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Lived experiences of smallholder farmers in adopting modern farming technologies in Maconacon, Isabela, Philippines

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ABSTRACT

Modern agricultural technologies have become essential in improving agricultural productivity, enhancing food security, and increasing the livelihoods of smallholder farmers in rural communities. However, limited qualitative studies have explored the lived experiences of upland farmers in geographically isolated municipalities who cultivate diversified crops using modern farming technologies. This phenomenological study explored the lived experiences of smallholder farmers in adopting modern farming technologies in the Municipality of Maconacon, Isabela, Philippines. Twelve purposively selected farmers from the barangays of Santa Maria, Malasin, and Diana participated in face-to-face semi-structured interviews. The collected data were analyzed using Braun and Clarke's thematic analysis. Four major themes emerged: improved farm productivity and efficiency, financial and environmental constraints, limited institutional support, and adaptive coping strategies. The findings revealed that while modern farming technologies enhanced productivity and reduced labor, farmers continued to face challenges related to high production costs, inadequate government assistance, and difficult terrain. The study highlights the need to strengthen agricultural extension services, improve rural infrastructure, and provide accessible financial and technological support to promote sustainable agricultural development among upland farming communities.

Keywords: Modern farming technologies, smallholder farmers, phenomenology, upland agriculture, Maconacon, Isabela.

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INTRODUCTION

Agriculture remains one of the most important economic activities in the Philippines, providing employment and livelihood to millions of rural households while ensuring the country's food security. Despite continuing advances in agricultural science, many smallholder farmers continue to face challenges associated with low productivity, increasing production costs, climate variability, limited market access, and inadequate support services. These concerns are particularly evident in geographically isolated and disadvantaged municipalities where farming continues to rely largely on manual labor and traditional production practices.

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The development of modern agricultural technologies has significantly transformed crop production across many developing countries. Mechanized land preparation, improved crop varieties, efficient irrigation systems, precision fertilization, integrated pest management, and post-harvest technologies have enabled farmers to improve productivity while reducing labor requirements. In many Asian countries, agricultural mechanization has gradually replaced labor-intensive farming activities, resulting in faster farm operations and increased production efficiency (Bhattacharya & Ali, 2015). Likewise, Alizadeh and Allameh (2013) emphasized that modern farming technologies have become essential in helping farmers respond to increasing food demand, labor shortages, and changing climatic conditions.

In the Philippines, agricultural modernization has become a central strategy for improving food production and increasing farmers' incomes. Through research and development initiatives, government agencies have introduced improved seed varieties, modern farm machinery, and crop management technologies intended to enhance farm productivity (Villano et al., 2014). Programs implemented by the Department of Agriculture have likewise encouraged farmers to adopt improved farming technologies to increase agricultural output and strengthen food security. Studies have shown that the use of improved varieties and modern production practices contributes to higher yields and improved farm profitability, particularly when technologies are properly implemented and supported.

Numerous studies conducted in different countries have demonstrated the positive effects of adopting modern agricultural technologies. Addison et al. (2022) found that improved seeds and fertilizer technologies contributed to higher incomes among rice farmers in Ghana while reducing income inequality. Similarly, Wordofa et al. (2021) reported that Ethiopian farmers who adopted improved agricultural technologies generated higher annual farm revenues than non-adopters. In Mozambique, Cunguara and Darnhofer (2011) likewise observed that the adoption of improved crop varieties and mechanized farming contributed to higher household incomes, especially among farmers with better market access. These findings collectively suggest that technological innovation can substantially improve agricultural productivity and rural livelihoods.

Despite these advantages, technology adoption among smallholder farmers remains uneven. Hasan et al. (2020) observed that although mechanization improves efficiency and reduces labor requirements, high acquisition costs and limited access to machinery continue to hinder its widespread adoption. Segal and Minh (2019) further noted that rising production costs, unsustainable farming practices, and climate-related risks continue to threaten the long-term sustainability of agricultural production. In the Philippine setting, Palis (2015) reported that limited financial capital remains one of the primary constraints confronting smallholder farmers, compelling many to rely on informal lending sources that impose high interest rates.

While technological innovations continue to expand, many Filipino farmers still combine traditional knowledge with selected modern practices. Gallibu and Tindowen (2015) documented that some farming communities continue to preserve indigenous agricultural practices and beliefs while gradually integrating modern production methods. This reflects the reality that technology adoption is influenced not only by economic considerations but also by local culture, environmental conditions, accessibility, and farmers' accumulated experiences.

These circumstances are particularly relevant in the Municipality of Maconacon, Isabela, a geographically isolated municipality situated along the eastern coast of the Sierra Madre mountain range. The municipality is characterized by rugged terrain, rain-fed farming systems, and communities that rely heavily on agriculture as their primary source of livelihood. Farmers from the barangays of Santa Maria, Malasin, and Diana primarily cultivate upland rice, corn, and various vegetables using a combination of traditional farming methods and modern agricultural technologies. Because of the municipality's mountainous topography,

limited transportation infrastructure, and vulnerability to extreme weather conditions, farmers encounter unique opportunities and challenges in adopting modern farming innovations.

Although previous studies have extensively examined the economic benefits of agricultural modernization, most have focused primarily on rice production, productivity, and income. Comparatively fewer investigations have explored how smallholder upland farmers experience the adoption of modern farming technologies within geographically isolated farming communities. Likewise, limited qualitative evidence exists regarding how diversified crop farmers engaged in upland rice, corn, and vegetable production perceive the benefits, limitations, and day-to-day realities of modern agricultural technologies.

This gap provided the rationale for conducting the present phenomenological inquiry. Specifically, this study explored the lived experiences of smallholder farmers in the Municipality of Maconacon, Isabela, in adopting modern farming technologies. By understanding their experiences, perceived benefits, challenges, and coping mechanisms, the study seeks to generate contextualized information that may assist local government units, the Department of Agriculture, agricultural extension workers, and other development partners in designing more responsive agricultural programs for upland farming communities. Furthermore, the findings are expected to contribute to the growing body of knowledge on agricultural technology adoption among geographically isolated smallholder farmers in the Philippines and provide baseline information for future agricultural and rural development research.

Statement of the problem

This phenomenological study aimed to explore the lived experiences of smallholder farmers in adopting modern farming technologies in the Municipality of Maconacon, Isabela, Philippines.

Specifically, the study sought to answer the following research questions:

1. What are the lived experiences of smallholder farmers in adopting modern farming technologies in terms of land preparation, crop production, and harvesting and postharvest activities?
2. What positive impacts have smallholder farmers experienced from the use of modern farming technologies?
3. What negative impacts have smallholder farmers encountered in adopting modern farming technologies?
4. What challenges do smallholder farmers encounter in the adoption and utilization of modern farming technologies?
5. What coping strategies do smallholder farmers employ to address the challenges associated with modern farming technologies?
6. Based on the findings of the study, what recommendations may be proposed to enhance the adoption and sustainability of modern farming technologies among smallholder farmers in the Municipality of Maconacon, Isabela?

METHODOLOGY

This study employed a qualitative research approach using a phenomenological research design to explore the lived experiences of smallholder farmers in adopting modern farming technologies in the Municipality of Maconacon, Isabela. The study was conducted in the barangays of Santa Maria, Malasin, and Diana, where upland rice, corn, and vegetable

farming serve as the primary sources of livelihood. Twelve (12) purposively selected smallholder farmers participated in the study based on their farming experience and use of modern agricultural technologies.

Data were collected through face-to-face semi-structured interviews using a researcher-developed and expert-validated interview guide. The interviews were audio-recorded with the participants' consent, transcribed verbatim, and supplemented with field notes. The collected data were analyzed using Braun and Clarke's (2006) six-phase thematic analysis to identify recurring themes and patterns from the participants lived experiences. To ensure the trustworthiness of the findings, the study adhered to Lincoln and Guba's (1985) criteria of credibility, transferability, dependability, and confirmability. Ethical principles, including informed consent, voluntary participation, confidentiality, and secure handling of research data, were strictly observed throughout the study.

RESULTS AND DISCUSSION

The qualitative findings presented in this section are drawn from a thematic analysis of interview transcripts collected from smallholder farmer participants in the Municipality of Maconacon, Isabela, identified in the excerpts below as Participant 2 through Participant 11, reflecting a purposively selected group of informants engaged directly in modern farming technology adoption. The study employed a qualitative research design using semi-structured interviews as the primary data collection instrument, with responses analyzed through thematic analysis to identify recurring patterns of meaning across participants lived experiences. The discussion that follows is grounded entirely in the data gathered through this process and is interpreted in direct relation to the study's objective of understanding the lived experiences of smallholder farmers in adopting modern farming technologies, including the benefits they perceive, the constraints they encounter, the institutional support available to them, and the coping strategies they employ. The thematic analysis of the interview transcripts generated four major themes describing these lived experiences: improved farm productivity and efficiency, financial and environmental constraints, limited institutional support, and adaptive coping strategies.

Improved farm productivity and efficiency

Participants generally viewed modern farming technologies as beneficial in improving farm productivity and reducing the physical demands of farming. They reported that improved seed varieties, power sprayers, brush cutters, mini tillers, and mechanical corn shellers enabled them to complete farm operations more efficiently while increasing crop yields. One farmer shared, "Since we started planting improved upland rice and corn varieties, our harvest has become better. We finish land preparation faster, so we can plant on time" (Participant 3). Another participant remarked, "Using the power sprayer saves both time and labor. Before, we spent almost the whole day spraying the vegetables. Now we finish in just a few hours" (Participant 8). These findings suggest that modern agricultural technologies contribute to improved labor efficiency and higher agricultural productivity among the smallholder farmers of Maconacon. Similar findings were reported by Hasan et al. (2020), who noted that mechanization reduces labor requirements while improving farming efficiency, and by Addison et al. (2022), who found that adopting improved agricultural technologies increased farm productivity and household income. Taken together, these accounts indicate that technology adoption is perceived not merely as a technical upgrade but as a meaningful improvement in the timeliness, ease, and output of farm labor, reinforcing the practical value

that farmers assign to mechanized and improved-variety inputs despite the constraints discussed in subsequent themes.

Financial and environmental constraints

Despite recognizing the benefits of modern technologies, participants consistently identified high production costs as their greatest concern. The increasing prices of fertilizers, pesticides, fuel, and machinery maintenance substantially reduced their farming income. One participant explained, "The technology is helpful, but fertilizers and chemicals are becoming too expensive. Sometimes our earnings are barely enough to recover our expenses" (Participant 5). Farmers also emphasized that the mountainous terrain of Maconacon limits the use of large farm machinery. As one participant stated, "Many of our farms are on steep slopes. Big machines cannot reach them, so we still depend on manual work" (Participant 10). These findings support Palis (2015), who identified inadequate financial capital as a major constraint among Filipino farmers, and align with Segal and Minh (2019), who observed that increasing production costs and environmental challenges continue to threaten the sustainability of agricultural technologies. The convergence of these accounts suggests that the benefits described under the first theme are not uniformly realized, since financial pressure and topographical limitations create a persistent gap between the technological potential of modern farming inputs and their practical accessibility in geographically constrained farming areas such as Maconacon.

Limited institutional support

Most participants acknowledged receiving occasional assistance from government agencies; however, they perceived the support as insufficient to address their production needs. They expressed the need for greater access to farm inputs, machinery, agricultural training, and improved farm-to-market roads. According to one participant, "We receive assistance once in a while, but not everyone benefits. We hope more farmers can receive seeds, fertilizers, and training" (Participant 7). Another farmer added, "Transporting vegetables is still difficult, especially during the rainy season when roads become muddy" (Participant 2). These experiences highlight the continuing importance of agricultural extension services and rural infrastructure in sustaining technology adoption. Laiprakobsup (2019) emphasized that government support significantly influences agricultural productivity, while Teves (2022) argued that equitable implementation of agricultural programs remains essential for improving farmers' livelihoods. The inconsistency in institutional assistance described by participants indicates that structural and infrastructural gaps, rather than farmers' willingness to adopt technology, may represent the more significant barrier to sustained agricultural modernization in the municipality.

Adaptive coping strategies

To overcome production challenges, participants employed various coping strategies, including crop diversification, borrowing production capital, sharing farm equipment, and relying on family labor. Many farmers cultivated upland rice, corn, and vegetables simultaneously to reduce financial risks associated with crop failure. One participant explained, "We plant different crops so that if one crop fails, we still have another source of income" (Participant 11). Another shared, "Sometimes we borrow equipment from relatives or

neighbors instead of buying our own because it is more affordable" (Participant 4). These strategies demonstrate the resilience and resourcefulness of smallholder farmers in adapting to changing agricultural conditions. Their experiences illustrate that technology adoption involves not only acquiring modern equipment but also developing practical approaches that fit local environmental and economic realities, indicating that farmers actively negotiate between the demands of modernization and the limitations of their financial and geographic circumstances rather than passively absorbing the constraints identified in the preceding themes.

On the whole, the findings indicate that modern farming technologies have improved agricultural productivity and labor efficiency among smallholder farmers in Maconacon, as reflected in participants' accounts of faster land preparation, reduced labor time, and improved harvests following the adoption of improved seed varieties and mechanized tools. However, high production costs, difficult terrain, limited institutional support, and inadequate infrastructure continue to constrain the full realization of these technologies' benefits, as evidenced by participants' concerns over rising input prices, the inaccessibility of large machinery on steep slopes, inconsistent government assistance, and difficult transport conditions during the rainy season. Farmers respond to these constraints through adaptive strategies such as crop diversification, equipment sharing, and reliance on family labor, underscoring their resourcefulness in sustaining agricultural livelihoods despite systemic limitations. These four themes collectively address the study's objective of understanding the lived experiences of smallholder farmers in adopting modern farming technologies by revealing a coherent narrative in which perceived technological benefits are consistently tempered by financial, environmental, and institutional constraints, and by demonstrating that farmers actively mediate these tensions through locally grounded coping mechanisms. This contributes to the field of agricultural development research by grounding broader claims about mechanization and productivity, as advanced by Hasan et al. (2020) and Addison et al. (2022), within the specific socioeconomic and geographic realities of a mountainous, geographically isolated farming community, while reinforcing calls by Laiprakobsup (2019) and Teves (2022) for more equitable and sustained institutional support. These findings, taken as a whole, provide the empirical and experiential foundation for the subsequent chapter, which builds on this thematic understanding to propose recommendations for strengthening agricultural extension services, expanding access to affordable farm inputs, improving rural infrastructure, and increasing government support to enhance the sustainability of modern farming practices in Maconacon and similarly situated farming communities.

CONCLUSION

The findings of this phenomenological study reveal that modern farming technologies have positively influenced the farming practices of smallholder farmers in the Municipality of Maconacon, Isabela. The participants perceived that improved seed varieties, mechanized farm equipment, and modern crop management practices enhanced agricultural productivity, reduced labor requirements, improved farming efficiency, and increased household income. These technologies enabled farmers to perform farming operations more effectively, particularly in cultivating upland rice, corn, and vegetables.

Despite these benefits, the farmers also encountered significant challenges that constrained the full adoption of modern agricultural technologies. High production costs, increasing prices of fertilizers and pesticides, the unsuitability of some machinery for mountainous terrain, poor farm-to-market roads, and limited access to government support were identified as major barriers. To cope with these difficulties, the farmers adopted practical strategies such as crop diversification, equipment sharing, reliance on family labor, and borrowing production capital.

The findings emphasize that technology adoption extends beyond the availability of modern equipment. Its success depends on sustained institutional support, accessible agricultural extension services, affordable production inputs, and infrastructure that responds to the realities of geographically isolated farming communities.

In light of these findings, local government units, the Department of Agriculture, and other development partners should strengthen extension programs, expand farmers' access to affordable inputs and appropriate farm machinery, improve rural transportation infrastructure, and provide continuous capacity-building activities tailored to upland farming systems. Such interventions may enhance the productivity, resilience, and long-term sustainability of smallholder farmers in Maconacon and other similarly situated rural communities.

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