest and disease outbreaks, and soil erosion that damages fertile land. Studies in other regions such as Hubei, Yunnan, and Sub-Saharan Africa show similar patterns where extreme weather increases the poverty vulnerability of farming households and threatens food, nutrition, and income security (Chen et al., 2022; Madamombe et al., 2024). These findings mirror the challenges currently faced by farmers in South Central Timor.

Despite these difficulties, local communities have developed traditional knowledge systems to adapt. One such system is Salome, a local planting technique that involves planting three types of seeds—corn, peanuts, and

pumpkin—in a single hole. Corn provides structural support for pumpkin vines, peanuts fix nitrogen into the soil, and all three crops optimize land use and improve food availability. This system represents not just a planting method but a form of ecological resilience passed down through generations (Levis et al., 2017; Raharjo & Delang, 2020).

Salome has become a vital climate adaptation strategy in the face of growing environmental pressures. For rural households in South Central Timor, livelihood refers to the total income or resources used to meet daily needs. If agricultural income declines, household livelihoods are directly threatened. This study aims to explore how farmers in South Central Timor use innovative, traditional strategies like Salome to maintain their household livelihoods amidst climate change. These intelligent practices offer important lessons for household resilience in other regions facing similar environmental pressures.

This research presents several key innovations. First, it highlights a locally-rooted climate adaptation strategy (Salome) that remains underexplored in the academic literature. Second, it provides a micro-level analysis of climate impacts on farmer livelihoods—an approach that contrasts with the more common macro-level, statistical studies. Third, the study offers contextual insights that can inform other rural communities and development stakeholders on the importance of indigenous knowledge in building sustainable and resilient farming systems. By bringing attention to these locally driven practices, the study contributes both empirical evidence and practical recommendations for climate-resilient development, especially in areas where formal support systems are limited.

MATERIALS AND METHODS

The research method used is a qualitative model with a case study approach because the author can explore and understand certain phenomena or events in a real-life context through an in-depth analysis of one or more specific cases (Morse & McEvoy, 2014). The case study approach allows researchers to investigate a case by considering various factors that influence it, such as the social, cultural, political, and historical environment and the dynamics that occur in that context (Collins & Stockton, 2018; Panke, 2024).

The reason for choosing Tublopo, Hane, Nule, Biloto, Oebobo, Nusa, Kesetnana and Haumenibaki Villages in South Central Timor Regency, East Nusa Tenggara Province, the researcher refers to the number of active farmers in eight villages, the average number of active farmers from the five villages reaches 72 percent of the village population. The characteristics based on the number of active farmers make the author more interested in exploring the livelihood resilience pattern of farmers in the location.

This qualitative study uses the interview method to study informants' experiences (Maxwell & Reybold, 2015). In determining informants, the author uses "purposive sampling is a research method with deliberate sampling according to the provisions" (Grant et al., 2019). The criteria for informants considered appropriate by the author to be studied in this study include 1) People whose profession is a farmer; 2) People who work as farm labourers; 3) homemakers; 4) community and traditional leaders. Twenty people determined the number of informants based on the criteria. In-depth interviews were conducted with key informants, such as farmers, daily farm labourers, contract farm labourers, homemakers and village officials. The author determined the informants using the criteria mentioned above. The authors identified informants based on the requirements mentioned above. All informants gave verbal consent to be interviewed. Informants agreed to collect and store the interview results in written form, which was conducted during the interview. This study has received ethical permission from the research and community service institute of Nusa Cendana University through letter number 034/E5/PG.02.00/PL.Batch2/2024.

In the data processing process, researchers used QDA Miner 6 software developed by Provalis Research to analyze interview transcripts, focus groups, and documents (Ikonne, 2023). The function of utilizing this software is to help researchers organize, code, annotate, retrieve, and analyze document collections, while for data analysis, the author applies a data analysis pattern consisting of four stages, namely: category collection, direct interpretation; researchers form patterns and look for equivalence between two or more categories, and finally researchers develop naturalistic generalizations (Lochmiller, 2021). The advantages of the method used are the sensitivity to see every symptom in the research object (social situation), the ability to explore data sources through in-depth interviews, and the communication of research results to the broader community.

RESULTS

The data covers three main categories: climate change adaptation, government policies and support, and social and economic resilience. Each category has several sub-aspects measured by the number and percentage of responses.

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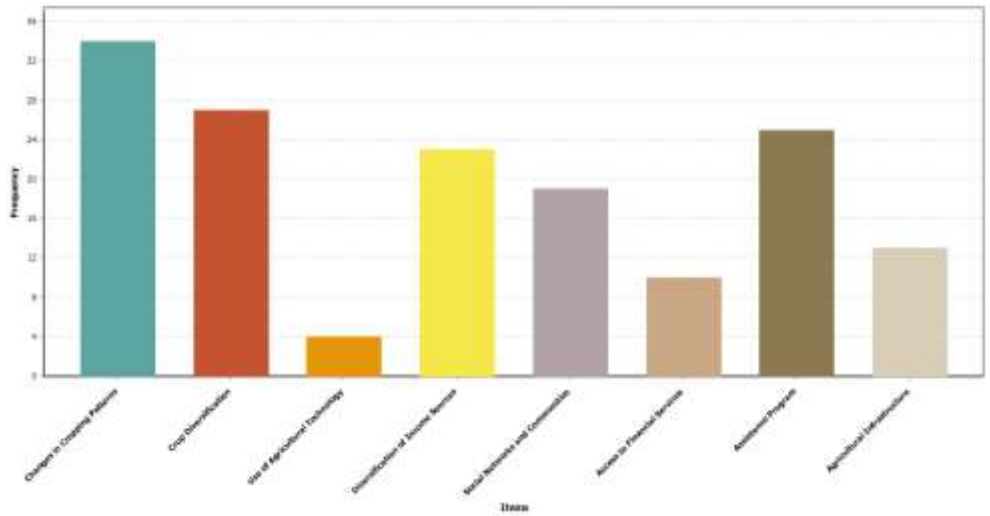

Figure 1. Percentage of words that make up the code
Source: Field Data Processing With QDA Miner v6.0.11 Software

Changing cropping patterns was the most widely adopted adaptation strategy, with 34 reports representing 21.9% of the total data. This reflects a high awareness of how to adjust cropping patterns to address climate change. Crop diversification strategies were also well accepted, with 27 reports or 17.4%. This suggests that many choose to grow various crops to reduce the risk of crop failure due to extreme weather. The use of agricultural technology, such as modern tools or data-driven technology to manage farms, was reported by only a few, with only 2.6% of respondents choosing this strategy, which may reflect limited access to or understanding of such technology.

Infrastructure that supports farming, such as irrigation or storage facilities, was reported by 13 (8.4%) as necessary in supporting climate change adaptation. Government assistance programs, such as subsidies or direct cash transfers, are a common form of support for farmers and communities. 16.1% of respondents reported receiving this form of assistance. Access to financial services, such as loans or agricultural insurance, is essential to farmers' economic resilience. However, only 6.5% of respondents reported having access to financial services, indicating gaps in the accessibility of these services. Income diversification strategies were among the most widely used methods to increase economic resilience. 14.8% of respondents reported having diversified their income. Social and community networks play an essential role in supporting climate change adaptation. 12.3% of respondents reported having accessible social networks.

These data suggest that climate change adaptation is being implemented more through strategies directly related to agriculture, such as changing cropping patterns and crop diversification. On the other hand, although government support in aid programs is welcome, agricultural infrastructure still needs to be improved to be more equitable. Regarding social and economic resilience, income diversification and social networks play a significant role, although access to financial services remains limited. The decline in the use of agricultural technology indicates challenges in access to and adoption of more advanced technologies, which need to be a focus to improve efficiency and long-term resilience.

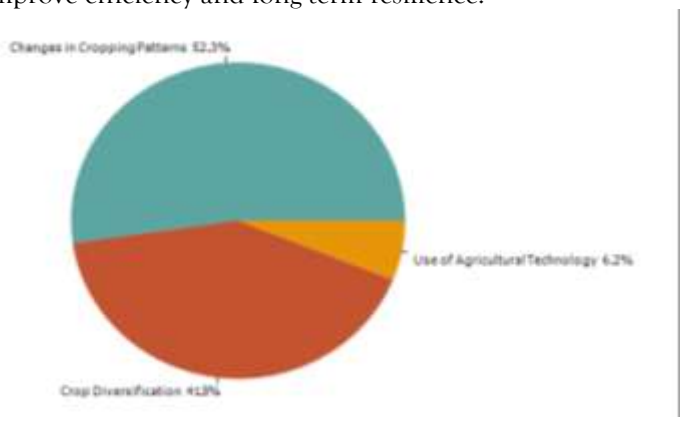

Figure 2. Distribution of codes in the category of adaptation to climate change
Source: Field Data Processing With QDA Miner v6.0.11 Software

Figure 2 shows that 52.3% of the respondents reported changing cropping patterns as an adaptation strategy to climate change. This means that almost one-third of the respondents tried to adjust the types of crops they planted or the timing of their planting in response to climate change (e.g., changes in temperature, rainfall patterns, or extreme weather). 41.5% of the total respondents reported that they implemented crop diversification as an adaptation strategy to climate change. Crop diversification is the practice of growing different types of crops to reduce the risk of loss if one kind of crop fails due to extreme weather or natural disasters associated with climate change. This indicates that many respondents recognize the importance of diversity in their farming patterns to improve food and economic security. 6.2% is a meagre figure, indicating that only a few respondents reported using agricultural technology to adapt to climate change. This may reflect limited access to or knowledge of available farm technologies or even cost issues that may limit the adoption of technology by farmers, especially in less developed areas.

Changing cropping patterns and crop diversification are the adaptation strategies that farmers widely accept and implement. Both methods are widely adopted with high rates of full implementation, indicating that farmers are experiencing direct benefits from changing their crop types or planting times to cope with climate change.

The use of agricultural technology remains very limited, with only 6.2% reporting the use of technology, and even of those, only a tiny number implementing it fully. This could reflect challenges such as cost, lack of training, or limited access to more advanced technology. These data suggest that despite awareness and efforts to adapt to climate change, most respondents prefer approaches directly related to cropping patterns and crop diversity rather than relying on more advanced agricultural technology.

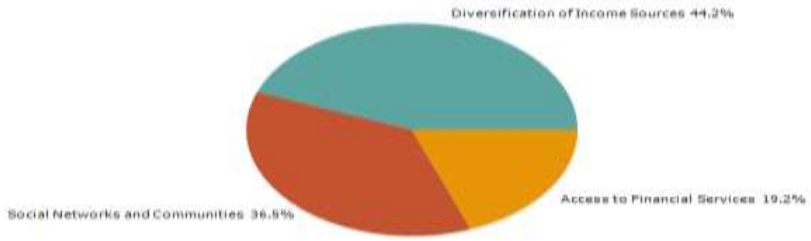

Figure 3. Distribution of codes in the social and economic resilience categories
Source: Field Data Processing With QDA Miner v6.0.11 Software

Figure 3 shows that 44.2% of total respondents reported diversifying their income sources as part of their strategy to increase economic resilience. This diversification may include side businesses, off-farm investments, or developing other skills outside of farming to reduce dependence on a single source of income. This diversification is essential in the face of economic fluctuations or risks posed by climate change that could disrupt primary income. 36.5% of total respondents reported having access to or participating in social and community networks that are important to their social resilience. These social networks may include farmer groups, community organizations, or local communities that provide social support, information, and other essential resources in dealing with climate change and economic challenges. 19.2% of respondents reported having access to financial services, such as loans, agricultural insurance, or other financial products. Access to financial services is essential in increasing economic resilience, as it can help farmers or individuals manage risk, obtain capital for their businesses, or protect themselves from losses due to disasters or climate change.Diversification of Income Sources is a widely implemented strategy, with 95% full implementation, indicating that almost all respondents who chose to diversify their income sources were successful in doing so. This diversification is crucial to reducing dependence on a single source of income and strengthening economic resilience, especially in the face of external risks such as climate change. Social and Community Networks play a critical role in social resilience.

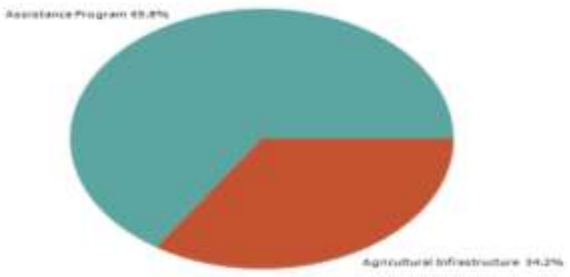

Figure 4. Distribution of codes in the category Government policy and support
Source: Field Data Processing With QDA Miner v6.0.11 Software

Figure 4 shows that 65.8% of the total respondents reported that they received assistance programs from the government as part of their support for their social and economic resilience. These assistance programs can be direct subsidies, cash transfers, or other support aimed at helping farmers or communities affected by climate change or financial crises. 34.2% of the total respondents reported that they had access to or benefited from agricultural infrastructure, which includes physical facilities such as irrigation, agrarian storage, agricultural roads, and other infrastructure that support farm productivity and food security. Good agricultural infrastructure is critical in supporting adaptation to climate change, as it allows farmers to manage their land and agricultural products more efficiently. With 65.8% of respondents reporting assistance, government assistance has covered most needy individuals. However, there is still room to increase the coverage and distribution of this assistance to more expansive areas. Agricultural infrastructure is still an area that requires more attention. However, 34.2 of the respondents reported the existence of supporting agrarian infrastructure. This indicates a gap between areas or individuals who benefit from existing infrastructure and those who do not. The development and improvement of agricultural infrastructure must be a priority to ensure that all farmers, especially those in remote areas, can use it.

The next step is to use the Co-occurrences coding feature, where the occurrence network is a graphical representation of how often codes appear together. This network is commonly used to measure how usually two words appear in a document. The occurrence network allows us to examine several pairs of codes that appear together. To build an occurrence network, each code is represented by a node, an edge, or a link, representing the occurrence between the two variables, as in the following figure.

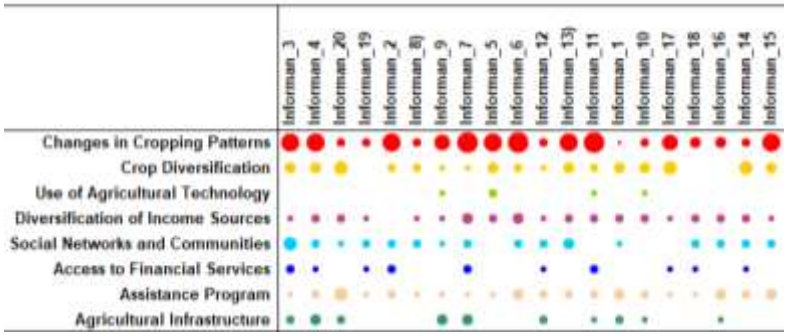

Figure 5. Coding By Variable: Code Frequency: Adaptation to Climate Change, Social and Economic Resilience, Government Policy and Support
Source: Field Data Processing With QDA Miner v6.0.11 Software

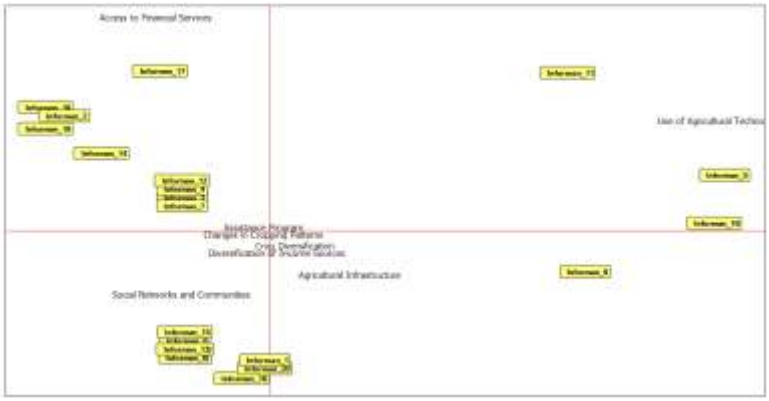

Figure 6. Coding By Variable: Correspondence Analysis: Count: Adaptation to Climate Change, Social and Economic Resilience, Government Policy and Support
Source: Field Data Processing With QDA Miner v6.0.11 Software

The quadrant map shows that farmers' attitudes towards climate change are strongly influenced by network factors and techniques related to crop diversification and income. This suggests that climate change adaptation is essential to farmers' survival intentions. Furthermore, the significance of social networks and community government assistance programs is recognized, as they facilitate farmers' action patterns to adjust cropping patterns and income. This map highlights the importance of a comprehensive strategy that combines cropping pattern changes, crop diversification, income source diversification and community social networks.

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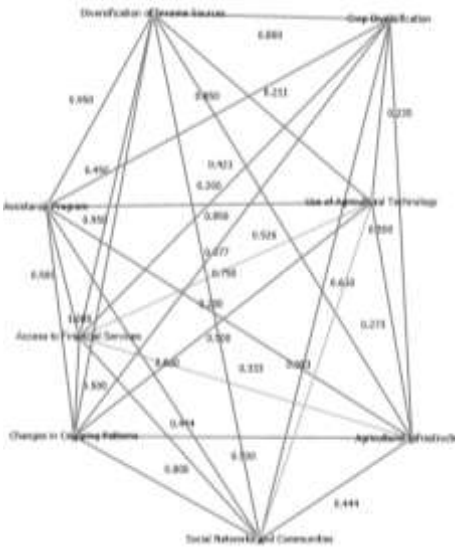

Figure 7. Coding Co-occurrences: Link analysis: adaptation to climate change, social and economic resilience, government policies and support
Source: Field Data Processing with QDA Miner v6.0.11 Software

Figure 7 shows that factors such as changes in cropping patterns, crop diversification, and diversification of income sources are critical in dealing with climate change because of their strong links with various other elements. Changes in cropping patterns are an essential factor linking community social networks, assistance programs, and technology use, indicating that community social networks influence cropping pattern use patterns. The correlation between cropping pattern changes and crop diversification shows that Figure 7 shows that factors such as "cropping pattern changes," "crop diversification," and "income diversification" are critical in coping with climate change because of their strong links with other elements. Cropping pattern changes are essential to connecting community social networks, assistance programs, and technology use, indicating that community social networks influence patterns. The correlation between "cropping pattern changes" and "crop diversification" shows that changes in meeting needs significantly foster alternative farming in the community. These elements are the foundation that supports farmers in coping with climate change. "cropping pattern changes" occupy a central position in the structure of farmer actions. Furthermore, "cropping pattern changes" correlate with income diversification, underscoring the importance of adjusting mindsets and actions in difficult situations. The visualization in Figure 8 shows three patterns of relationships between different segments, focusing on the cropping pattern change code that has a strong relationship with the program support code and income diversification, which can be seen in Figure 8.

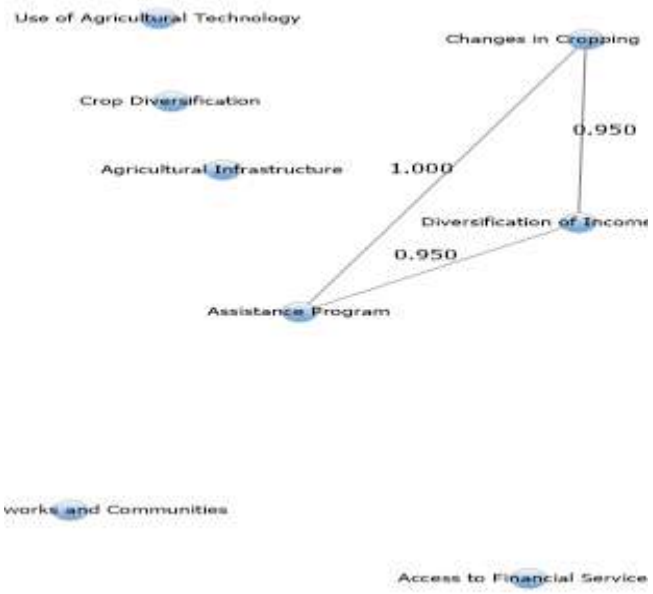

Figure 8. Patterns and relationships between different code segments
Source: Field Data Processing with QDA Miner v6.0.11 Software

DISCUSSION

Farmer's Adaptation to Climate Change in South Central Timor

There are several reasons why climate change adaptation is essential. Climate change affects many aspects of human life, especially sectors that depend on environmental conditions, such as agriculture, health, water resources, and ecosystems. Climate change causes an increase in the frequency and intensity of extreme weather events such as storms, floods, droughts, and heat waves. Kalugin proved in the study "Climate Change Effects on River Flow in Eastern Europe: Arctic Rivers vs. Southern Rivers" that global climate change with a warming of 1.5 to 2°C will have a significant impact on river flow patterns in Eastern Europe, with differences in impacts seen between northern and southern regions (Kalugin, 2023), while Lee highlighted the effects of climate change on food security in China and showed that climate change significantly affects food security, increasing uncertainty and risk (Lee et al., 2024). Human life is directly affected by climate change.

Climate change is causing significant losses across various sectors, especially in the most vulnerable areas. Miller presents research findings from Ghana, highlighting how social inequalities exacerbate disaster vulnerability among urban dwellers. Communities most vulnerable to flooding and extreme weather live in informal settlements or areas lacking infrastructure, such as adequate drainage (Miller et al., 2022). To cope with climate change, communities must adapt. Without adaptation, communities and infrastructure will remain exposed to impacts that can result in economic losses, environmental damage, and death. Similarly, climate change can impact agriculture and food security, affecting seasonal planting patterns and water availability and reducing agricultural productivity. Prolonged droughts or excessive rainfall can lead to crop failures, reducing food supplies (Hu et al., 2023; James et al., 2023). Farmers must adapt by changing the way they grow crops. This includes adopting technologies that address climate challenges, more efficient irrigation, and resilient crop varieties to extreme climates.

Harvest success is highly dependent on stable climate conditions in South Central Timor, as in many lowland areas in Indonesia (Yulianti et al., 2022). They face various problems when the climate is uncertain, which affects their productivity and welfare (Linggarwati & Yamin, 2023; Suliyanto et al., 2024). Specific research results on farmer adaptation in several countries have been published by Usman Alhassan, Anna Ann Dwarka and Aruna Kainyande. In Ethiopia and Nigeria, rural farmers' adaptation decisions were heavily influenced by agricultural extension programs and community social networks (Alhassan & Haruna, 2024); in Guyana, South America, adaptation decisions included planting superior or more resistant crop varieties, changing planting times according to rainfall, collecting water in furrows near plants, using drip irrigation systems and techniques for preparing beds, and using shade houses to mitigate the impacts of climate change (Anna Ann Dwarka et al., 2024), while farmers in Sierra Leone used crop rotation and planting timing as adaptation strategies (Kainyande, 2024). Similarly, farmers in Sub-Saharan Africa diversified cropping patterns, adjusted planting schedules based on traditional weather forecasts, and maintained soil moisture (Legide et al., 2024).

Unpredictable climate conditions, such as shifts in the rainy and dry seasons in South Central Timor, can disrupt farmers' planting patterns. The data processing results, as shown in Figures 2 and 3, show how farmers in South Central Timor adapt, changing planting patterns and diversifying sources of income are the main activities to deal with climate change. By planting various types of crops, farmers can reduce the risk of crop failure due to extreme climates, pests, or diseases specific to crops. Crop diversification makes the agricultural system more resilient to disturbances. Crop diversification provides flexibility in dealing with climate change that can affect weather patterns and soil conditions. By planting various types of crops, farmers in South Central Timor are better prepared to adapt to climate and weather changes.

The implications of adaptation carried out by farmers in South Central Timor affect their social and economic resilience, especially the sustainability of daily livelihoods. Onyekuru showed that adaptation strategies carried out by farmers in West Africa produced the highest profits, with significant average annual net profits (Onyekuru et al., 2024). Nahar also confirmed that farming households in Northern Bangladesh who carried out crop adaptation were more food secure than households with less crop diversification (Nahar et al., 2024). Figures 5 and 6 show how farmers in South Central Timor adapt to climate change by diversifying income sources and social networks. Farmers in South Central Timor rely on more than one type of crop or commodity when facing more significant risks. With crop diversification, they have more income options from various other crops, while the role of social networks in adaptation allows for faster and broader information exchange among farmers. Farmers need to get information about more efficient agricultural practices, climate change, or markets through their social networks in the context of adaptation. The information will help them make better decisions regarding cropping patterns, crop diversification, or resource conservation.

The South Central Timor region's condition on the coast of East Nusa Tenggara, Indonesia, makes it vulnerable to drought. During the dry season, which lasts for a long time, agricultural land experiences drought, damaging crops and reducing soil fertility; plants will lack water, especially for farmers who rely on traditional irrigation. South Central Timor is known for its horticultural products, such as vegetables and fruits. Unpredictable climate, especially temperature fluctuations, can impact these plants' growth (Linggarwati & Yamin, 2023). Temperatures too low or too high can inhibit growth, make plants susceptible to disease, or even fail to bear fruit (Berlilana et al., 2019).

The adaptation carried out by farmers in South Central Timor certainly has its reasons. Farmers have to incur additional costs when the climate is uncertain to cope with these conditions. Before adaptation measures are taken, they must use more fertilizers or pesticides to protect crops from pests and diseases that often appear during climate change. Naveesh also said the same thing happened in India: an integrated land management system that combines crops, trees, and sometimes livestock offers a potential adaptation solution to increase livelihood resilience (Naveesh Y. B. et al., 2023). In addition, farmers in South Central Timor have to buy water or create better irrigation systems to cope with drought. As a result of all these challenges, farmers' income in South Central Timor has decreased significantly, which has affected their livelihood resilience. Low yields or crop failures mean farmers cannot sell their products in sufficient quantities, while production costs remain the same or even increase, affecting their income.

Adaptation carried out has a strong relationship between one indicator and another. Figure 6 shows a strong relationship in adaptation actions during climate change. Actions to change cropping patterns, crop diversification, and agricultural technology are essential instruments and the central axis of adaptation farmers in South Central Timor carry out. It can be seen in Figure 7 that the fulcrum lies in changes in cropping patterns, which are strongly related to agricultural infrastructure and crop diversification. In changing cropping patterns, farmers in South Central Timor choose crop types such as tubers that are appropriate to land conditions, climate, and market needs. When changing cropping patterns, they switch from monoculture to polyculture to reduce the risk of crop failure and increase production yields. Acheampong stated that farming households in Ghana who change cropping patterns are more likely to adopt crop rotation (Acheampong et al., 2023). In contrast to Acheampong's findings, Sedighkia showed different research results that optimizing cropping patterns is not an effective strategy to reduce the economic impact of climate change in the Tajan River Valley, Iran (Sedighkia et al., 2023).

The difference between cropping pattern change and crop diversification for farmers in South Central Timor is clarified by defining indicators. Cropping pattern change refers to the modification or rearrangement of the types of crops grown in a given period on the same land. Farmers focus on how and when a crop grows to increase income. In contrast, crop diversification is the practice of raising more than one type of crop simultaneously or on a single plot to reduce dependence on a single crop in the event of crop failure, the main objective being to increase income. So, the main aim of both concepts for farmers in South Central Timor is income, which impacts livelihoods in times of climate change and unpredictable weather.

Farmers' Livelihood Resilience in South Central Timor

Climate change significantly impacts the social and economic resilience of farmers in South Central Timor, and various actions taken to deal with climate change are very important to ensure the sustainability of their livelihoods and well-being. Figure 1 shows various actions taken by farmers in South Central Timor, climate change adaptation is mostly implemented through strategies directly related to agriculture, such as changes in cropping patterns and crop diversification. Stavros Kalogiannidis suggests that the government should design social protection programs to increase agricultural production, protect the lives of the most vulnerable populations, strengthen their resilience, and achieve well-being (Kalogiannidis et al., 2023). To improve livelihood resilience, South Central Timor farmers must diversify their income sources. The income diversification they do is outside the agricultural sector. Figure 7 is a critical highlight of the diversification of income sources and social networks, a strong relationship pattern related to the livelihood resilience of farmers in South Central Timor.

Diversification actions also help reduce dependence on agricultural products vulnerable to climate change. Figure 3 convinces us that farmers in South Central Timor have less access to financial services for their income diversification activities. This is in contrast to the findings of Alejandra Guzmán Luna, who concluded that farmers in Mexico and Nicaragua diversified by relying on improving agroecology for small farmers as a way to achieve food sovereignty (Guzmán Luna et al., 2022). There are also findings from a study conducted by Tadele Alamneh in Ethiopia, showing the results of livelihood diversification with on-farm activities alone (36.1%), on-

farm plus non-farm (17.5%), on-farm plus off-farm (24.5%), and a combination of on-farm plus non-farm plus off-farm (21.9%) (Alamneh et al., 2023).Agricultural businesses are highly vulnerable to climate fluctuations. Drought, flooding, or unstable rainfall patterns can cause crop failure or decreased production. By having additional sources of income, farmers in South Central Timor can reduce the economic risks caused by climate factors. By diversifying income sources, farmers in South Central Timor can survive during drastic climate change conditions and are considered to strengthen the resilience of their household livelihoods. Theoretically, Chambers and Conway see livelihoods as assets, capabilities, and activities that people use to earn a living; they agree that a livelihood is said to be sustainable when it can cope with and recover from stress and shocks and can maintain or increase its assets (Abdulai et al., 2022). This indicates that farming households in South Central Timor have livelihood capabilities even in uncertain climate conditions and are strongly linked to livelihood strategies and diversification.In difficult times when extreme climate change occurs, the government always tries to provide support and assistance as a stakeholder in farmers' production. Figure 6 shows a strong relationship between agricultural infrastructure and agricultural extension services derived from government assistance while farmers face climate change. However, in reality, this assistance cannot fully help farmers in South Central Timor get out of livelihood threats. Hence, actions such as opening land for tourists to visit, offering farm or fruit garden tours, and making bamboo weaving, ceramics, or traditional textiles become strategies to deal with climate change. Lassa, during his research on several governments in Asia regarding climate change, showed that most governments have a strong view only on emergency food reserves, which are considered to be able to reduce shocks from disasters and climate change and reduce trade disruptions (Lassa et al., 2019). The findings of Yutong Wang, who measured government policy measures on the resilience of smallholder farmers' livelihoods by implementing skills training and subsidies, did not have a significant impact on climate change on the Tibetan Plateau (Wang et al., 2024).The livelihood resilience of farmers in South Central Timor is shaped by their ability to utilize resources and the availability of existing social networks. Crop diversification and changes in cropping patterns are dominant actions to overcome uncertainty in agricultural production. In contrast, diversification of income sources and community social networks are key actions when they enter difficult times due to climate change. The pattern of anticipation of changes in livelihoods carried out by farmers in South Central Timor is a common pattern that other farmers have carried out; Akramkhanov provided information that in Uzbekistan, in diversifying household food crop production, they prioritize the agricultural experience of the head of the household, education level, source of income, number of livestock and land, and proximity to the market as important factors for carrying out diversification actions (Akramkhanov et al., 2023). Meanwhile, Mazrou revealed that farmers in Pakistan's household choices and adoption of livelihood diversification strategies were influenced by age, education level, livestock ownership status, access to credit, extension contacts, and income (Mazrou et al., 2024). The main difference in the diversification of farmers in South Central Timor with farmers in Uzbekistan and Pakistan lies in their socio-economic environment; farmers in South Central Timor do not leave or abandon the agricultural sector as their main instrument of diversification while factors outside agriculture still influence farmers in Uzbekistan and Pakistan and open up opportunities for farmers to leave the agricultural sector when the diversification of their livelihoods is successful.Living in difficult times, such as unpredictable climate change, is difficult for South Central Timor farmers. The desire to survive and protect the household with a decent living continues despite facing difficult situations such as climate change. Their consistency in continuing to work in the agricultural sector is a smart practice for farmers in other areas because the pattern of diversifying livelihoods is significant to maintaining farmer regeneration. Sustainability of livelihoods for farming households that is carried out carefully will make work in the agricultural sector more attractive and sustainable.

Salome as a Pattern of Farmer Household Resilience to Climate Change in South Central Timor

Farmers in South Central Timor face increasingly unpredictable weather patterns, longer dry seasons, and reduced water availability, causing droughts that inhibit plant growth and reduce crop yields, increasing the risk of crop failure (Neo & Ceunfin, 2018). These conditions affect the sustainability of traditional agriculture and increase the vulnerability of food security and livelihoods of farmers in South Central Timor. In dealing with uncertain conditions, farmers in South Central Timor have adaptive patterns that aim to maintain the sustainability of agricultural practices and protect their communities from the negative impacts of climate change (Ngongo et al., 2022). The adaptive patterns implemented will help farmers in the short-term and long-term sustainability and demonstrate resilience in the face of the ongoing climate crisis.

In general, farmers in South Central Timor apply adaptive patterns by switching their crop types from plants that require much water to plants that are more resistant to drought and can survive in less fertile soil, as well as

legumes that can bind nitrogen, helping to maintain soil fertility even in conditions of minimal water (Mohammed et al., 2024).

Farmers in South Central Timor combine plant types and planting patterns with the term "Salome," meaning three different kinds of seeds are given in one planting hole, such as corn, peanuts and pumpkins. As a tall plant, corn supports climbing plants such as pumpkins, thus saving space and maximizing land use, while peanuts will add nitrogen to the soil, which is beneficial for corn and pumpkins. Nitrogen-rich soil helps the growth of other plants without adding chemical fertilizers. The broad leaves of pumpkins can cover the soil, reduce evaporation, maintain soil moisture, and help other plants get enough water. The planting technique farmers use in South Central Timor is an example of polyculture, where different plants are planted together to support each other in their growth process.

Salome has been applied since the ancestors worked their agricultural land, so this planting pattern has become a hereditary habit. Farmers start Salome by preparing the land to carry out farming activities. They do not use chemicals but clean them using agricultural tools such as machetes to clear the land of bushes and agrarian waste. Then, planting is carried out without random lines with an uncertain distance until the plants can be produced and used for family food consumption, and some of the production is sold to increase family income (Fatima & Rambut, 2022).

Farmers who practice the Salome farming system adopt a holistic approach based on local knowledge passed down through generations. This practice offers a range of behaviours and attitudes that contribute directly to food security. Resilience to Climate Variability: The diversity of crops and livestock in the Salome system makes it more resilient to extreme weather events, such as droughts, floods, or irregular rainfall patterns. Farmers do not rely on a single crop, which reduces the risk of food shortages due to crop failure. The types of commodities selected in the Salome planting pattern (based on farmers' consumption patterns) are staple foods consisting of corn, beans and pumpkins. As this planting pattern mixes several commodities in one planting hole, the same is valid for how the cooking is served, similar to this planting pattern. All types of food are mixed and cooked and then served in one container because it is more practical and economical and by ancestral culture. The food consumption pattern followed according to ancestral culture has been going on since ancient times. Hence, it has implications for the types of commodities planted, which are mutualistic symbiosis, meaning mutually beneficial. Namely, corn stalks facilitate the propagation of bean plants so that corn harvest time can also pick beans without a long gap, and the bean harvest can take place after the corn harvest, while pumpkin plants help to reduce the risk of pest attacks (Raharjo & Delang, 2020).

The Salome system promotes self-sufficiency in food production, an essential aspect of food security. At the same time, the system also emphasizes community and cooperation among farmers, where excess produce is often shared with neighbours, ensuring that no one goes without food. In many cases, Salome's farming practices are embedded in the social and cultural fabric of the community. Knowledge about soil fertility, crop management, and weather forecasting is passed down from older generations to younger farmers, ensuring the sustainability and continuity of the farming method. Although the Salome system is rooted in tradition, many farmers are integrating new knowledge and technology to improve Salome practices. For example, they are adopting better seed varieties, organic fertilizers, or new irrigation techniques to increase yields without compromising the sustainability principles of the Salome system.

The food security of farmers who implement the Salome farming system in South Central Timor can be assessed through several indicators: Food Availability: The combination of crops, livestock, and trees in the Salome system ensures continuous food availability throughout the year, reducing dependence on external food sources. Food Access: The diversity in this farming system helps increase the economic resilience of farmers, as they can generate income from the sale of excess produce, livestock, and non-timber forest products. This income can then be used to purchase other necessities. Food Utilization: The integration of various types of food in the Salome system (such as fruits, vegetables, meat, and grains) contributes to the diversity and nutrition of the diet, which improves overall health and well-being. Sustainability: Using traditional agroecological practices, the Salome system encourages sustainable management of natural resources, ensuring that this farming system can support food security for future generations.

The Salome farming system in South Central Timor is an example of how traditional farming practices can contribute to food security through a combination of sustainable farming techniques, climate change resilience, and community-based collaboration. This local wisdom is a valuable resource in building more resilient farming systems, especially in areas with limited resources and vulnerable to climate change.

CONCLUSION

Adaptation to climate change is critical for farmers in South Central Timor to maintain food security and sustain their livelihoods. Unpredictable climate conditions—such as prolonged droughts, erratic rainfall, and increasing temperatures—have disrupted cropping patterns and reduced agricultural productivity. In response, farmers in this region have developed various adaptation strategies, including changing cropping patterns, diversifying crops, and adopting more efficient agricultural techniques.

Shifting from monoculture to polyculture, and planting drought-tolerant crops like tubers and legumes, reduces the risk of crop failure and enhances soil health. Additionally, diversifying income sources—such as engaging in tourism, traditional crafts, or small-scale trade—provides financial buffers for farming households vulnerable to climate variability.

The *Salome* farming system, which integrates multiple crops (corn, peanuts, and pumpkin) into a single planting hole, exemplifies a form of local innovation rooted in indigenous knowledge. This system not only improves land-use efficiency and soil fertility but also contributes to household food security and economic resilience. However, despite these adaptive strategies, farmers continue to face significant structural challenges, such as limited access to financial services, agricultural infrastructure, and sustained government support.

Successful adaptation among farmers in South Central Timor thus relies on the integration of sustainable agricultural practices, income diversification, and the reinforcement of social networks and community-based collaboration. Government and institutional actors play a vital role in supporting this resilience through inclusive policies that improve access to technology, information, and capital.

Research Limitations

This study is limited in its geographic scope, focusing only on selected farming communities in South Central Timor. As a result, the findings may not fully represent the diverse experiences of farmers in other regions of East Nusa Tenggara or Indonesia more broadly. Additionally, this study primarily relies on qualitative and descriptive data, which, while rich in local context, may lack generalizability to other settings with different ecological or socio-economic conditions. There are also limitations in the availability of time-series climate and yield data, which constrained the ability to quantify the long-term effectiveness of adaptation strategies.

Future Research Directions

Future research should aim to expand the scope of study across multiple districts and agro-ecological zones to capture a broader range of adaptation practices and their effectiveness. Quantitative analyses using longitudinal data can help measure the direct impact of traditional systems like *Salome* on food security and income stability. In addition, interdisciplinary studies that combine social science, agronomy, and climate modeling would provide deeper insights into how indigenous knowledge systems can be integrated with modern climate adaptation frameworks. Further investigation is also needed into how institutional support, gender dynamics, and youth participation influence the sustainability of these adaptation efforts.

Acknowledgment

The author would like to thank the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, especially the Directorate General of Higher Education, for providing the 2024 Research and Community Service Grant Fund. The author would like to thank the Directorate of Research, Technology, and Community Service, Directorate General of Higher Education, Ministry of Education and Culture for the 2024 Catalyst Research Grant Fund scheme, along with all parties who have contributed to the completion of this research and publication process.

Author Contributions

DRN and MCBU: devised and formulated the methodology for the study and research. MRP: gathered data and performed interviews. NK: composed the article up to the submission phase. SZAT contributed to the analysis of the findings and assisted in drafting the article. MCBU and NK contributed insights and engaged in the composition and enhancement of the article. All authors participated in the article's development and endorsed the submitted version.

Funding: The authors received direct research funding, contract number 490/UN15.22SP2H/ PL/2024 2024, from Indonesia's Ministry of Education, Culture, Research and Technology.

Conflict of Interest: The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

Data Availability

The data that support the findings of this study are available from the corresponding author, [DRN; MCBU; MRP; NK; SZAT]

REFERENCES

- Abdulai, I. A., Ahmed, A., & Kuusaana, E. D. (2022). Secondary cities under siege: examining peri-urbanisation and farmer households' livelihood diversification practices in Ghana. *Heliyon*, *8*(9). https://doi.org/10.1016/j.heliyon.2022.e10540
- Acheampong, P. P., Yeboah, S., Adabah, R., Asibuo, J. Y., Nchanji, E. B., Opoku, M., Toywa, J., & Lutomia, C. K. (2023). Gendered perceptions and adaptations to climate change in Ghana: what factors influence the choice of an adaptation strategy? *Frontiers in Sustainable Food Systems*, *7*. https://doi.org/10.3389/fsufs.2023.1091812
- Akramkhanov, A., Akbarov, A., Umarova, S., & Le, Q. B. (2023). Agricultural Livelihood Types and Type-Specific Drivers of Crop Production Diversification: Evidence from Aral Sea Basin Region. *Sustainability (Switzerland)*, *15*(1). https://doi.org/10.3390/su15010065
- Alamneh, T., Mada, M., & Abebe, T. (2023). The Choices of Livelihood Diversification Strategies and Determinant Factors Among the Peri-Urban Households in Amhara Regional State, Ethiopia. *Cogent Social Sciences*, *9*(2). https://doi.org/10.1080/23311886.2023.2281047
- Alhassan, U., & Haruna, E. U. (2024). Rural farmers' perceptions of and adaptations to climate change in Sub-Saharan Africa: Does climate-smart agriculture (CSA) matter in Nigeria and Ethiopia? *Environmental Economics and Policy Studies*, *26*(3). https://doi.org/10.1007/s10018-023-00388-8
- Anna Ann Dwarka, Phillip N. B. Da Silva, & Lakhnarayan Kumar Bhagarathi. (2024). Cash crop farmers' perceptions of, and adaptation to climate change: A preliminary study of Black Bush Polder, Guyana. *World Journal of Biology Pharmacy and Health Sciences*, *17*(1). https://doi.org/10.30574/wjbphs.2024.17.1.0034
- Berlilana, Baihaqi, W. M., & Sarmini. (2019). Artificial neural network for rainfall prediction base on historical rainfall data by day. *International Journal of Advanced Trends in Computer Science and Engineering*, *8*(1.5 Special Issue). https://doi.org/10.30534/ijatcse/2019/4881.52019
- Chen, Z., Yan, H., & Yang, C. (2022). A study on the impact of extreme weather on the poverty vulnerability of farming households—evidence from six counties in the hubei and yunnan provinces of china. *Frontiers in Environmental Science*, *10*. https://doi.org/10.3389/fenvs.2022.942857
- Collins, C. S., & Stockton, C. M. (2018). The Central Role of Theory in Qualitative Research. *International Journal of Qualitative Methods*, *17*(1). https://doi.org/10.1177/1609406918797475
- Fatima, I., & Rambut, K. (2022). social capital and the welfare of community of vegetable farmers in Pemo village, Kelimutu sub-district, Ende regency, east Nusa Tenggara province, Eastern Indonesia. *International Journal of Business, Economics & Management*, *5*(2). https://doi.org/10.21744/ijbem.v5n2.1892
- Grant, A. D., Wolf, G. I., & Nebeker, C. (2019). Approaches to governance of participant-led research: A qualitative case study. *BMJ Open*, *9*(4). https://doi.org/10.1136/bmjopen-2018-025633
- Guzmán Luna, A., Bacon, C. M., Méndez, V. E., Flores Gómez, M. E., Anderzén, J., Mier y Terán Giménez Cacho, M., Hernández Jonapá, R., Rivas, M., Duarte Canales, H. A., & Benavides González, Á. N. (2022). Toward Food Sovereignty: Transformative Agroecology and Participatory Action Research With Coffee Smallholder Cooperatives in Mexico and Nicaragua. *Frontiers in Sustainable Food Systems*, *6*. https://doi.org/10.3389/fsufs.2022.810840
- Hu, Y., Wei, F., Fu, B., Wang, S., Zhang, W., & Zhang, Y. (2023). Changes and influencing factors of ecosystem resilience in China. *Environmental Research Letters*, *18*(9). https://doi.org/10.1088/1748-9326/acec89
- Ikonne, O. (2023). Advancing Efforts and Strategies to Stop Female Genital Mutilation/Cutting (Fgm/C) in South-East Nigeria: A Qualitative Approach. *International Journal of Research and Innovation in Social Science*, *VII*(VII). https://doi.org/10.47772/ijriss.2023.70806
- James, R. K., Keyzer, L. M., van de Velde, S. J., Herman, P. M. J., van Katwijk, M. M., & Bouma, T. J. (2023). Climate change mitigation by coral reefs and seagrass beds at risk: How global change compromises coastal ecosystem services. *Science of the Total Environment*, *857*. https://doi.org/10.1016/j.scitotenv.2022.159576
- Kainyande, A. (2024). Exploring climate change perspectives among smallholder farmers in Tonkolili district, Sierra Leone. *GeoJournal*, *89*(2). https://doi.org/10.1007/s10708-024-11086-7
- Kalogiannidis, S., Papadopoulou, C. I., Loizou, E., & Chatzitheodoridis, F. (2023). Risk, Vulnerability, and Resilience in Agriculture and Their Impact on Sustainable Rural Economy Development: A Case Study of Greece. *Agriculture (Switzerland)*, *13*(6). https://doi.org/10.3390/agriculture13061222
- Kalugin, A. (2023). Climate Change Effects on River Flow in Eastern Europe: Arctic Rivers vs. Southern Rivers. *Climate*, *11*(5). https://doi.org/10.3390/cli11050103
- Lassa, J. A., Teng, P., Caballero-Anthony, M., & Shrestha, M. (2019). Revisiting Emergency Food Reserve Policy and Practice under Disaster and Extreme Climate Events. *International Journal of Disaster Risk Science*, *10*(1). https://doi.org/10.1007/s13753-018-0200-y
- Lee, C. C., Zeng, M., & Luo, K. (2024). How does climate change affect food security? Evidence from China. *Environmental Impact Assessment Review*, *104*. https://doi.org/10.1016/j.eiar.2023.107324
- Legide, Y. Y., Feyissa, G. S., & Karo, T. M. (2024). Revitalizing indigenous practices employed by farmers to reduce agriculture's vulnerability to climate change: a systematic review. In *Journal of Environmental Studies and Sciences* (Vol. 14, Issue 2). https://doi.org/10.1007/s13412-024-00888-3

- Levis, L. R., Sukesi, K., Sugiyanto, S., & Yuliati, Y. (2017). Farmers behaviour regarding food security by practicing the "salome" farming system as local wisdom in west timor, east nusa tenggara province, indonesia1. *Tropical and Subtropical Agroecosystems*, *20*(2). https://doi.org/10.56369/tsaes.2276
- Linggarwati, T., & Yamin, M. (2023). Overtourism in Lokawisata Baturraden, Banyumas After the Covid-19 Pandemic. *KnE Social Sciences*. https://doi.org/10.18502/kss.v8i3.12849
- Lochmiller, C. R. (2021). Conducting thematic analysis with qualitative data. *Qualitative Report*, *26*(6). https://doi.org/10.46743/2160-3715/2021.5008
- Madamombe, S. M., Ng'ang'a, S. K., Öborn, I., Nyamadzawo, G., Chirinda, N., Kihara, J., & Nkurunziza, L. (2024). Climate change awareness and adaptation strategies by smallholder farmers in semi-arid areas of Zimbabwe. *International Journal of Agricultural Sustainability*, *22*(1). https://doi.org/10.1080/14735903.2023.2293588
- Maxwell, J. A., & Reybold, L. E. (2015). Qualitative Research. In *International Encyclopedia of the Social & Behavioral Sciences: Second Edition*. https://doi.org/10.1016/B978-0-08-097086-8.10558-6
- Mazrou, Y. S. A., Ahmad, S., Abdelkhair, F. Y. F., Mudawi, S. S. A., Ashraf, S., & Ashraf, I. (2024). Determinants Of Livelihood Diversification In Punjab, Pakistan. *Migration Letters*, *21*(S6). https://doi.org/10.59670/ml.v21is6.7890
- Meka, C. E., & Nahak, H. M. I. (2022). Dinamika Survival Petani dan Tantangan De-agrarianisasi. *Jurnal Ilmu Sosial Dan Humaniora*, *5*(1). https://jayapanguspress.penerbit.org/index.php/ganaya
- Miller, J., Taylor, C., Guichard, F., Peyrillé, P., Vischel, T., Fowe, T., Panthou, G., Visman, E., Bologo, M., Traore, K., Coulibaly, G., Chapelon, N., Beucher, F., Rowell, D. P., & Parker, D. J. (2022). High-impact weather and urban flooding in the West African Sahel – A multidisciplinary case study of the 2009 event in Ouagadougou. *Weather and Climate Extremes*, *36*. https://doi.org/10.1016/j.wace.2022.100462
- Mohammed, H. Y., Teferra, T. F., & Sime, G. (2024). Indigenous knowledge and nutritional and morphological characterization of okra (Abelmoschus esculentus (L.) Moecnh) varieties in Western Ethiopia. *Food Science and Nutrition*, *12*(4). https://doi.org/10.1002/fsn3.3936
- Morse, A., & McEvoy, C. (2014). Qualitative Research in Sport Management: Case Study as a Methodological Approach. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2014.1032
- Nahar, N., Rahman, M. W., Miah, M. A. M., & Hasan, M. M. (2024). The impact of crop diversification on food security of farmers in Northern Bangladesh. *Agriculture and Food Security*, *13*(1). https://doi.org/10.1186/s40066-023-00463-z
- Naveesh Y. B., Raaga R., Sagar N., Suresh K. P., Ashwini M., Jayashree A., Sushma R., Krishnamoorthy P., Siju S. J., & Patil S. S. (2023). Probing Farmers' Awareness about Climate Change and Adaptation in Karkihalli Village, Koppala District, Karnataka. *Asian Journal of Environment & Ecology*, *22*(4). https://doi.org/10.9734/ajee/2023/v22i4512
- Neo, F. X., & Ceunfin, S. (2018). Pengaruh Model Tumpangsari dan Pengaturan Jarak Tanam Kacang Nasi (Vigna angularis L.) Kultivar Lokal terhadap Pertumbuhan dan Hasil Tanaman Jagung (Zea mays L.). *Savana Cendana*, *3*(01). https://doi.org/10.32938/sc.v3i01.135
- Ngongo, Y., Basuki, T., Derosari, B., Hosang, E. Y., Nulik, J., Dasilva, H., Hau, D. K., Sitorus, A., Kotta, N. R. E., Njurumana, G. N., Pujiono, E., Ishaq, L., Simamora, A. V., & Mau, Y. S. (2022). Local Wisdom of West Timorese Farmers in Land Management. In *Sustainability (Switzerland)* (Vol. 14, Issue 10). https://doi.org/10.3390/su14106023
- Onyekuru, N. J. A., Marchant, R., Touza, J. M., Ume, C., Chiemela, C., Onyia, C., Eboh, E. C., & Eze, C. C. (2024). A–Z of cost-effective adaptation strategies to the impact of climate change among crop farmers in West Africa. *Environment, Development and Sustainability*, *26*(8). https://doi.org/10.1007/s10668-023-03474-9
- Panke, D. (2024). Research Design & Method Selection: Making Good Choices in the Social Sciences. In *Research Design & Method Selection: Making Good Choices in the Social Sciences*. https://doi.org/10.4135/9781529682700
- Raharjo, K. T. P., & Delang, V. R. (2020). Pengaruh Jenis Residu Kompos Biochar dan Umur Defoliasi Daun Jagung (Zea mays L.) terhadap Pertumbuhan dan Hasil Kacang Merah (Phaseulus vulgaris L.) dalam Tumpangsari Salome. *Savana Cendana*, *5*(03). https://doi.org/10.32938/sc.v5i03.1054
- Sedighkia, M., Datta, B., & Razavi, S. (2023). Optimizing agricultural cropping patterns under irrigation water use restrictions due to environmental flow requirements and climate change. *Water Resources and Economics*, *41*. https://doi.org/10.1016/j.wre.2023.100216
- Suliyanto, S., Rahab, R., & Arini, D. V. (2024). The influence of tourist satisfaction on revisit intention: the moderating role of health consciousness. *International Journal of Public Health Science (IJPHS)*, *13*(2). https://doi.org/10.11591/ijphs.v13i2.23613
- Wang, Y., Yan, J., & Wu, Y. (2024). Impact of policy measures on smallholders' livelihood resilience: Evidence from Hehuang Valley, Tibetan Plateau. *Ecological Indicators*, *158*. https://doi.org/10.1016/j.ecolind.2023.111351
- Yulianti, S. D., Mulyaningrum, E. R., & Rahayu, P. (2022). Species Diversity and Distribution Area of Lichen in Baturraden Botanical Garden, Banyumas. *Journal of Biotechnology and Natural Science*, *2*(1). https://doi.org/10.12928/jbns.v2i1.5226