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Livelihood Resilience Patterns of Baturraden Highland Farmers

Muhamad Chairul Basrun Umanailo[1*], Rhisanda Nitma Tesyawa[2], Annisa Retrofilia Umanailo[3]
[1]Faculty of Agriculture and Forestry, Universitas Iqra Buru, Namlea, Indonesia
[3]Faculty of Law, Universitas Wijayakusuma, Purwokerto, Indonesia
[3]Faculty of Science and Technology, Universitas Pattimura, Ambon, Indonesia

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ABSTRACT
The majority of farmers in Baturraden live in mountainous areas and work as farmers. Although agriculture is the primary driver of the community's economy and the primary source of livelihoods, it is hampered by natural conditions, including unpredictable climate change. Climate instability is a major driver of farmers' livelihood problems, threatening economic resilience and the sustainability of farmer regeneration. Previous studies have explained how farmers cope with climate change by storing their harvests for use when times of famine arrive. This study aims to explore the agricultural practices used by farmers in Baturraden to deal with uncertain climate conditions. The approach is qualitative, using a case study methodology to uncover the nature of the events. The data collection process was carried out through interviews. Informants for interviews were purposively sampled, meaning they were deliberately selected based on predetermined criteria aligned with the research objectives. The interview results were then analyzed using QDA Miner 6 software. The study findings indicate that farmers' practices include changes in cropping patterns and crop diversification. Farmers do all of this to maintain income from the agricultural sector. For farmers, livelihood is their primary focus because it is closely linked to household sustainability and farmer regeneration. This study is limited to farmers' practices in addressing climate change and has not examined the social, cultural, and economic influences that support these practices; therefore, further studies are needed to obtain in-depth results on the livelihood resilience of farmers in Baturraden

1. INTRODUCTION

Geographically, Baturraden District is a lowland area focused on extractive sectors, including agriculture, plantations, and animal husbandry. This is further supported by the fact that most Baturraden residents live in rural areas and primarily depend on agriculture. Widiarrachman pointed out that most farmers in Baturraden are considered poor due to climate fluctuations affecting agricultural production (Widiarrachman et al., 2023). Poverty among farmers reflects the challenges they face, including limited access to resources, technology, and markets. Although Baturraden is known for its thriving tourism sector, many farmers in the area still struggle to improve their economic well-being.

Climate instability in Baturraden significantly affects farmers, most of whom depend on the agricultural sector for their livelihoods. Chen revealed that extreme weather in Hubei and Yunnan significantly impacts the poverty vulnerability of farming households (Chen et al., 2022), Meanwhile, in sub-Saharan Africa, Madamombe said that agricultural production, food, nutrition and income security of small farmers are threatened by extreme weather events, such as increasing frequency of dry seasons and rising temperatures, resulting in limited water and nutrient retention capacity, which leads to low crop productivity (Madamombe et al., 2024). The impact of climate instability results in farmers in Baturraden facing the risk of pest and disease attacks on plants, soil erosion that erodes the fertile soil layer, and drastic temperature changes that disrupt the plant growth cycle.

Climate fluctuations have a significant impact, disrupting the sustainability of farmers' livelihoods in Baturraden. A farmer's livelihood is the total income and economic resources used to meet their daily needs. For farmers in Baturraden, livelihood encompasses various aspects related to agricultural income and other factors that influence well-being. Therefore, if agricultural income is disrupted, farmers' livelihoods will also be affected. This study aims to explore the smart practices implemented by farmers in the Baturraden Highlands to address the problem of climate change, which significantly impacts their household livelihoods. These smart practices provide important lessons for the resilience of farming households in areas experiencing similar situations or natural phenomena.

** Corresponding Author: Muhamad Chairul Basrun Umanailo: chairulbasrun@gmail.com*

2. METHOD

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

The reason for selecting the villages of Ketenger, Kemutug Lor, Kebumen, Karangtengah, and Karangsalam in Baturraden District, Banyumas Regency, Central Java, was the number of active farmers in each. On average, the number of active farmers in the five villages was 65 percent of each village's population. This characteristic, given the number of active farmers, further motivated the author to explore the patterns of farmers' livelihood resilience in these locations.

This qualitative research uses interviews to study informants' experiences. (Maxwell & Reybold, 2015). In determining informants, the author used the "purposive sampling" method, which is a research method that deliberately takes samples according to the provisions (Grant et al., 2019). The informant criteria that the author considered appropriate for this study include: 1) People whose profession is a farmer; 2) People whose profession is a farm laborer; 3) Housewives; 4) Community and traditional leaders. The number of informants was determined based on the criteria and set at 30. In-depth interviews were conducted with key informants, including farmers, daily and contract farm laborers, housewives, and village officials. The determination of informants was carried out by the author using the criteria mentioned above, followed by data triangulation using member check

The function of using this software is to help researchers organize, code, annotate, retrieve, and analyze a collection of documents. For data analysis, the author applies a data analysis pattern consisting of four stages: collecting categories; direct interpretation; researchers form patterns and look for equivalence between two or more categories; and, finally, researchers develop naturalistic generalizations. (Ikonne, 2023). The function of using this software is to help researchers organize, code, annotate, retrieve, and analyze a collection of documents. For data analysis, the author applies a data analysis pattern consisting of four stages, namely: collecting categories; 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 that it is sensitive to detecting every symptom in the research object (social situation), can uncover data sources through in-depth interviews, and can communicate research results to the wider community.

3. RESULT AND DISCUSSION

This study provides an overview of farmers' action patterns in responding to climate change that are strongly related to their household livelihoods. Field data were collected at 5 research locations, and interview data were compiled into interview result tabulations. The interview data were then processed using Miner software version 6.0.11, a product of Provalis Research. This software is used for qualitative and quantitative data analysis, including text data from interviews, articles, or surveys. QDA Miner allows researchers to code text, identify themes, analyze relationships between various categories, and produce data visualizations.

In the first step, the researcher entered all tabulated results for processing using the features available in QDA Miner. Before processing, the researcher first entered categories and codes that would later become the basis for coding all interview tabulated documents. The resulting categories consisted of adaptation to climate change, social and economic resilience, policies, and government support. The three categories were then developed into nine codes: changes in cropping patterns, crop diversification, use of agricultural technology, diversification of income sources, social and community networks, access to financial services, assistance programs, agricultural infrastructure, and agricultural extension. The next step was to measure the percentage of words that comprised the codes, as shown in Figure 1.

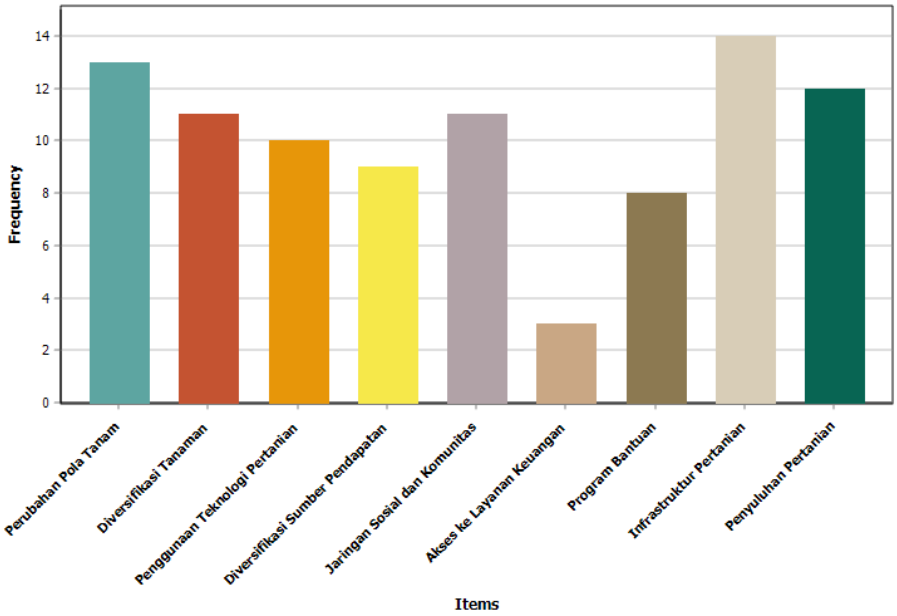

Figure 1. Percentage of words forming the code
Source: Field Data Processing with QDA Miner v6.0.11 Software

In the context of qualitative data analysis using software such as QDA Miner, the percentage of words that form a code refers to the proportion of words in a text that have been coded into a particular category compared to the total number of words in the text. In Figure 1, the number of words that form the agricultural infrastructure code reaches 14 percent of the total words used for coding, while the words that form the access to financial services code are the code with the smallest number of words that form the code.

In qualitative analysis, researchers divide text (for example, interview transcripts or documents) into categories or themes based on the meanings or topics that appear in it. This process is called coding, and codes are labels assigned to specific parts of the text that have special meaning or relevance to the research being conducted. Based on the data in Figure 1, the percentage of words that constitute the agricultural infrastructure code illustrates how much attention the text places on the theme of farmer resilience patterns facing climate change and household livelihoods in Baturraden. This indicates that the theme is very dominant or frequently discussed in the text. Conversely, in the distribution of themes, access to financial services is a code that is less discussed in the theme of farmer resilience patterns facing climate change and household livelihoods in Baturraden. To see the distribution of codes in each category, the following presents the results of data processing as images.

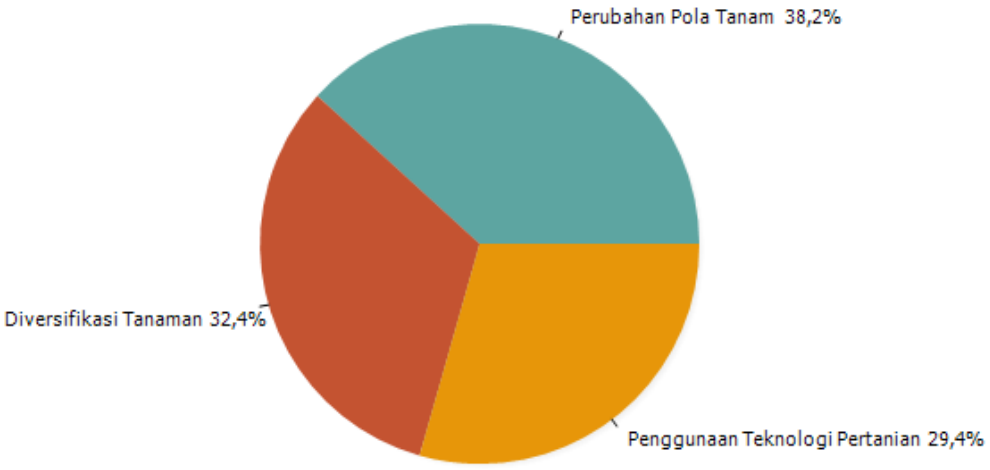

Figure 2. Code distribution in the climate change adaptation category
Source: Field Data Processing with QDA Miner v6.0.11 Software

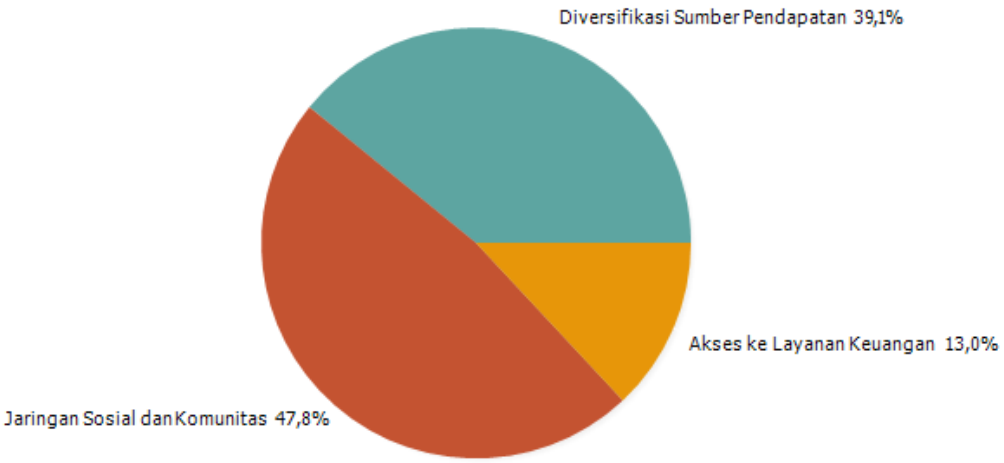

Figure 3. Distribution of codes across social and economic resilience categories
Source: Field Data Processing with QDA Miner v6.0.11 Software

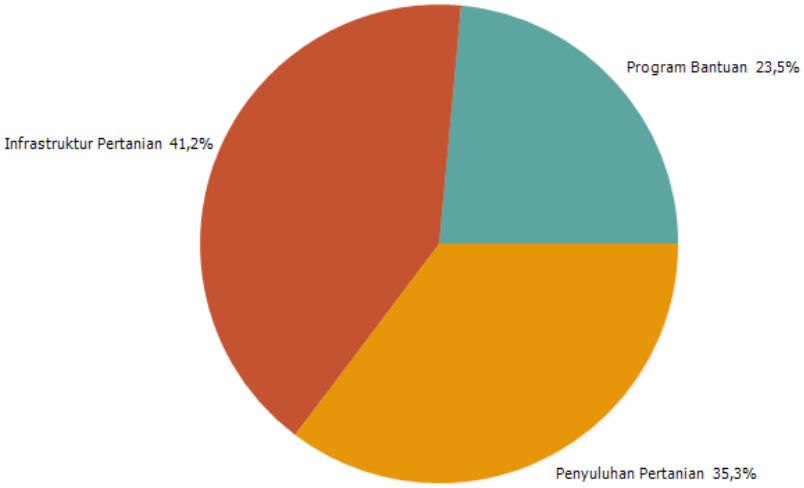

Figure 4. Code distribution in the Government Policy and Support category
Source: Field Data Processing with QDA Miner v6.0.11 Software

Code distribution within categories refers to how the codes identified during the qualitative analysis process are distributed within a particular category or theme. This is a way to understand how frequently specific codes appear within a particular category in the analyzed data. Figure 2 shows the code for changes in cropping patterns as a specific code within the adaptation to climate change category. The distribution of codes within the adaptation to climate change category shows three variations. By examining the code distribution in Figure 2, the researcher concludes that the discussion in the climate change adaptation category focuses on the code for changes in cropping patterns and is a specific code within that category. Furthermore, Figure 3 shows the social and community network code as a specific code within the social and economic resilience category. The distribution of codes within the resource utilization category shows three variations within that category. By examining the code distribution in Figure 3, the researcher understands that the discussion in the social and economic resilience category focuses on the social and community network code, which is a specific code. Similarly, Figure 4 shows the agricultural infrastructure code as a specific code within the government policy and support category. The distribution of codes within the government policy and support category shows three variations. By examining the code distribution in Figure 4, the researcher concludes that the discussion in the government policy and support category focuses on the agricultural infrastructure code and is a specific code within that category.

The next step is to use the Co-occurrences coding feature, which provides a graphical representation of how frequently codes co-occur. This network is commonly used to measure how often two words appear in a single document. The co-occurrence network allows us to examine multiple pairs of codes that appear together. To construct the co-occurrence network, each code is represented by a node, and an edge (link) represents the co-occurrence between the two variables, as in the following figure.

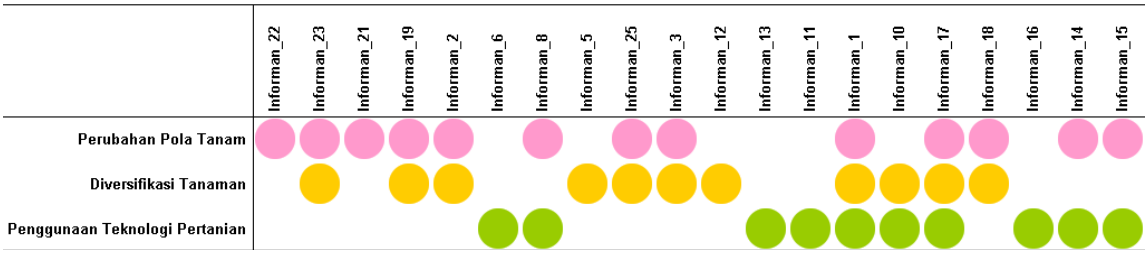

Figure 5. Coding by Variable: Code Frequency: Adaptation to Climate Change
Source: Field Data Processing with QDA Miner v6.0.11 Software

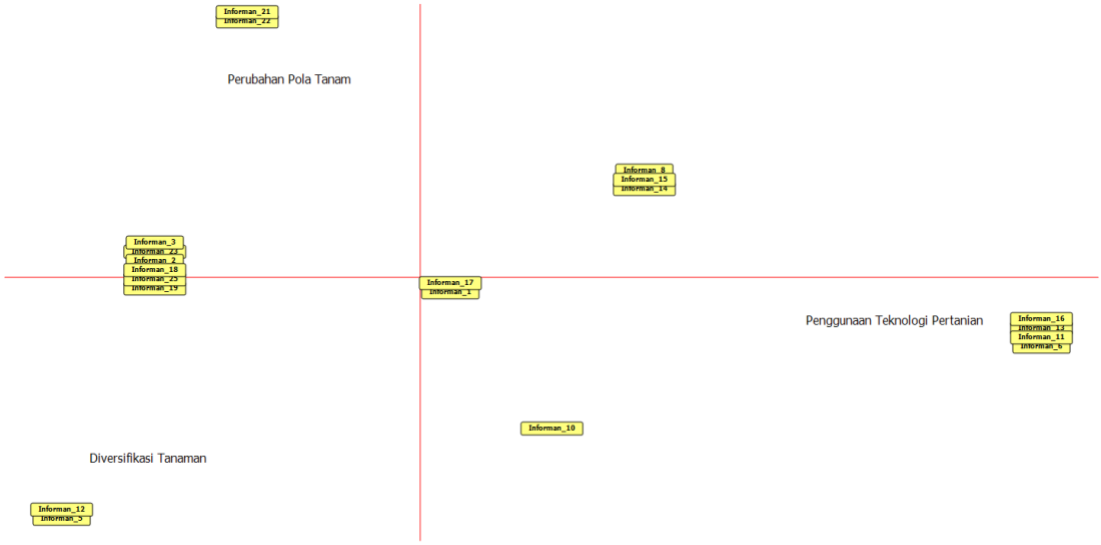

Figure 6. Coding by Variable: Correspondence Analysis: Count: Adaptation to Climate Change
Source: Field Data Processing with QDA Miner v6.0.11 Software

Intercoding patterns for categories refer to the relationships or associations that emerge between various codes within one or more categories. This process involves identifying how codes identified in the data analysis interact, recur, or correlate with one another within a particular category. Figures 5 and 6 show the relationship between changes in cropping patterns and crop diversification as codes that frequently appear together in the adaptation to climate change category. Figures 5 and 6 show four areas in the correspondence analysis diagram. Informants within a given area share similarities in one or more codes. Informants 23, 19, 2, 25, 3, and 18 are grouped in one area for the code changes in cropping patterns and crop diversification, indicating that the six informants share similar assessments of the themes in the interview transcripts related to these two codes. Meanwhile, informants 17 and 1 show similar responses across three codes and have the least relationship pattern in the adaptation to climate change category. Informants 5, 6, 11, 12, 13, and similar responses across 16 are in the area with no code. This area is a collection of informant answers that do not have close answers to the three codes in the adaptation to climate change category (see the clusters formed).

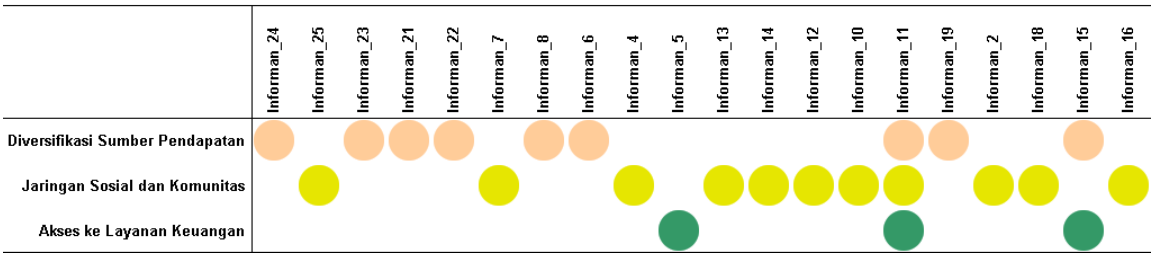

Figure 7. Coding by Variable: Code Frequency: Social and Economic Resilience
Source: Field Data Processing with QDA Miner v6.0.11 Software

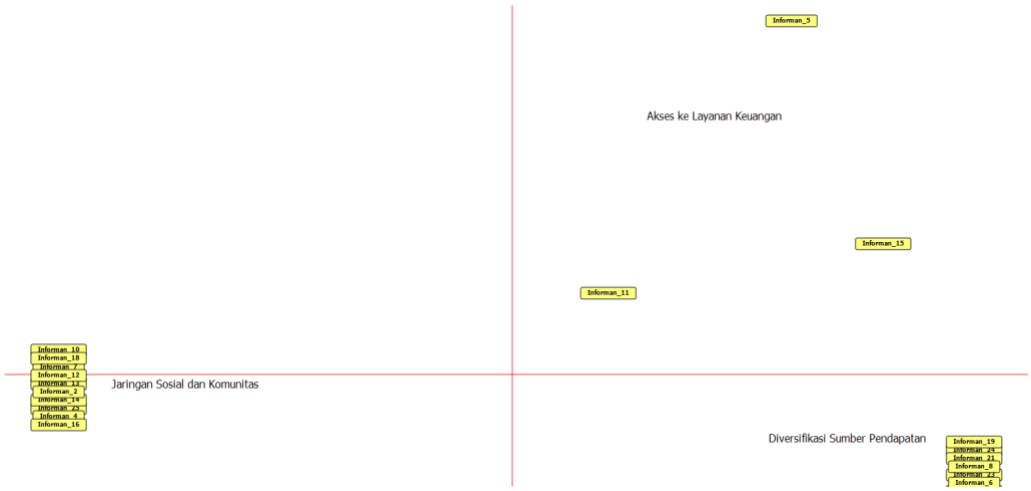

Figure 8. Coding by Variable: Correspondence Analysis: Count: Social and Economic Resilience
Source: Field Data Processing with QDA Miner v6.0.11 Software

Figures 7 and 8 show four areas in the correspondence analysis diagram. Informants within an area share similarities in one or more codes. Informants 11 and 15 are grouped in the same area for the codes income diversification and social networks and communities, meaning that these three informants share similarities in assessing the themes in the interview transcripts related to these two codes. Meanwhile, informants 24, 25, 21, 22, 7, 8, 6, 5, 4, 13, 14, 12, 10, 19, 2, 18, and 16 are in an area that is a collection of informants' answers that do not have close answers in the social and economic resilience category (see the clusters formed).

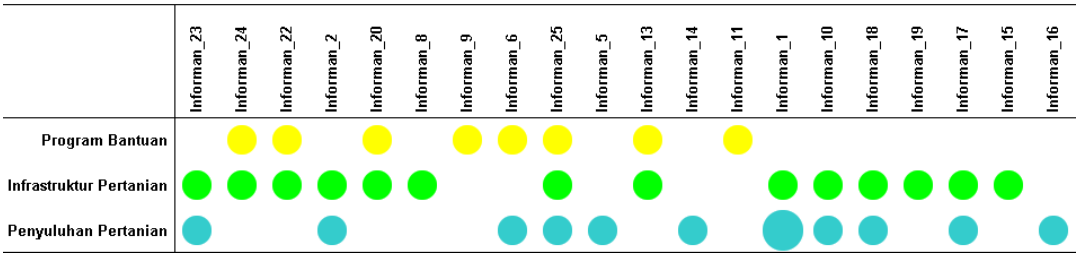

Figure 9. Coding by Variable: Code Frequency: Government Policy and Support
Source: Field Data Processing with QDA Miner v6.0.11 Software

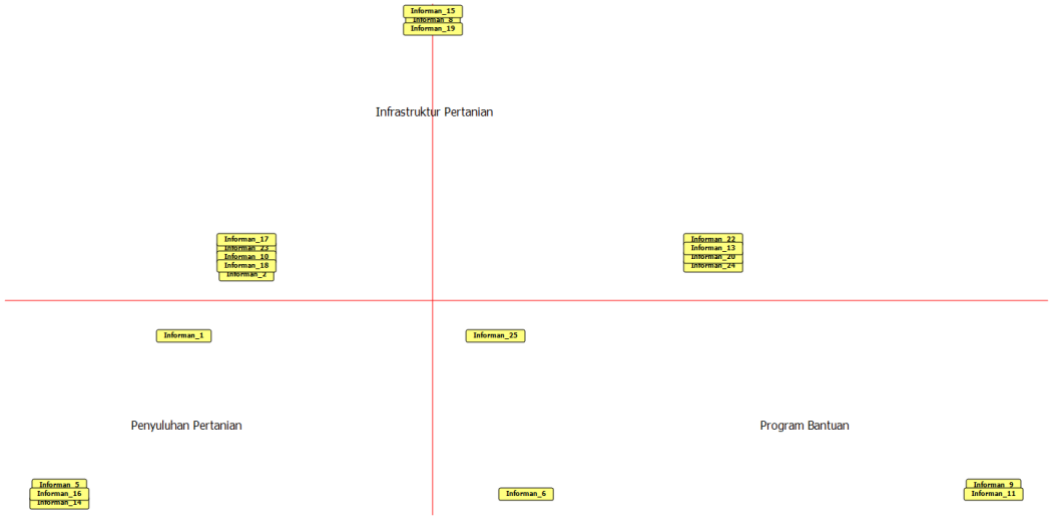

Figure 10. Coding By Variable: Correspondence Analysis: Count: Government Policy and Support
Source: Field Data Processing with QDA Miner v6.0.11 Software

Figures 9 and 10 show four areas in the correspondence analysis diagram. Informants within an area share similarities in one or more codes. Informants 24, 22, 20, and 13 are grouped together under the same area for the agricultural aid and infrastructure program code, meaning these four informants share similarities in assessing the

themes in the interview transcripts related to this code. Meanwhile, informants 23, 2, 1, 10, 18, and 17 demonstrate close responses to the two codes and form the most frequent relationship pattern in the government policy and support category (see the clusters formed).

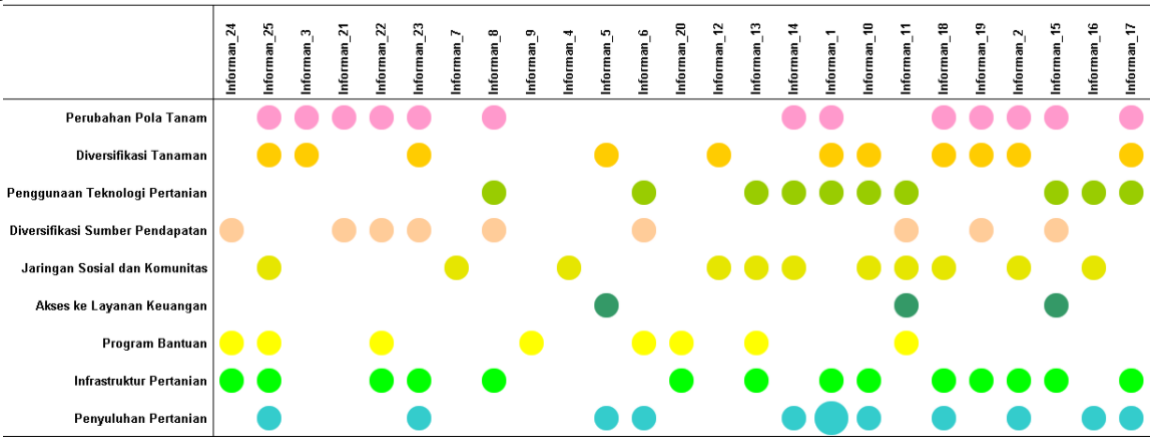

Figure 11. Coding By Variable: Code Frequency: Adaptation to Climate Change, Social and Economic Resilience, Government Policy and Support

Source: Field Data Processing with QDA Miner v6.0.11 Software

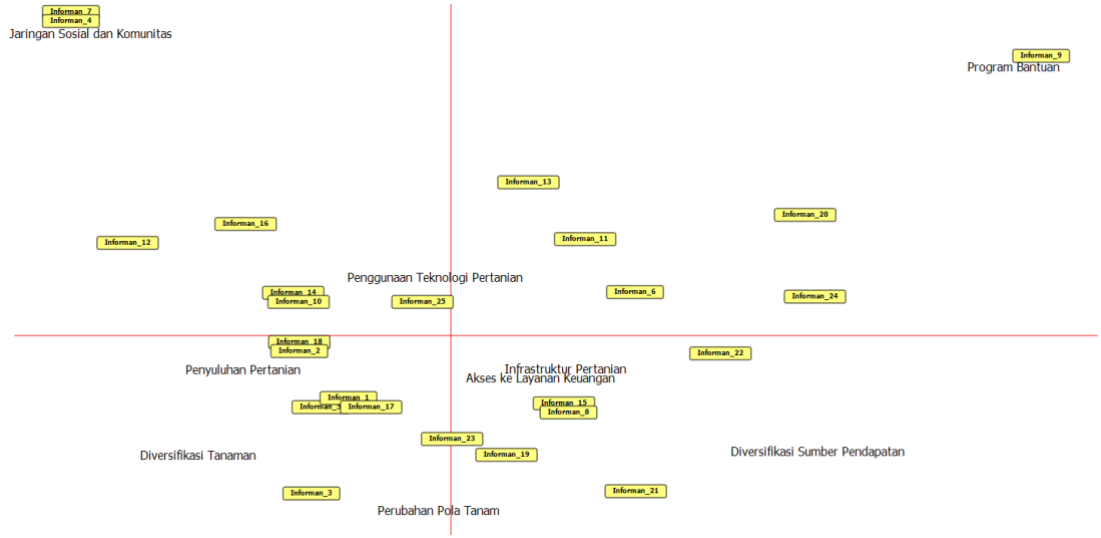

Figure 12. Coding By Variable: Correspondence Analysis: Count: Adaptation to Climate Change, Social and Economic Resilience, Government Policy and Support

Source: Field Data Processing with QDA Miner v6.0.11 Software

Figures 11 and 12 show four areas in the correspondence analysis diagram. Informants in one area have similarities in one or more codes and are randomly distributed (see the formed clusters). Informants 25, 23, 1, 10, 18, 2, and informant 17 are grouped in the same area with an average closeness of 5 codes out of 9 available codes from 3 categories, while informants 7 and 4 are not in the area that shows closeness of answers from 9 codes and 3 categories.

Data processing was continued using the Coding co-occurrences feature, which in QDA Miner refers to the analysis of how frequently two or more codes appear together in a set of documents. The resulting data help identify patterns and relationships among different code segments, and the matrix shows how frequently codes appear together, as shown in Figure 13.

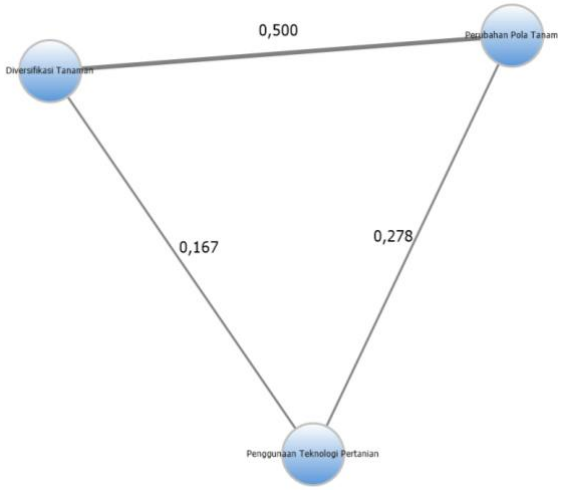

Figure 13. Coding Co-occurrences: Link analysis: adaptation to climate change
Source: Field Data Processing with QDA Miner v6.0.11 Software

Figure 13 shows the frequency and strength of the relationship between the crop diversification code and changes in cropping patterns, which is 0.500 higher than that between crop diversification and the use of agricultural technology, and between the use of agricultural technology and crop diversification. The visualization in Figure 13 shows that, in the adaptation to climate change category, the crop diversification code and changes in cropping patterns are strongly related.

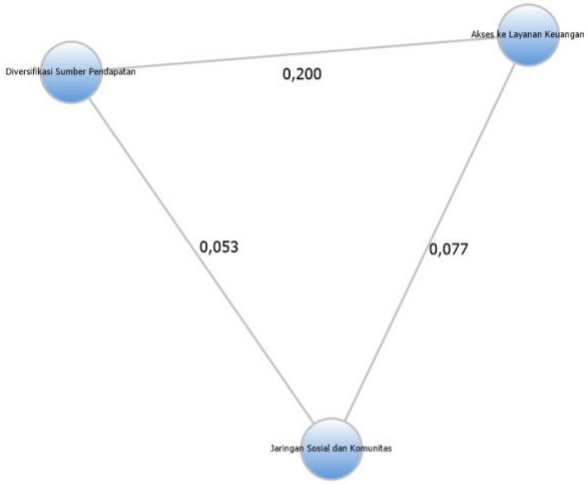

Figure 14. Coding Co-occurrences: Link analysis: social and economic resilience
Source: Field Data Processing with QDA Miner v6.0.11 Software

Figure 14 shows the frequency and strength of the relationship between the income source diversification code and access to financial services, reaching 0.200 higher than access to financial services with social and community networks, as well as community social network patterns with income source diversification. The visualization in Figure 14 shows that, in the Social and Economic Resilience category, the income source diversification code and access to financial services are strongly related.

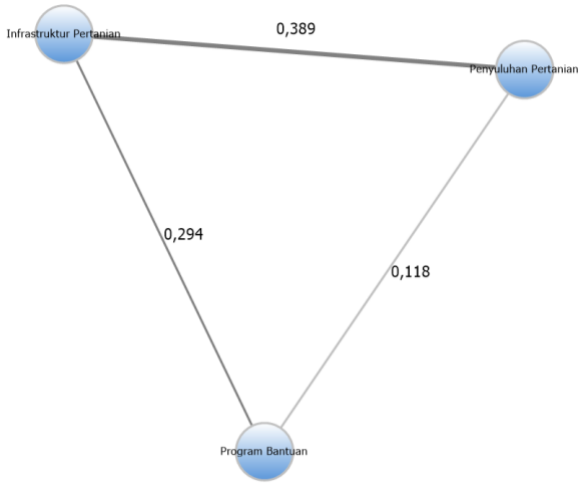

Figure 15. Coding Co-occurrences: Link Analysis: Government Policy and Support
Source: Field Data Processing with QDA Miner v6.0.11 Software

Figure 15 shows the frequency and strength of the relationship between agricultural infrastructure codes and agricultural extension, reaching 0.389, higher than that between agricultural extension and aid programs and aid programs and agricultural infrastructure. The visualization in Figure 15 shows that, in the Government Policy and Support category, the agricultural infrastructure code and agricultural extension are strongly related.

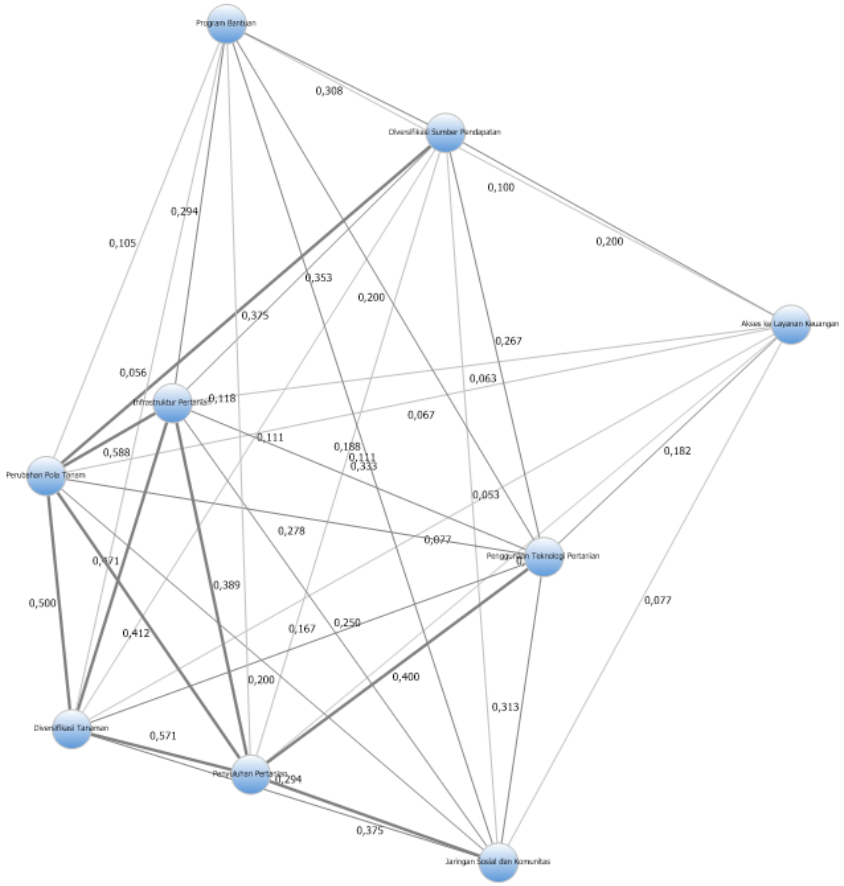

Figure 16. Coding Co-occurrences: Link analysis: adaptation to climate change, social and economic resilience, government policies, and support
Source: Field Data Processing with QDA Miner v6.0.11 Software

Figure 16 shows the frequency and strength of relationships among all codes across the three categories. The highest frequency was for agricultural infrastructure and changes in cropping patterns, at 0.588, while the lowest was for changes in cropping patterns with income diversification, at 0.056.

The visualization in Figure 17 shows the relationship patterns among different segments, with the pivot point in the cropping pattern change code showing a strong relationship with the agricultural infrastructure, crop diversification, and agricultural extension codes. A tabulation of the frequency of two or more codes appearing together in a set of documents can be seen in Figure 17.

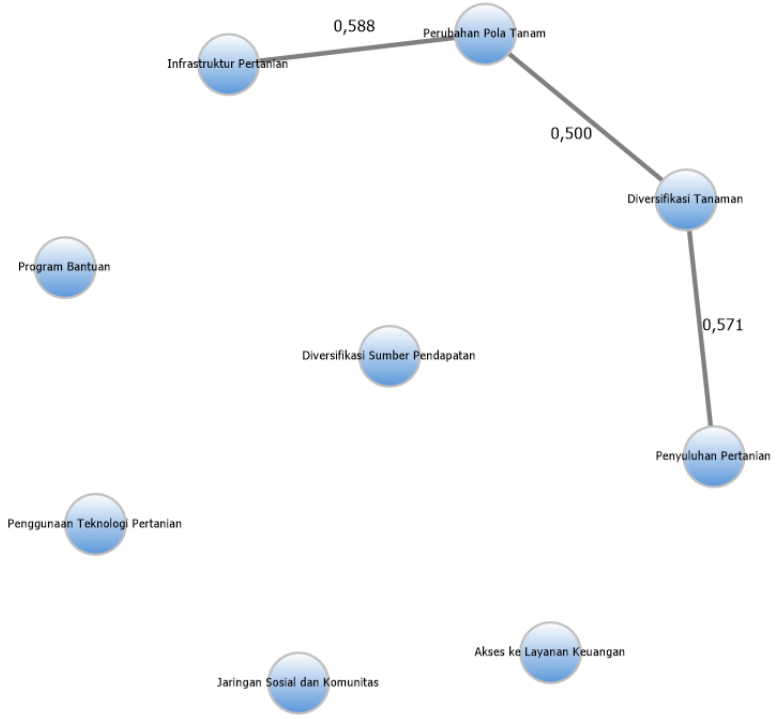

Figure 17. Patterns and relationships between different code segments
Source: Field Data Processing with QDA Miner v6.0.11 Software

Farmers' Adaptation to Climate Change in Baturraden

Adaptation to climate change is becoming increasingly important because it impacts many aspects of human life, especially sectors that depend on environmental conditions, such as agriculture, health, water resources, and ecosystems. There are several reasons why adaptation to climate change is essential, including the increased frequency and intensity of extreme weather events such as storms, floods, droughts, and heat waves. Alexandre Ionno's study, "Impacts of climate change on flood volumes over North American catchments," proves that climate contributes significantly to the variability of flood volume uncertainty (Ionno et al., 2024), while Jordan Hristov highlights the heterogeneity of climate change impacts in Europe and suggests market and trade adjustments as mechanisms for economic adaptation to climate change (Hristov et al., 2024). Climate change directly impacts human life.

Climate change is causing significant losses across sectors, especially in vulnerable areas. James Boafo presented research findings in Ghana indicating that climate change has non-economic aspects, leading to the loss of social cohesion and indigenous agricultural knowledge, thereby encouraging individualism among farmers (Boafo et al., 2024). Communities need adaptation strategies to cope with climate change. Without adaptation, communities and infrastructure will continue to be exposed to impacts that can result in economic losses, environmental damage, and loss of life. Similarly, the impact of climate change on agriculture and food security can disrupt planting season patterns and water availability, thereby reducing agricultural productivity. Prolonged drought or excessive rainfall can lead to crop failure, which in turn reduces food supplies (Hu et al., 2023; James et al., 2023). Adaptation is necessary for farmers to change their farming methods, such as using crop varieties that are resistant to extreme climates, more efficient irrigation, and implementing technologies that help address climate challenges.

Farmers in Baturraden, as in many mountainous areas of Indonesia, depend heavily on stable climate conditions for successful harvests (Yulianti et al., 2022). When the climate is uncertain, they face various challenges that affect their productivity and well-being (Linggarwati & Yamin, 2023; Suliyanto et al., 2024). Specific studies on farmer adaptation in several countries have been conducted by Usman Alhassan, Anna Ann Dwarka, and Aruna Kainyande. In Ethiopia and Nigeria, rural farmers' adaptation decisions were significantly influenced by agricultural extension programs and community social networks (Alhassan & Haruna, 2024). In

Guyana, South America, adaptation decisions are made by planting superior or more resistant crop varieties, changing planting times according to rainfall, collecting water in furrows near plants, utilizing drip irrigation systems and techniques for preparing plant beds, and using shade houses to mitigate the impacts of climate change (Anna Ann Dwarka et al., 2024). Meanwhile, farmers in Sierra Leone employ crop rotation and time management in planting as adaptation strategies (Kainyande, 2024). Similarly, farmers in Sub-Saharan Africa are diversifying their cropping patterns, adjusting planting schedules based on traditional weather forecasts, and maintaining soil moisture (Legide et al., 2024).

Unpredictable climate conditions, such as shifts in the rainy and dry seasons in Baturraden, can disrupt farmers' cropping patterns. Data processing results, as shown in Figures 5 and 6, demonstrate how farmers in Baturraden are adapting. Changing cropping patterns and crop diversification are key activities to address climate change. By planting a variety of crops, farmers can reduce the risk of crop failure from extreme weather, pests, or plant-specific diseases. Crop diversification makes agricultural systems more resilient to disturbances. Crop diversification provides flexibility in dealing with climate change that can affect weather patterns and soil conditions. By planting a variety of crops, farmers in Baturraden are better prepared to adapt to changes in climate and weather.

The adaptations undertaken by farmers in Baturraden affect their social and economic resilience, particularly the sustainability of their daily livelihoods. Onyekuru demonstrated that the adaptation strategies employed by farmers in West Africa yielded the highest returns, with significant average annual net profits (Onyekuru et al., 2024). Nahar also confirmed that farming households in Northern Bangladesh that adopted crop adaptation were found to be more food secure than households that were less crop diversified (Nahar et al., 2024). Figures 7 and 8 show how farmers in Baturraden are adapting to climate change by diversifying their income sources and social networks. Baturraden farmers no longer rely solely on one crop or commodity when facing increased risks. Diversification provides them with more income options from a variety of crops, while the role of social networks in adaptation enables faster and broader information exchange among farmers. In the context of adaptation, farmers need to obtain information about more efficient agricultural practices, climate change, or markets through their social networks. This information will help them make better decisions regarding cropping patterns, crop diversification, or resource conservation.

The condition of the Baturraden area, which is located on the slopes of Mount Slamet, Central Java, Indonesia, makes it vulnerable to heavy rain and landslides (Firmansyah et al., 2022). When rain falls heavily and lasts for a long time, agricultural land can become flooded or eroded, damaging crops and reducing soil fertility. Conversely, if the dry season lasts longer than usual, crops will experience water shortages, especially for farmers who rely on traditional irrigation. Baturraden is known for its horticultural produce, such as vegetables and fruits. Unpredictable climates, especially temperature fluctuations, can impact the growth of these crops. (Linggarwati & Yamin, 2023). Temperatures that are too low or too high can inhibit growth, make plants susceptible to disease, or even cause them to fail to bear fruit (Berlilana et al., 2019).

The adaptations undertaken by Baturraden farmers certainly have their own reasons. When the climate is unpredictable, farmers must incur additional costs to cope with these conditions. Before adaptation measures are implemented, they must use more fertilizer or pesticides to protect crops from pests and diseases that often arise due to climate change. Naveesh also noted a similar trend in India: integrated land management systems that combine crops, trees, and sometimes livestock offer potential adaptation solutions to improve livelihood security (Naveesh Y. B. et al., 2023). Furthermore, farmers in Baturraden must purchase water or build better irrigation systems to cope with the drought. As a result of all these challenges, farmers' incomes in Baturraden have significantly decreased, impacting their livelihood security. Low yields or crop failures prevent farmers from selling sufficient quantities of their produce, while production costs remain constant or even increase, further impacting their incomes.

Adaptation shows a strong relationship between indicators. Figure 17 shows a strong relationship in adaptation actions in response to climate change. Changes in cropping patterns, crop diversification, and the use of agricultural technology are important instruments and the main axis of adaptation undertaken by farmers in Baturraden. Figure 17 shows that the pivot point lies in changes in cropping patterns, which are then strongly linked to agricultural infrastructure and crop diversification. In changing cropping patterns, farmers in Baturraden choose crops such as chilies, tomatoes, and vegetables that are appropriate to land conditions, climate, and market needs. In changing cropping patterns, they shift from monoculture to polyculture to reduce the risk of crop failure and increase production yields. Acheampong stated that farming households in Ghana who change their cropping patterns are more likely to adopt crop rotation (Acheampong et al., 2023). In contrast to Acheampong's findings, Sedighkia shows different research results, indicating that optimizing cropping patterns is not an effective strategy for mitigating the economic impacts of climate change in the Tajan River Valley, Iran (Sedighkia et al., 2023).

Next, we discuss the crop diversification carried out by farmers in Baturraden as an integral part of their adaptation measures. Farmers choose potatoes, cabbage, and tomatoes, planting nutrient-intensive potatoes, followed by less nutrient-intensive cabbage, and finally, tomatoes, which have a different growth cycle. Their crop

diversification not only improves agricultural sustainability but also helps farmers cope with the risks of climate, weather, and market changes, and increases their income.

The distinction between changes in cropping patterns and crop diversification among farmers in Baturraden is clarified by the use of indicators. Cropping pattern changes refer to the modification or rearrangement of crop types grown over a period of time on the same plot of land. Farmers focus on how and when certain crops are planted to increase income. In contrast, crop diversification is the practice of growing more than one crop simultaneously or on a single plot of land to reduce dependence on a single crop in the event of crop failure. The primary goal is to increase income. Therefore, the primary goal of both concepts for farmers in Baturraden is income that supports livelihoods during climate change and unpredictable weather.

Farmers' Livelihood Resilience in Baturraden

Climate change will undoubtedly have a significant impact on the social and economic resilience of farmers in Baturraden. Various actions taken to address climate change are crucial to ensuring the sustainability of their livelihoods and well-being. Stavros Kalogiannidis recommends that the government design social protection programs to increase agricultural production, safeguard the lives of the most vulnerable populations, strengthen their resilience, and achieve well-being (Kalogiannidis et al., 2023). To improve livelihood security, farmers in Baturraden are diversifying their income sources. This diversification occurs outside the agricultural sector, for example, through agrotourism, handicrafts, or other small businesses. Figure 7 highlights the importance of diversifying income sources and social networks as a strong relationship pattern linked to the livelihood security of farmers in Baturraden.

Diversification measures taken also help reduce dependence on agricultural products that are vulnerable to climate change. Figure 14 confirms that farmers in Baturraden access financial services to diversify their income sources. This contrasts with Alejandra Guzmán Luna's findings, which concluded that farmers in Mexico and Nicaragua are diversifying by relying on improved agroecology for smallholders as a means 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 only (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).

The trend of livelihood diversification undertaken by farmers in Baturraden in response to climate change in recent years. Many farm owners have opened their lands to tourists, for example, by offering tours of farms or orchards, as well as experiences that involve participating in agricultural activities. This phenomenon can be understood in Figure 8. The trend of income diversification is driven by social networks and the community. Making and selling handicrafts from local materials available in Baturraden, such as bamboo weaving, ceramics, and traditional textiles, provides an alternative source of income for people struggling to cope with climate change. The strength of social networks is also used to process agricultural produce into processed products such as jams, pastries, or regional specialty foods that can be sold locally or at markets. Wei Liu studied livelihood diversification in China. Households with lower sensitivity tend to adopt non-agricultural livelihood adaptation strategies, whereas households with higher adaptive capacity prefer a diverse range of adaptation strategies. The weaker a household's social network, the more likely they are to choose non-agricultural adaptation strategies (Liu et al., 2023). This situation contrasts with the conditions of farmers in Baturraden, who use household social networks to support their adaptation strategies in the agricultural sector.

Agricultural businesses are highly vulnerable to climate fluctuations. Drought, flooding, or unstable rainfall patterns can lead to crop failure or decreased production. By having additional sources of income, farmers in Baturraden can mitigate economic risks arising from climate factors. By diversifying their income sources, farmers in Baturraden will be able to survive drastic climate change and are considered to strengthen the resilience of their household livelihoods. Theoretically, Chambers and Conway view livelihoods as the assets, capabilities, and activities that people use to earn a living. They agree that a livelihood is considered sustainable when it can cope with and recover from stresses and shocks and maintain or increase its assets (Abdulai et al., 2022). This indicates that farming households in Baturraden can generate livelihoods even under uncertain climate conditions and have strong links to livelihood strategies and diversification.

In difficult times when extreme climate change occurs, the government, as a stakeholder in farmers' production, consistently strives to provide support and assistance. Figure 15 demonstrates a strong relationship between agricultural infrastructure and agricultural extension services, both of which stem from government assistance to farmers as they navigate climate change. However, in reality, this assistance has not fully helped farmers in Baturraden overcome the threat to their livelihoods. Therefore, actions such as opening land for tourists, offering tours of farms or orchards, and producing bamboo weaving, ceramics, or traditional textiles have become strategies for coping with climate change. Lassa, in his research on climate change in several Asian governments, demonstrated that most governments have a strong focus on emergency food reserves, which are believed to

cushion the shocks of disasters and climate change and mitigate disruptions to trade (Lassa et al., 2019). Meanwhile, Yutong Wang's findings, which measured the impact of government policies on the resilience of smallholder farmers' livelihoods through 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 Baturraden is shaped by their ability to utilize resources and the availability of existing social networks. Crop diversification and changes in cropping patterns are dominant measures to mitigate uncertainty in agricultural production, while diversifying income sources and community social networks are key measures when entering difficult times due to climate change. The pattern of anticipating changes in livelihoods among farmers in Baturraden is common among other farmers. Akramkhanov reported that in Uzbekistan, when diversifying household food crop production, they prioritize the head of household's agricultural experience, education level, source of income, number of livestock and land, and proximity to the market as important factors in implementing diversification (Akramkhanov et al., 2023). Meanwhile, Mazrou revealed that household choices and farmers' adoption of livelihood diversification strategies in Pakistan are influenced by age, education level, livestock ownership status, access to credit, extension contacts, and income (Mazrou et al., 2024). The main difference between the diversification practices of farmers in Baturraden and those in Uzbekistan and Pakistan lies in their socio-economic environment. Farmers in Baturraden do not rely on the agricultural sector as their primary means of diversifying, whereas farmers in Uzbekistan and Pakistan remain influenced by factors outside agriculture, allowing them to leave the sector once their livelihood diversification is successful.

Maintaining a living in difficult times, such as those brought about by unpredictable climate change, is no easy feat for farmers in Baturraden. The desire to survive and provide a decent living for their families persists, even in the face of challenges such as climate change. Their consistent commitment to working in the agricultural sector is a smart practice for farmers in other areas, as diversifying their livelihoods is crucial for sustaining farmer regeneration. Carefully managing the livelihood security of farming households will make agricultural work more attractive and sustainable.

4. CONCLUSION

Climate change has a significant impact on the agricultural sector, particularly on farmers' livelihoods and their households. Facing climate change, farmers must develop adaptive skills to overcome economic challenges. Farmers in Baturraden rely on shifting cropping patterns and crop diversification to cope as climate change threatens their household livelihoods. Changing cropping patterns requires farmers to rearrange the types of crops planted on the same plot of land. The choice of crop sequence is crucial for achieving economic value. Similarly, crop diversification involves planting multiple crops simultaneously to reduce dependence on a single crop. This action is taken to avoid crop failure. The essence of both practices is to sustain the livelihoods of farming households.

5. ACKNOWLEDGE

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6. CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

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BIOGRAPHIES OF AUTHORS

Dr. Muhamad Chairul Basrun Umanailo is currently actively teaching at several universities, including Brawijaya University, Pattimura University, Sriwijaya University and several private universities. He has served as Director of the Center for Development Studies and Social Transformation (2014), Head of the Center for Planning and Development Studies (2017). Active as a member of the Indonesian Sociological Association and the International Sociological Association. Since 2018, he has been active as a research leader in various national research grant schemes including Beginner Lecturer Research (2018-2019), Scientific Research of the Ministry of Education and Culture-Higher Education-LPDP (2021), National Competitive Basic Research (2022-2025), RIIM Competition (2022-2023), RIIM Expedition (2025-2026) Applied Research (2024) Catalyst Research (2024), Prototype (2026), Downstream Priority Research - Social Innovation - BOPTN (2026). chairulbasrun@gmail.com

Rhisanda Nitma Tesyawa is a law student at Wijayakusuma University, Purwokerto. She is active in student activities and research. She is currently developing qualitative research methods and field testing at the Center for Community Development Planning Studies. rhisandanitma01@gmail.com

Annisa Retrofilia Umanailo is a student at the Faculty of Science and Technology, Pattimura University, who actively researches land and plant functions, is involved in student activities, and conducts research at the Center for Community Development Planning Studies. annisaretroo@gmail.com