Article

Social Resilience and Livelihood Adaptation of Rice Farming Households in Manyaran, Wonogiri: Shifting from Paddy to Horticulture

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Abstract
This study investigates the resilience strategies of rice farmers in Manyaran District, Wonogiri Regency, in adapting to agricultural challenges and diversifying into the horticultural sector. The research is grounded in resilience and adaptation in agricultural systems, emphasizing crop diversification as a strategy to sustain farmer livelihoods amidst environmental and economic pressures. In May and June 2024, the study utilized surveys, observations, structured interviews, and a literature review to collect data. 42 rice-farming households across seven villages in Manyaran District were selected through simple random sampling. The sample comprised middle-aged farmers aged 40–50, With an average age of 45 years, as younger populations often migrate to urban areas, leaving agriculture dominated by this demographic. Descriptive data analysis using simple tabulation was employed to illustrate the conditions of the studied area. The findings reveal that farmers in Manyaran District exhibit strong learning capacities, which enhance their resilience. They adapted by transforming rice fields into horticultural areas and experimenting with various horticultural commodities. Technological flexibility, including the use of social media for acquiring and sharing horticultural knowledge, played a crucial role in their adaptation. Information exchange among farmers further contributed to the sustainability of their livelihoods. This research highlights the importance of crop diversification as a strategy for farmers to adapt to shifting environmental and economic conditions. The results underscore the adaptability and resilience of Manyaran farmers in sustaining agricultural practices despite ongoing challenges, offering insights for broader agricultural adaptation strategies.

Keywords
adaptive, capacity of learning, livelihood, resilience, rice farmer

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INTRODUCTION

The impacts of climate change on the agricultural sector are diverse, encompassing resources, farming infrastructure, agricultural production systems, food security, independence, and the well-being of farmers and society. These influences can be differentiated based on two indicators, namely vulnerability and impact. Vulnerability to climate change is when individuals, plants, and farm animals experience a reduced capacity to adapt and perform their physiological or biological functions. This includes the inability to achieve optimal natural development, growth, production, and reproduction due to climate change-related risks. Climate change can generate disturbances or situations that result in loss or gain, whether physical, social, or economic. As Nissa et al., (2019) explain this is climate change's impact.

Agriculture drives economic development in the Manyaran District, Wonogiri Regency, Central Java. Manyaran District farmers focus on rice and supplementary crops. Rice and secondary crop farming sustain most. BPS data from Wonogiri Regency in 2016-2020 shows a decrease in rice field area from 78,271 Ha to 76,152 Ha, with fluctuating production. In 2018, rice production reached 414,345 tons, but in 2019, it plummeted to 389,874 million tons. Finally, rice output in Wonogiri Regency rose to 404,928 tons in 2020 despite little growth. The Covid-19 epidemic may have caused Wonogiri Regency's rice production to drop. Furthermore, the 2019-2020 COVID-19 epidemic increased the number of village residents in Wonogiri Regency from 527 thousand to 601 thousand per kilometer (BPS Kabupaten Wonogiri, 2020). This hurts rural economic growth more.

According to Dedi et al., (2022) most village residents in Manyaran District, Wonogiri Regency, are farmers. Manyaran subdistrict agricultural land is terraced and small. Thus, Manyaran District farmers must optimize land management to create high rice yields that suit their living demands. According to the Stads et al., (2008) 70% of rice growers are impoverished, low-income agricultural laborers and small-scale farmers. Manyaran District farmers mostly grow small-scale rice, secondary crops, and subsistence crops. Some Manyaran District villages have resorted to horticulture, namely vegetables, since 2020. BPS Kabupaten Wonogiri, (2020) shows that horticulture crop harvests in Manyaran District have been rising from 2019 to 2022.

Climate change has caused uncertainty in the livelihoods of traditional rice and secondary crop farming households, including those in the Manyaran District. Climate anomalies, leading to floods or prolonged droughts, have destabilized rice prices, affecting the income and resilience of rice farming households. In addition to climate-related challenges, the COVID-19 pandemic and rising production costs have further exacerbated vulnerabilities, leading to a decline in rice production. To sustain their livelihoods, households combine their available resources, including natural, physical, human, financial, and social capital, to maximize their sources of (Ellis, 2000). In the face of climate change, they undertake a series of resilience actions to maintain their livelihoods. Resilience refers to a range of actions related to the capacity of individuals, groups, or social-ecological systems to withstand pressures and enhance capacity through various approaches in response to climate change (Ifejika Speranza et al., 2014). Resilience is closely linked to climate change and adaptation, where the higher the resilience of a community, the better they are at preventing, coping with, and utilizing the expected and unexpected impacts of climate change (Berbés-Blázquez et al., 2017). Furthermore, various adaptation actions are taken because climate change affects human health, the environment, and behavior (Zolnikov, 2019). The concept of livelihood adaptation is central to understanding how communities adjust to climate-induced challenges. Livelihood adaptation refers to the strategies individuals or households employ to sustain their means of living under changing environmental and socio-economic conditions. These strategies often include diversifying

income sources, shifting to alternative agricultural practices, or utilizing technology to enhance productivity and sustainability. To analyze the findings, this research also incorporates Putnam's (1994) theory of social capital, which emphasizes the role of social networks, trust, and norms in fostering collective action and resource sharing. Putnam's framework is particularly relevant for understanding how farmers in the Manyaran District share information, collaborate, and utilize their networks to adapt to climate change. As defined by Putnam, social capital enhances resilience by enabling communities to mobilize resources, share knowledge, and collectively respond to challenges. This study seeks to answer the following research questions: How do rice-farming households in Manyaran District respond to the impacts of climate change? What resilience, livelihood adaptation, and social capital strategies are employed to cope with and adapt to these challenges? Through these questions, the study aims to provide insights into the interplay between resilience, livelihood adaptation, and social capital in ensuring agricultural sustainability amidst climate change.

METHOD

This study uses a quantitative research approach focusing on structured data collection and analysis. The approach is chosen to systematically assess the resilience and adaptation strategies of rice-farming households in Manyaran District, Wonogiri Regency, in response to climate change. By utilizing a Likert scale and specific criteria for resilience components, the study aims to quantify the level of resilience across various dimensions, including buffer capacity, self-organization, and learning capacity. The research population consists of rice-farming households in Manyaran District, which has been significantly affected by climate change, particularly droughts and unpredictable rainfall patterns. The study targeted households that have engaged in rice farming and have diversified into horticulture as an adaptation strategy. According to data from the Agricultural Extension Center of Manyaran Sub-District, there are approximately 55 rice farmers in the district who also cultivate horticultural crops. The total sample for this study included 42 participants, selected through simple random sampling. These respondents were evenly distributed across seven villages in Manyaran District. This sample size is methodologically appropriate for the quantitative analysis, ensuring that the data collected is representative and sufficient for assessing the resilience and adaptation strategies of the farmers. The study examined household capital and resilience by utilizing a Likert scale, which followed the criteria set by Ifejika Speranza et al., (2014) and Wahyuni, (2016) to assess the sub-components of buffer capacity, self-organization, and learning capacity. Equation 1, as referenced by Puspitawati and Herawati (2013), was used to get the final total score for each indication.

Y=((X-Minimum score n)/(Maximum score-Minimum score))x 100%

Description:

Y = Index score in percentage

X = The average of households' resiliency action in Likert's scale

The results of calculating the index value (Y) are categorized using Bloom's cut-off, where values <60% are classified into the low category, values between 60-80% are classified into the medium category, and values >80% are classified into the high category. The instrument for measuring resilience measures is presented in Table 1.

Descriptive and qualitative analysis of community adaption reveals climate change consequences and adaptation efforts. Interview data are also used to study community adaptation and goals descriptively.

RESULT AND DISCUSSION

Climatic Conditions and the Influence on Rice Production

The climate plays a vital role in agricultural activities. The timing of rice production and the ensuing harvest quality are influenced by weather and climatic conditions. According to Zaini & Saitama (2021),

Table 1. The instrument for measuring rice farming households' resiliency

Variable	Indicator	Component Value
Resiliency Action	Household resilience initiatives	Buffer capacity (natural capital, physical capital, social capital, human capital, skill) Self-organization (reliance on own resources, cooperation and networks, reciprocity, trust) Capacity of learning (commitment to learning, knowledge of threats and opportunities, participation to access information, experimentation, knowledge transfer capability)

rice yield and quality are often better during wet than dry seasons. Climatic considerations impact the quality of rice paddies and the expenses related to their preparation. Expenses during the rainy season are often lower than those during the dry season. Nevertheless, the ample availability of rice resulting from efficient production during the rainy season exhibits an inverse relationship with market prices. This is because the higher rice production causes a price decline (Patunru & Ilman, 2019). According to Nguyen et al., (2024), one factor contributing to the instability of grain output and prices is climate change, characterized by unpredictable climate phenomena and weather circumstances. Figure 1 presents data from the Bureau of Statistics for the Wonogiri Regency that provides information on the yearly rainfall in the Wonogiri Regency for 2021-2023.

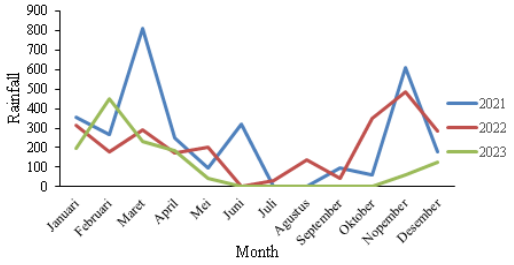

Figure 1. Annual rainfall in Wonogiri Regency in 2021 -2023 (Source: Badan Pusat Statistik Kabupaten Wonogiri, 2021 (modified))

The fluctuation of the long rainy and dry seasons influences the production and price of paddy and rice. Farmers experienced only one harvest period in March due to the El Nino drought in the second cultivation period, significantly reducing their incomes (Pratiwi et al., 2018). Based on BPS Provinsi Jawa Tengah, (2023), information on paddy and rice production in the Wonogiri Regency is presented in Figure 2.

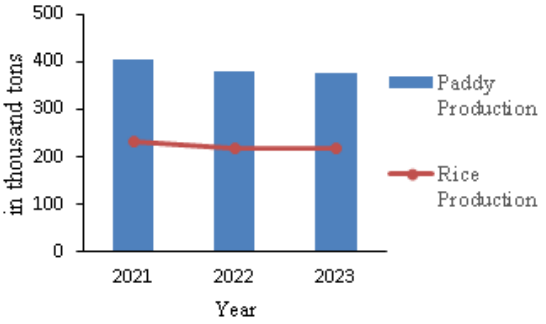

Figure 2. Paddy and rice production in Wonogiri Regency (Source: BPS Provinsi Jawa Tengah, 2023 (modified))

Characteristics of farmers' resource endowment

Based on the findings presented in Table 2, most farmers in the Manyaran District were categorized as productive workers based on their age. The minimum age of rice farmers who shift their crops is 26. The results showed that the mean age of the respondents was 46 years old, which indicates that the majority of respondents were economically active. The average education level that the Manyaran farmers achieved was senior high school, indicating that a large proportion of the sample had a primary understanding of climatic variables to agricultural production. The average rice farm size was 3650 m^2, and the mean of the rice farm size that shifted into horticultural farm size was 1680 m^2, which showed that many of the respondents were small-scale farmers and shifted their half of the rice farm into

Table 2. Characteristic of farmers' resource endowment

Variable	Frequency	Percentage (%)
Age of Respondents (years old)		
Less than 30 y.o	2	4.77
30 – 50 y.o	25	59.52
More than 50 y.o	15	35.71
Education level		
Primary School	4	9.52
Junior High School	9	21.42
Senior High School	26	61.90
Diploma/Bachelor degree	3	7.14
Cropping System Adaptation Strategies		
Shifting rice to Horticultural Crop	10	23.80
Intercropping system (single to more than 2 crop planting)	9	21.42
Multiple Cropping	21	50
Starting Diversify/Shifting Crop (years)		
Before 2018	8	19.04
2018 - 2020	20	47.62
After 2020	14	33.34
Rice Farm Size (m^2)		
>2500	6	14.28
2500-5000	22	52.38
<5000	14	33.34
Horticultural Farm Size (m^2)		
>1000	15	35.71
1000-3000	17	40.47
<3000	10	23.80

Source: Primary Data (2024)

the horticultural farm.

The diversity of crops cultivated by farmers in the Manyaran district appears to reflect their capability to experiment with different commodities to sustain or enhance their livelihood resilience (Figure 3). The data reveals that many farmers have grown a wide range of crops, with red/green chilies, cayenne peppers, eggplant, and cucumbers being the most commonly cultivated, as indicated by the high percentages. Conversely, crops like corn, cassava, and soybean are less prevalent, suggesting a lower suitability for the region or possibly lower market demand. This diversity in crop cultivation highlights farmers' adaptive strategies to mitigate risks associated with market fluctuations, climate variability, and other economic challenges.

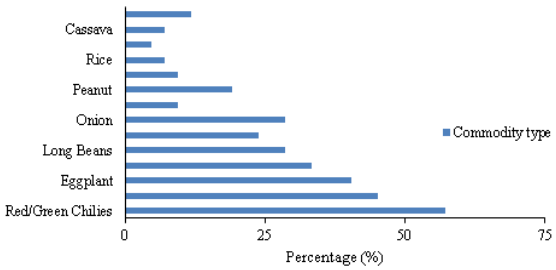

Figure 3. Crop Diversification in Manyaran District (source: Primary data (2024))

Resilience of rice farming households

Resilience actions include activities to

mitigate the effects of climate change and enhance resilience. In their investigation, Speranza et al. (2014) categorize resilience behaviors into three distinct components: buffer capacity, self-organization, and learning capacity. The components of resilience are explained based on the research conducted by Ifejika Speranza et al., (2014)and Wahyuni (2016) as follows: 1) Buffer capacity refers to the household's resilience in dealing with challenges and ability to seize opportunities to escape poverty. Buffer capacity encompasses various forms of capital, including natural capital (the capacity and quality of resources), physical capital (buildings and infrastructure), social capital (the increase in assets resulting from membership in an organization), human capital (the level of education and literacy), and skills (abilities beyond agriculture); 2)Self-organization is the inherent capacity to regulate one's behaviors and exercise freedom of choice, which directly impacts the outcomes of one's livelihood. Self-organization includes utilizing resources, such as the distance or travel time required to access input resources. It also involves reciprocity, which refers to the amount of work done outside of agriculture. Additionally, self-organization involves cooperation and the formation of networks, where individuals join groups to enhance their income. Trust is another crucial aspect, referring to people's confidence in borrowing and lending money; 3) Learning capacity pertains to the skills and knowledge acquired via learning and experience, intending to enhance one's ability to generate income. Learning capacity encompasses dedication to learning (actively engaging in and participating in activities related to one's means of living), awareness of potential risks and opportunities (the ability to identify and understand potential advantages and disadvantages to one's means of living), active involvement in accessing information (attending counseling sessions within a 12-month timeframe), willingness to experiment (engaging in multiple attempts with new methods or resources within the past 12 months), and the ability to effectively share knowledge (disseminating new ideas or actions on a large scale within the livelihood sector).

The buffer capacity action values of rice farming households in Manyaran District predominantly exhibit elevated levels (Table 3). The significance of social action and human capital is the primary factor contributing to buffer capacity. Most farmers in Manyaran District have attained a minimum of 9 years of mandatory schooling. Despite already completing primary school, the older generation possesses extensive expertise and customs.

Table 3. Value of resiliency actions of buffer capacity

Action Type	Action Value (%)	Category
Natural Capital	53,46	Low
Human Capital	86,01	High
Financial Capital	77,38	Medium
Physical Capital	77,38	Medium
Social Capital	88,99	High

Source: Primary Data (2024)

The values of the four components of self-organization are included in the medium and high category (Table 4). Cooperation, Network, and trust are the actions with the highest values. Almost all rice farmers who diversify commodities are members of farmer groups. They also form small groups consisting of farmers who diversify commodities or plant rice and then switch to planting horticulture, initiated by one of the farmers who becomes the group leader.

Table 4. Value of resiliency actions of self-organization

Action Type	Actions Value (%)	Category
Reliance on Own Resources	79,17	Medium
Reciprocity	77,78	Medium
Cooperation and Network	94,05	High
Trust	80,95	High

Source: Primary Data (2024)

The table provides a quantitative assessment of the values associated with

different resiliency actions within the framework of the Capacity of Learning, as shown in Table 5. The data reveals varying contribution levels by different action types, with Knowledge Transfer Capability, Experimentation, and Commitment to Learning demonstrating exceptionally high percentages, underscoring their significant role in enhancing resilience. The categorization into "High" and "Medium" further emphasizes the varying degrees of impact these actions have on resilience capacity. This analysis highlights the critical importance of knowledge management, continuous learning, and adaptive practices in building and maintaining resilient systems or organizations.

Table 5. Value of resiliency actions of Capacity of Learning

Action Type	Action Value(%)	Category
Participation in Access Information	68,65	Medium
Knowledge of threats and opportunity	84,52	High
Knowledge transfer capability	95,83	High
Experimentation	92,26	High
Commitment to Learning	91,67	High

Source: Primary Data 92024)

This data suggests that Manyaran district rice farmers actively engage in the transfer and application of knowledge, with a strong focus on experimentation to enhance their agricultural practices. The high values for "Knowledge transfer capability" and "Experimentation" suggest that these farmers are not just passive recipients of information but are actively testing and applying new methods and techniques in their crop planting systems.

Discussion

Figure 1 illustrates substantial fluctuations in monthly precipitation patterns over three years, illustrating the influence of climate change in the Wonogiri district. Heavy rainfall, with intensities surpassing 800mm in March 2021 and 600mm in November 2022, presents a potential threat of floods that can harm rice cultivation, leading to reduced crop yields. Conversely, extended periods of reduced precipitation, particularly in the middle of 2022 and 2023, raise concerns over drought conditions. These conditions could impede the growth and development of rice crops due to a lack of water. The variations in rainfall patterns have a direct impact on both the quantity and quality of rice production. Insufficient water can decrease grain quality and make crops more vulnerable to pests and diseases. Shah et al., (2013) found that extreme weather events can directly impact the ability to create sustainable livelihoods and limit the options available for rural poor households.

Wonogiri Regency rice production changes affect farmers' livelihoods. Farmers may face multiple obstacles due to the 2021–2023 rice crop reduction and rainfall variability. Farmers struggled financially due to erratic weather and increased use of irrigation, pesticides, fertilizers, and labor. These production changes also cause market price instability, generating uncertainty and vulnerability. Low production may raise prices, but farmers with lower yields may lose. In contrast, increasing output may lower prices and incomes. Market speculation and hoarding worsen price volatility, which hurts farmers, who are price takers. Farmers may lose money due to rising production costs and volatile market pricing. Losses can lead to lower income, debt, and food poverty. According to Michaelsen et al.,(2020) climatic variability and extreme weather events hurt farmers' incomes and livelihoods. Climate change, rice production, and farmer livelihoods in the Wonogiri Regency are interrelated.

Farm size is a critical factor that influences farmers' output. This agrees with similar results obtained by (Larbi et al., (2019) who categorized small-scale farmers as having holdings ranging from 0,2 hectares to 9 hectares. The results of the mean cropping system used by rice farm households in the Manyaran District indicate that multiple cropping and shifting rice to

horticulture were commonly used as their cropping system in adapting strategies to become more resilient. These results are in line with the results obtained by Becker et al., (2024) and Larbi et al., (2019) which revealed that the most commonly adopted adaptation measures to climate change by food crop farmers were changing planting dates, mulching, planting different crops, and planting different crop varieties.

The percentage distribution of various crops cultivated by farmers in the Manyaran district, potentially as a strategy to enhance or maintain their livelihood resilience. The diversity of crops grown, ranging from staple grains like corn and rice to vegetables like bitter melon and kale, and even spices like cayenne pepper and chilies, suggests a multifaceted approach to agricultural production. This diversification could respond to environmental variability, market fluctuations, or other socio-economic factors threatening their livelihoods. This practice aligns with the concept of agricultural biodiversity, a key component of livelihood resilience theory. This theory posits that a diverse range of crops can act as a buffer against risks, ensuring a more stable income and food supply. For instance, if one crop fails due to pests, disease, or adverse weather conditions, others may still thrive, mitigating potential losses. Furthermore, different crops may have varying market demands and prices, offering farmers a more comprehensive range of income opportunities.

This empirical evidence from the Manyara district resonates with findings from various studies. For example, research by Kassegn & Endris, (2021) in Ethiopia, crop diversification significantly contributed to household food security and income stability. Similarly, a study by Aryal et al., (2020) and Grigorieva et al., (2023) highlighted the role of agricultural biodiversity in enhancing resilience to climate change impacts. These studies and the data from Manyaran underscore the importance of crop diversification as a strategy for livelihood resilience in the face of various challenges.

The high level of social capital among rice farming households in Manyaran District, Wonogiri Regency, can be attributed to the region's characteristics, which still has a strong rural feel. The concept of social capital, as defined by Coleman, (1986)and Putnam, (1993) refers to the network of relationships, norms, and beliefs that facilitate action and cooperation among individuals in a community. Rural life, characterized by intensive social interaction, mutual cooperation, and shared values, forms close social ties between residents. This can be seen from the various mutual cooperation activities still routinely carried out in the Manyaran District, such as community service in cleaning irrigation canals, helping each other in cultivating the land, and the tradition of "s*ambatan*" or helping each other in harvest activities.

Various farmer groups and community organizations in the Manyaran District also help strengthen social capital. These groups are a forum for farmers to exchange information, share experiences, and collaborate in overcoming various agricultural problems. The trust and norms of reciprocity built within these groups become valuable social capital for farmers facing various challenges, including price fluctuations and climate change. The high social capital level in Manyaran District positively impacts the sustainability of rice farming businesses. Farmers with substantial social capital tend to have easier access to information, technology, and other resources. They can also better adapt to environmental changes and overcome various potential risks. Apart from that, social capital also plays an essential role in building trust between farmers. Farmers can find a lot of information and network through online communities, which can ultimately improve farmers' bargaining position in the agribusiness system. Wibowo, (2023) it was also said that the capacity of individuals, groups, and institutions plays an essential role in adapting to climate change. This impacts the community's collective action to maintain the sustainability of the agriculture sector.

In Manyaran District, it was found that

farmer groups not only interact with farmer groups in their hamlets or farmer groups for certain commodities but also collaborate with other farmer groups in an organization called GAPOKTAN at the village level. Through GAPOKTAN, each farmer group can access various agricultural needs, such as seeds, fertilizers, agricultural tools and machinery, market price information, agribusiness training, and agricultural insurance. Although farmers have received much information from the organization, social interactions in this small scope can be categorized as a homogeneous society with the same perceptions and knowledge related to agricultural practices. In addition, the rural structure still has a strong genealogical element, so almost all farmers have kinship relations even though they live in different villages. This becomes one of the reasons for the ease of accessing loans or debts. There is a high level of trust in relatives and a sense of helping each other's families or relatives. In addition, borrowing from relatives is considered very easy to get and return, so their recovery time to be resilient from the lowest point is very fast. This convenience is because there is no need for collateral and payment terms that can be negotiated or discussed. Nissa et al. (2023) also stated that genealogical relationships and territorial ties in the study location make social capital dominant. This process that leads to adaptation or system change is as important as the ultimate goal of resilience (Petersen-Rockney et al., (2021), with key local leaders and self-organizing networks essential contributors to the transformation process (Olsson et al., 2004).

The resilience capacity of learning measures shows almost all high categories for all indicators (Table 4). This indicates the high participation and activeness of rice farmers in following information searches and the willingness to apply new things in the business they are engaged in. The value of the knowledge transfer capability component is the highest. Utaranakorn & Yasunobu, (2016) argue that improving farmers' managerial skills can be obtained from learning and sharing information or ideas among farmers from other groups and communities on a broader network. Thus, the various benefits of diversifying commodities or horticultural cultivation methods can be understood from interactions or cooperation in the network. Wintergalen et al., (2022) added that communities with high learning capacity can collect and apply new knowledge to resilience-building activities. The ability to identify knowledge, or the ability to identify practical knowledge and the willingness to experiment with new ideas, are indicators of learning capacity demonstrated by rural communities.

The utilization of social media platforms such as WhatsApp, YouTube, and Facebook plays a crucial role in this knowledge dissemination and experimentation process. Social media provides a rapid and accessible means for farmers to gain insights, share experiences, and learn from peers and experts. These platforms have become essential tools for farmers to quickly access and share information, often bypassing traditional extension services such as those provided by Agricultural Extension Service Centers. As farmers can now directly connect with peers, experts, and agricultural communities online, the impact and relevance of traditional extension services appear to be diminishing. The speed and convenience of accessing information through social media have led to a reduced dependency on formal extension services. According to Mardiana & Kembauw, (2021) adopting new ideas or technologies typically follows a process where individuals first become aware of the innovation, gain interest, evaluate its merits, try it out, and finally, adopt it. The high scores for "Knowledge transfer capability" and "Experimentation" in the table reflect this process, where farmers, after learning from social media or other sources, move to experimentation and, if successful, adopt.

Furthermore, the critical role of social media in facilitating this learning and experimentation process is supported by

Bandura's (1977) Social Learning Theory, which posits that people learn from one another through observation, imitation, and modeling. Kanjina, (2021)and their role as a source of agricultural information. To this end, 365 farmers in Chiang Mai, Thailand, were sampled and interviewed using a questionnaire. The findings revealed that the majority of respondents (81.92% Social media platforms provide a virtual space where farmers can observe and model practices shared by others, which they experiment with within their fields. Linking this analysis to the previous bar chart, which shows a wide range of crops being experimented with by these farmers, it is evident that the knowledge gained through social media is likely a key driver of this diversification in crop planting. The willingness of farmers to experiment with different crops, as indicated by the high percentage in the experimentation category (92.26%), is a testament to their commitment to learning and adapting new practices to enhance their livelihood resilience. Using social media for knowledge acquisition and experimentation is advantageous in providing timely and diverse information. It also raises concerns regarding the information's quality and reliability. Without proper vetting or expert guidance, there is a risk of disseminating incorrect or contextually inappropriate advice, potentially leading to unsuccessful experiments or crop failures. Therefore, while social media serves as a valuable tool for knowledge transfer and experimentation, it should ideally be complemented by access to more formal and expert-driven sources of agricultural knowledge to ensure the reliability and relevance of the information being applied.

This adaptability can be examined through the Resilience Theory, which posits that systems, including agricultural communities, must absorb disturbances, adapt, and reorganize while changing to maintain essential functions (Holling, 2001). The farmers' experimentation with various crops can be seen as a proactive approach to diversify their income sources, reduce reliance on a single commodity, and enhance resilience against external shocks such as market fluctuations and climate variability.

Furthermore, the concept of Livelihood Diversification is applicable in this context. Livelihood diversification involves constructing diverse activities and support mechanisms to reduce risk and improve living standards (Ellis, 2000). In the Manyara district, cultivating multiple crops represents a strategic response to environmental and economic uncertainties, aligning with the notion that diversification is necessary and a method for achieving income stability and risk mitigation. To strengthen the statement about diversification in Manyaran District, the findings from Tables 3, 4, and 5 can be integrated to demonstrate how resilience is formed through the actions of farmers. The data from these tables highlight key aspects of resilience that support the strategic response of cultivating multiple crops. In Table 3, which shows the value of resiliency actions in terms of buffer capacity, Human Capital (86.01%) and Social Capital (88.99%) are particularly high. This indicates that farmers in Manyaran District possess a strong ability to adapt to changing conditions through their knowledge, skills, and social networks. High social capital reflects the importance of trust and cooperation within the community, which is critical when diversifying agricultural activities to reduce risks. The high value of human capital suggests that farmers are equipped with the necessary skills and knowledge to manage both rice and horticultural crops effectively. Table 4, which reflects self-organization, shows that Cooperation and Network (94.05%) and Trust (80.95%) are high, indicating that farmers work together and rely on each other's resources and knowledge. This social capital enables them to share information and adapt collectively to environmental and economic challenges. A strong sense of community and cooperation is essential for the success of agricultural diversification, as farmers can exchange

experiences and strategies for managing multiple crops. Table 5, which focuses on capacity for learning, further supports the adaptability of farmers in the district. Knowledge transfer capability (95.83%) and Commitment to Learning (91.67%) are high, showing that farmers are open to new information and willing to experiment with new crops and farming techniques. This reflects their resilience in the face of climate change and economic uncertainty, as they are actively seeking ways to diversify and stabilize their income. Together, these findings demonstrate that the resilience of farmers in Manyaran District is built on strong social networks, high human capital, and a commitment to continuous learning, all of which are essential for successfully diversifying crops as a strategy for income stability and risk mitigation.

The integration of horticultural crops into the farming system of Manyaran District can be seen as a direct result of these social resilience strategies. By relying on strong social networks, farmers have been able to diversify their crops, moving beyond rice cultivation to include horticultural crops that are better suited to the changing climate and market demands. This diversification is not just a technical or financial adaptation but also a social one, as it involves cooperation, trust, and the sharing of knowledge and resources within the community. According to Astuti et al., (2023) role of social capital in the development of rural society, emphasizing the importance of networks, mutual trust, and social values in fostering cooperation among stakeholders. The research identifies three types of social capital—Bonding, Bridging, and Linking—which work together, with Bridging Social Capital being the most influential in driving tourism progress in the region.

Ellis (2000) argues that rural households diversify to mitigate risk and uncertainty and improve their economic resilience. Similarly, Adger, (2000) emphasizes the importance of adaptive strategies in maintaining community resilience in the face of social and environmental changes. Moreover, Scoones, (2009) discusses how sustainable rural livelihoods are often underpinned by the ability to diversify and adapt to changing conditions, highlighting the significance of such strategies in ensuring long-term resilience. These theoretical insights and empirical evidence underscore the critical role of agricultural experimentation and diversification in bolstering the resilience of rural farming communities like those in the Manyaran district.

CONCLUSION

The rice farmers' households in Manyaran District, Wonogiri Regency, Central Java, Indonesia, have shown remarkable resilience and adaptability by leveraging their strong learning capacity. By transitioning from traditional rice and secondary crops to a diverse range of horticultural commodities, they have effectively responded to changing environmental and economic conditions. This shift is facilitated by their use of social media to quickly acquire and apply knowledge about horticulture, demonstrating technological flexibility. The transformation of rice fields into horticultural areas and the active sharing of information among farmers have contributed to the sustainability of their livelihoods. This research underscores the importance of crop diversity as a strategic adaptation tool, illustrating how rice farmers in Manyaran District have successfully navigated agricultural challenges through continuous learning and innovation.

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