Journal of Ecohumanism
2025
Volume: 4, No: 1, pp. 4397 – 4410
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v4i1.6331

Resilience and Coping Strategies during COVID-19: Perspectives from Agricultural Enterprise Farmers

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Abstract

COVID-19 posed threats to Thailand, particularly affecting agricultural enterprises. This study examines coping strategies of the Khok Sawang Agricultural Enterprise (KSAE) in Khon Kaen province in response to disturbances of the COVID-19 pandemic. A purposive sample of 75 members from the KSAE was analyzed using a mixed-methods approach. Data were collected through semi-structured questionnaires and in-depth interviews. Quantitative data were computed using SPSS, qualitative insights were derived through thematic analysis. The findings indicate that respondents faced considerable challenges across four domains: production and trade, food security, health, and income. Specifically, 86.7% reported income losses, 82.7% indicated increased mental health stress, and 70% reported reduced access to healthcare services. Market pressures, rising production costs, and decreased consumer demand collectively resulted in a 30% decline in production. To cope with these disruptions, respondents adopted diverse coping strategies. In terms of production, farmers reduced working hours, implemented daily wage cuts, and adopted digital platforms to facilitate direct sales. Health-related strategies included engagement in vaccination schemes and enhancing social networks to provide emotional support. This study underscores the resilience in navigating the extensive disturbances of COVID-19. It emphasizes the need for integrated policy frameworks that enhance farmers' resilience to deal with future crises.

Keywords: *Resilience, Coping strategy, COVID-19, Agricultural Enterprise, Thailand.*

Introduction

The COVID-19 pandemic, first identified in late 2019, rapidly evolved into a global health crisis with far-reaching consequences (WHO, 2021). The virus, primarily transmitted through airborne particles and respiratory droplets, has a long contagious period, with asymptomatic individuals potentially spreading the disease for up to 20 days (Sereenonchai & Arunrat, 2021). The pandemic has resulted in substantial public health impacts, including severe respiratory symptoms and internal organ damage, alongside profound disruptions to economies, societies, and agricultural systems globally (Martínez-Montilla et al., 2017; World Health Organization Thailand, 2022). Policies such as social distancing, lockdowns, and travel restrictions, although essential for curbing the spread, have intensified these disruptions, affecting nearly 690 million people worldwide through poverty, unemployment, and deteriorating public health (Guven et al., 2022).

Thailand has been significantly affected by the pandemic across various sectors. Economically, the country's gross domestic product (GDP) experienced its sharpest decline in five years during the first quarter of 2020 (Sereenonchai & Arunrat, 2021). Contributing factors included the near-complete halt of international tourism, reduced domestic consumption, and weakened global exports. This economic contraction resulted in a 20% surge in unemployment, forcing approximately 800,000 individuals into poverty and causing a 60% drop in GDP (IMF, 2021). Public health impacts were equally severe, with over 4.19 million confirmed cases and 28,022 deaths reported by April 2022, placing Thailand fourth in Southeast Asia in aspects of case numbers (Bairagi et al., 2022). Recovery to pre-pandemic levels remains uncertain, with estimates ranging from two to five years depending on the effectiveness of government support (World Health Organization Thailand, 2022).

Farmers, who comprise 30% of Thailand's labor force across 6.4 million households, were among the most affected groups (Asian Development Bank, 2020). Their vulnerability stems from irregular incomes, limited access to social safety nets, and an aging population—the average age of Thai farmers is 53 years (United Nations Thailand, 2020; Wechsler et al., 2018). Additionally, the prevalence of monoculture farming

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exacerbated these vulnerabilities, leaving farmers more susceptible to socio-economic disturbances despite available irrigation systems (DEPA, 2020). The pandemic further magnified these challenges. Thai farm households experienced a 39% income loss, significantly higher than the 16% loss experienced by general households (Asian Development Bank, 2020). Disruptions to supply chains, labor shortages, and limited market access reduced farmers' productivity and income (Abebe, 2020). Concurrent environmental disturbances, such as droughts and low water reservoir levels, compounded the difficulties, forcing many farmers, particularly in the Northeast region, into distress sales or predatory loans to sustain their livelihoods.

Despite these enormous pressures, many Thai farmers demonstrated resilience capacity by adjusting their operations to mitigate the pandemic's impact. This included diversifying crop production to reduce dependence on rice cultivation and shifting to higher-value or fast-growing crops to maintain year-round income (Panpakdee et al., 2021; Massayamas & Silpcharu, 2020). Agricultural enterprises also demonstrated creative responses, exemplified by initiatives in Chiang Mai Province where enterprises collaborated to exchange food as a relationship-building measure during the crisis (TDRI, 2021). Similarly, in Khon Kaen Province, the Non-Koon agricultural enterprise leveraged a community food bank co-established with the Thai Health Promotion Foundation (Konkao, 2020). This system functioned as a credit institution, allowing members to borrow and repay staple foods with minor interest, ensuring food security during lockdowns.

The COVID-19 outbreak emphasizes the need for resilience in agricultural systems to mitigate immediate disruptions and ensure sustainability (Sereenonchai & Arunrat, 2021). Farmers who employed diverse coping strategies, backed by institutional support, demonstrated a greater capacity to adapt and thrive despite unforeseen challenges. For policymakers, building resilience involves strengthening social safety nets, promoting diversification, and establishing infrastructure to prepare for future disturbances, whether they arise from pandemics, climate variation, or other threats (Do, 2023).

This knowledge of resilience is essential for developing solutions that benefit farmers, especially in susceptible areas like Southeast Asia (Asian Development Bank, 2020). While numerous studies have examined the pandemic's effects on general populations and individual farmers, research focusing on farming enterprises remains scarce in Thailand. This gap is significant given the crucial role these enterprises play in generating rural income, reducing poverty, and contributing approximately 7% to Thailand's GDP (DEPA, 2020; Sornsena et al., 2021). Although they frequently serve as hubs for innovation, little is known about their crisis management tactics.

This study investigates how agricultural enterprises in Thailand adapted to the challenges of the COVID-19 pandemic. Understanding these strategies provides valuable insights for policymakers, stakeholders, and practitioners to enhance resilience in agricultural systems and prepare for future crises. The findings also contribute to the broader discourse on building sustainable and adaptive enterprises against global uncertainties. By addressing this research gap, the study offers practical and theoretical implications that underscore the resilience of agricultural enterprises as integral components of Thailand's agroeconomic development and rural development framework.

Literature Review

Resilience in Agroecological Systems

Agroecological systems (SES) are complex, characterized by dynamic interdependencies between social, ecological, and political dimensions (Folke et al., 2016). Farmers, as key stakeholders within these systems, are particularly vulnerable to disturbances such as economic instability, climatic variability, and global crises, including the COVID-19 pandemic (Guven et al., 2022). Their resilience—the capacity to absorb, adapt, and transform in response to such disturbances—is determined by the coping strategies in maintaining the functionality and stability of SES (Darnhofer, 2021).

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Coping strategies are short to medium-term responses to mitigate the immediate impacts of disturbances while minimizing long-term adverse effects (Neadkhun et al., 2023). These strategies are crucial to handling SES disruptions and are often established in local socioecological contexts (Berkes & Ross, 2012). In agricultural systems, common coping mechanisms include diversifying income streams, modifying farming practices, enhancing social networks, and exploiting natural resources (Panpakdee et al., 2022). For instance, farmers may adopt practices such as integrating high-value crops or using wild food resources to cope with the impacts of market disruptions or climatic shocks. Such actions allow farmers to maintain their livelihoods and contribute to the overall stability of SES.

Resilience within SES is not only the ability to recover from disturbances but extends to adapting to dynamic conditions and, when necessary, transforming systems to ensure sustainability (Darnhofer, 2021). In agricultural systems, resilience encompasses maintaining productivity, preventing food security, and preserving ecological integrity despite external pressures (Panpakdee et al., 2021). Coping strategies act as conduits for resilience, enabling farmers to bridge short-term needs with sustainability objectives (Do, 2023). For example, diversification of cropping systems reduces risks associated with monoculture while enhancing ecological resilience by strengthening biodiversity (Visave & Aldrich, 2025).

The interdependence between coping strategies and resilience is evident in their mutual reinforcement. Effective coping mechanisms enhance the adaptive capacity of farmers, strengthening their resilience. Adaptive strategies such as adopting new technologies, engaging in collective action, and leveraging financial and informational resources have been shown to significantly enhance farmers' responses to disturbances (Panpakdee & Palinthorn, 2021). During the COVID-19 pandemic, for example, farmers who diversified their income sources or utilized digital marketplaces exhibited higher resilience than those dependent on traditional marketing channels (Wolfers & Utz, 2022). Additionally, social capital, cultivated through networks of collaboration and trust, serves as a vital resource for coping and resilience (Folke et al., 2016).

While coping strategies are central to resilience, their efficiency is determined by factors, including individual capacity, resource availability, institutional support, and the scale of disturbances (Folke et al., 2016). Excessive dependence on external subsidies, for example, may nourish financial dependency, potentially undermining self-reliance, and deteriorating resilience (Darnhofer, 2021). Similarly, some coping mechanisms, such as reducing production inputs or dietary diversity, may yield immediate benefits but have detrimental long-term consequences for agricultural productivity and population health (Neadkhun et al., 2023).

To enhance resilience within SES, policymakers must prioritize support for adaptive coping strategies. This includes investments in education, capacity building, innovations, and infrastructure that increase resource access and facilitate knowledge dissemination. Additionally, reinforcing collaborations across local and institutional scales can bridge the gap between immediate coping needs and resilience objectives (Wolfers & Utz, 2022). Such integrated approaches are vital for empowering farming communities with the instrument to navigate disturbances while maintaining socioecological sustainability.

Challenges of COVID-19 on Agriculture Systems

The COVID-19 pandemic severely disrupted global agricultural systems, destabilizing livelihoods and exacerbating preexisting vulnerabilities, particularly among smallholder farmers in emerging economies (Tyllianakis et al., 2024).

In Thailand, travel restrictions and a critical increase in input costs created substantial difficulties for agricultural sectors (Rigg et al., 2016). One of the most serious challenges was the disruption of supply chains. Border closures and mobility limitations resulted in bottlenecks in agricultural trade, which is heavily reliant on domestic and international commerce (IMF, 2021). These disruptions caused post-harvest losses, financial strain, and delays in product sales, disproportionately affecting farmers who rely on traditional

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market channels and often lack access to alternative mechanisms like e-commerce (Panpakdee & Palinthorn, 2021). The horticultural sector was also impacted, with the depletion of export opportunities caused by declining global demand for non-essential agricultural products (Visave & Aldrich, 2025).

The pandemic affected global logistics, leading to rising costs for production inputs, including fertilizers, seeds, and pesticides (Asian Development Bank, 2020). Thailand's dependency on imported goods exacerbated these challenges, as international shipping delays caused input shortages and price surges (IMF, 2021). Many farmers struggled to procure essential inputs, hindering their ability to enhance production capacity and maintain crop quality.

A remarkable consequence of the pandemic was the sharp decline in farmers' incomes. Market closures and reduced access to markets amplified existing financial vulnerabilities (Sornsena et al., 2021). Seasonal labor shortages, driven by travel restrictions and the exodus of migrant workers from agricultural areas, further reduced productivity (Sereenonchai & Arunrat, 2021). To offset these income losses, some farmers turned to alternative revenue streams, such as local bartering or short-term non-farm employment (Abebe, 2020). However, these measures often proved insufficient to mitigate the broader economic downturn.

Additionally, the pandemic revealed vulnerabilities in Thailand's food security. Many rural farmers depended on local markets to purchase goods they did not produce, but market closures made it increasingly difficult to access these items (Konkao, 2020). In response, farmers prioritized staple crops over nutrient-dense foods. This condition leads to reduced dietary diversity and further jeopardizes food security (Tyllianakis et al., 2024). The socioeconomic challenges of COVID-19 also had extraordinary psychological repercussions on farming communities (World Health Organization Thailand, 2022). Income loss, isolation, and uncertainty about the future heightened stress levels among farmers, particularly those with limited access to social support networks (Panpakdee & Palinthorn, 2021). The pandemic disrupted traditional social structures that have long been vital for resilience in farming communities, such as group labor and village markets, diminishing social cohesion.

Coping Strategies of Thai Farmers During Challenges

Farmers in Thailand face critical vulnerabilities to disturbance stemming from economic, environmental, and health-related crises, such as the COVID-19 pandemic. These challenges necessitate adopting diverse coping strategies to sustain livelihoods and adapt to dynamic socio-economic uncertainties.

Income diversification is a well-documented coping strategy among Thai farmers, particularly during economic disruption and declining demand for agricultural products. Farmers often seek alternative income-generating opportunities to mitigate financial constraints (Somkauna & Chumnanmak, 2019). These strategies include engaging in non-farm employment, initiating small-scale processing enterprises, and increasing reliance on family labor to reduce production costs (Neadkhun et al., 2023). The significance of these activities is particularly prominent in rural areas where economic opportunities are limited (Chaiyo & Mahaprom, 2020). For instance, during the COVID-19 pandemic, farmers who ventured into value-added activities, such as processing products into marketable goods, demonstrated enhanced income stability and reduced vulnerability to external shocks (Bairagi et al., 2022).

Producing self-sufficient food emerges as a crucial coping strategy during crises. The consumption of home-grown staples, including rice, vegetables, and livestock, increased significantly (Sinha & Swain, 2022; Panyapong et al., 2024). Home gardens, a traditional feature of Thai households, played a key role in ensuring household food security. This approach provides an immediate solution to food access challenges while also serving as a foundation for sustainability and resilience (Darnhofer, 2021). However, the success of this strategy is contingent upon equitable access to essential resources, such as labor, water, and land, highlighting persistent disparities in resource availability across rural communities (Martínez-Montilla et al., 2017).

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Social networks have historically been a cornerstone of resilience in Thailand. Farmers rely heavily on mutual aid mechanisms, including bartering, shared labor, and community savings groups, to navigate periods of disturbance (Visave & Aldrich, 2025). These networks provide access to essential resources, such as food, tools, and labor, while also offering financial and emotional support during adversities (Fonseca et al., 2019). This emphasizes the significance of social capital in enhancing the adaptive capacity of farmers, reinforcing collective resilience, and promoting recovery from impromptu challenges.

While self-reliance remains a fundamental strategy, policy support has also been instrumental in helping farmers manage crises. During the COVID-19 pandemic, for instance, government programs, such as the COVID-19 Economic Relief Schemes, provided financial support to farmers (Asian Development Bank, 2020). In addition, institutional organizations implemented targeted initiatives, including input subsidies and mental health services, to bolster rural resilience (Massayamas & Silpcharu, 2020). Despite these efforts, significant gaps in accessibility and implementation persisted, often hindering the effectiveness of these measures (TDRI, 2021). Farmers often encountered bureaucratic hurdles, highlighting the need for more participatory approaches to policy design and delivery.

The coping strategies employed by Thai farmers during challenges reveal a blend of traditional resilience mechanisms and modern adaptations. Income diversification, reliance on self-produced food, social networks, and policy support collectively strengthened farmers' capacity to withstand challenges. However, addressing inequities in resource access and improving the inclusivity of institutional interventions remain vital for farming communities in Thailand.

Research Methods

Study Site

Khon Kaen province was selected as the study site for its central economic role, ranking as the second-highest contributor in Northeastern Thailand's regional economy (Petchpakdee, 2019). This selection was further substantiated by robust support from government and public organizations dedicated to reinforcing economic development in the province. Khon Kaen is among the top five provinces with the most farming enterprises registered with the Ministry of Agriculture and Cooperatives (Somkauna & Chumnanmak, 2019). This concentration reflects a well-developed infrastructure and a range of initiatives supporting agricultural activities, providing a fertile context for investigating agricultural development and coping strategies.

Sampling Procedure

A purposive sampling approach, specifically typical case sampling, was employed to select the Khok Sawang Agricultural Enterprise (KSAE) as the study's focal unit. This enterprise comprises 96 members, with a sample of 75 respondents chosen based on the following inclusion criteria: 1) Impacts of COVID-19: KSAE was severely affected by the pandemic, making it a suitable case for examining coping strategies (Community Development Department, 2020); 2) Direct Experience: Members with direct experiences of COVID-19 challenges, including illness, income loss, or market pressures; 3) Long-term Membership: Members with over seven years of participation in KSAE, providing insights into both individual and collective coping strategies; and 4) Willingness to Participate: Respondents who consented to participate in the study through informed consent.

Data Collection

A mixed-methods approach was utilized for data collection, combining quantitative and qualitative research techniques. Data were gathered using a semi-structured questionnaire, developed through expert consultations and a thorough literature review to address gaps related to COVID-19's impact on small-scale agricultural enterprises in Thailand. The primary objective of the questionnaire was to gather farmers' opinions about the agronomic, biophysical, and socioeconomic circumstances impacted by the pandemic.

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Particular attention was paid to the operational time of the 2022 epidemic when the pandemic had a strong domestic impact.

Before deployment, trial surveys were conducted to identify and rectify deficiencies in the questionnaire. Feedback from pre-tests informed revisions to ensure clarity, cultural relevance, and alignment with study objectives. Respondents were briefed on the study's aims and procedures before the interviews commenced.

Data collection took place from July to mid-December 2022 using a combination of open-ended and Likert-scale questions, whose measurements were on a 5-point scale (1 = Strongly Disagree to 5 = Strongly Agree). The survey was structured into three main sections: 1) Socio-economic Characteristics: Demographics, enterprise profiles, production methods, and market channels; 2) Pandemic Experiences: Economic, social, and operational challenges faced by members.; and 3) Coping Strategies: Adaptation measures such as changes in production, distribution, and sales practices.

Individual interviews with the 75 respondents lasted 30–50 minutes and were conducted in the Northeast dialect to ensure linguistic and cultural accessibility (Corbin & Strauss, 2015). Respondents were encouraged to elaborate on their experiences, with comment boxes included in the questionnaire to supplement responses to closed-ended questions.

Data Analysis

The study employed quantitative and qualitative analysis techniques to ensure a comprehensive understanding of the data within the studied context.

Quantitatively, data collected from the survey were analyzed using Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including means, percentages, frequencies, and standard deviations, were computed to summarize respondents' socio-economic profiles and the degree of the pandemic's challenges. These measures provided a clear overview of the patterns and trends within the dataset, contributing to a robust quantitative assessment. Qualitatively, the qualitative data, particularly responses provided in the comment boxes of the survey, were audio-recorded, transcribed, and analyzed using a thematic analysis (Creswell, 2007). This approach enabled the exploration of a deeper contextual understanding of the respondents' experiences, uncovering recurring patterns and trends and offering nuanced insights into the challenges faced and strategies of respondents.

Ethical Considerations

The study adhered strict ethical guidelines to ensure respondent safety and data integrity. All respondents were informed about the study's objectives and their rights as participants. Informed consent was obtained before participation, and measures were implemented to maintain confidentiality, including pseudonymization of respondent identities. COVID-19 safety protocols, such as social distancing and face mask usage, were rigorously followed during data collection.

Results and Discussion

Socio-economic Profiles of Respondents

This section provides a socio-demographic summary of the selected respondents before delving into the impact of COVID-19. Table 1 outlines KSAE's socio-economic characteristics. The sample comprised 72 female members (96.00%) and 3 male members (4.00%). Most respondents were under 40 years of age (28.00%), followed by those over 60 years (25.33%). Due to the satisfying revenue from KSAE's successful operating outcomes, roughly 53% of respondents have been involved with the company for over 15 years.

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Table 1. Socio-economic Profile of Respondents (n=75)

Characteristic	Frequency	%
Sex		
Male	3	4.00
Female	72	96.00
Age (year)		
40 and below	21	28.00
41-50	18	24.00
51-60	17	22.67
More than 60	19	25.33
Educational level		
Primary school	50	66.67
Early secondary school	18	24.00
Secondary school or vocational certification	1	1.33
Bachelor's degree	6	8.00
Annual income contributed by agriculture (USD)		
2,800 and below	39	52.00
2,801-5,600	12	16.00
5,601-8,400	5	6.67
More than 8,400	19	25.33

COVID-19's Challenges to Respondents

The findings in Table 2 illustrate the significant empirical challenges of COVID-19 on respondents' operations. The data reveal that the pandemic severely disrupted multiple dimensions of their livelihoods, with income reductions, market disruptions, and heightened mental health stress emerging as the most eminent issues. Specifically, 86.7% of respondents identified income reductions as the most extensive challenge, reflected by a mean score of 4.31 (SD = 0.85). This was followed by increased mental health stress, which recorded a mean score of 4.20 (SD = 0.91). Remarkably, 82.7% of respondents either somewhat or strongly agreed that isolation and economic hardships during the pandemic aggravated their stress levels.

Additionally, the findings indicate that over 70% of respondents agreed that limited access to healthcare services constituted a critical issue, as evidenced by a mean score of 3.85 (SD = 1.11). This limitation hindered their ability to address COVID-19-related concerns and constrained their capacity to manage other medical conditions, further compounding the challenges during the pandemic.

Table 2 Perceptions of Challenges due to COVID-19

Challenge	Strongly Disagree	Somewhat Disagree	Neither Agree/ Disagree	Somewhat Agree	Strongly Agree	Total	Mean (SD)
Production and trade challenges							
Reduce access to markets	3 (4.0%)	5 (6.7%)	8 (10.7%)	26 (34.7%)	33 (44.0%)	75	4.08 (0.98)
Reduce demand for non-essential goods	5 (6.7%)	9 (12.0%)	12 (16.0%)	22 (29.3%)	27 (36.0%)	75	3.76 (1.14)
Increase input costs	2 (2.7%)	6 (8.0%)	10 (13.3%)	30 (40.0%)	27 (36.0%)	75	4.00 (0.92)
Food security challenges							

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Decrease dietary diversity and external food purchases	4 (5.3%)	8 (10.7%)	11 (14.7%)	27 (36.0%)	25 (33.3%)	75	3.81 (1.06)
Increase consumption of self-produced food	3 (4.0%)	7 (9.3%)	10 (13.3%)	24 (32.0%)	31 (41.3%)	75	3.97 (1.03)
Close markets limiting food access	6 (8.0%)	10 (13.3%)	14 (18.7%)	25 (33.3%)	20 (26.7%)	75	3.57 (1.16)
Health challenges							
Reduce healthcare access for COVID-19 and other conditions	5 (6.7%)	8 (10.87%)	9 (12.0%)	24 (32.0%)	29 (38.7%)	75	3.85 (1.11)
Infect the pandemic among elderly respondents	4 (5.3%)	7 (9.3%)	15 (20.0%)	28 (37.3%)	21 (28.0%)	75	3.74 (1.03)
Increase mental health stress from isolation and economic strain	2 (2.7%)	4 (5.3%)	7 (9.3%)	26 (34.7%)	36 (48.0%)	75	4.20 (0.91)
Income challenges							
Decrease income	1 (1.3%)	3 (4.0%)	6 (8.0%)	27 (36.0%)	38 (50.7%)	75	4.31 (0.85)
Increase financial strain	2 (2.7%)	5 (6.7%)	7 (9.3%)	26 (34.7%)	35 (46.7%)	75	4.16 (0.94)

Note: Means are on a 5-point scale (1 = Strongly Disagree to 5 = Strongly Agree).

Challenges of COVID-19

Production and trade challenges

Respondents identified various shocks and stresses resulting from COVID-19-related disturbances. Travel restrictions, lockdowns, and mobility constraints significantly limited access to onsite markets, created high uncertainty in market demand and prices, and caused labor shortages. Concurrently, prices for essential production inputs such as sugar, flour, eggs, and vegetable oils (e.g., palm oil prices increased from 270 THB to 950 THB per bucket) surged by 30-100%, driven by hoarding for profit speculation and household food security concerns. Consequently, most respondents reported a necessary reduction in daily production by at least 30% to cope with a 50% decline in demand due to COVID-19 restrictions and to minimize supply chain interruptions, which increased transportation costs and logistical challenges, further straining financial resources.

Changes in consumer behavior in Thailand also influenced the decrease in production and trade. KSAE's main product, rice crackers, is a domestic snack. With most consumers experiencing constrained incomes, spending was prioritized on staple foods such as rice, eggs, and canned products instead of non-essential and perishable goods. This absence of demand further exacerbated the economic difficulties faced by respondents.

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Food security challenges

Food security and consumption among respondents were jeopardized. Reduced income, higher costs associated with dietary goods, and the closure of physical markets and food service businesses led to decreased food availability and diversity within households. Respondents reduced external food purchases and dining out, increasing the consumption of their produce and exploiting ecological services within the community.

Health challenges

Globally, the COVID-19 pandemic has had a significant impact on public health, and Khon Kaen is no different. Although the rural environment of the KSAE location provided some degree of insulation from the virus's rapid spread, many respondents remained susceptible to COVID-19 and related health challenges. Approximately 70% of respondents were over 40 years old, making them vulnerable to the pandemic. Consequently, outbreaks in the country led to health challenges, causing respondents to be frequently absent from the enterprise's activities due to infection. Recovery rates among respondents varied and were delayed due to limited healthcare access. Additionally, the fear of contracting the virus deterred them from seeking necessary medical services, leading to delays in adequate diagnosis and treatment for COVID-19 and other health conditions. These conditions impacted both the physical and mental health of respondents and KSAE's business operations.

Income challenges

Nearly all respondents experienced undesirable impacts of COVID-19 containment measures on their income, with losses estimated at 30–50%. This discrepancy was explained by the varying effects of lockdown protocols and the prevalence of COVID-19 infections, which resulted in absences from group activities. Approximately one-fourth of respondents had no alternative income sources, such as on-farm income or off-farm income sources, indicating high financial vulnerability. Their income losses were particularly severe, exceeding 60–70%.

Coping Strategies

The study revealed that support from the government and other sources was rarely visible, compelling respondents to rely principally on their coping strategies as summarized in Table 3.

Coping strategies for production and trade challenges

This section highlights the various challenges faced by respondents due to COVID-19 effects, prompting many to adopt different strategies to mitigate the negative impact. As KSAE's business struggled with higher production costs and lower consumer demand, respondents were officially asked to lower their daily remuneration by 25%, from 400 THB to 300 THB. The suggestion to increase product prices to avoid reducing daily payments was vetoed through a democratic system among respondents. Additionally, working hours were shortened from 8:00 a.m. to 3:00 p.m., a two-hour reduction. These coping strategies were implemented to continue operations during the crisis and retain all members without dismissals. This plan was prudently formulated based on data after respondents were informed by the accountant that revenue had decreased by about 25-30% during the first nine months of the pandemic outbreak.

Despite the unsatisfactory income preventing 100% daily payments as before COVID-19, a few members, particularly teenagers in the community, were recruited into the enterprises. They utilized their familiarity with digital devices and mobile applications to register on online marketplaces, selling products directly to consumers and bypassing traditional marketplaces severely disrupted by the pandemic.

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Coping strategies for food security challenges

Respondents adopted different strategies to cope with reduced income affecting food availability. Most respondents felt compelled to lower the quantity of daily meals, reduce dietary diversity, and decrease eating out at food service businesses. This strategy was combined with exploiting ecological services such as foraging for wild foods.

Coping strategies for health challenges

Like other Thai populations forced to modify daily behaviors to cope with COVID-19, respondents strictly practiced wearing surgical masks and washing hands with hand sanitizer or soap. Health monitoring and early response measures included immediate isolation, seeking medical attention, and utilizing telemedicine services for consultations. Although respondents were informed that the vaccine does not guarantee immunity from infection and may have side effects, they were enthusiastic about engaging in the government's COVID-19 vaccination campaign to reduce the risk of severe illness.

Coping strategies also encompassed mental health. Respondents stayed connected with other enterprise members through phone calls, messaging apps, and social media, sharing support, resources, and advice on prevention measures to alleviate stress during lockdowns or social isolation.

Coping strategies for income challenges

Respondents with available land, especially around household areas, integrated high-value crops and vegetable gardens to ensure a continuous food supply and small income. As agricultural families, they benefited from the government's 'No One Left Behind' and 'Let's Go Halves' co-payment programs, which provided monthly cash transfers and discounted 50% of goods from registered retailers, respectively. These subsidies allowed them to secure well-being at a semi-sufficient level. Notably, borrowing money from friends and sourcing inputs through alternative means were untraceable

Table 3 Challenges and Coping Strategies of Respondents during COVID-19

Challenge	Detail	Coping Strategy	References to Resilience Concepts
Production and Trade	- Market access restrictions due to travel and lockdown measures - Increased input costs (30–100% price hike). - Reduced demand for non-essential goods (e.g., rice crackers). - 30% reduction in production.	- Reduced working hours (from 08:00–17:00 to 08:00–15:00). - Lowered daily wages from 400 to 300 THB. - Adoption of online marketplaces to bypass disrupted traditional channels.	Adaptation through reduced operations and digital solutions reflects resilience to systemic disruptions.
Food Security	- Decreased dietary diversity and external food purchases. - Increased consumption of self-produced food. - Market closures limited food availability.	- Reliance on self-produced food and foraging - Reduced meal quantities and variety - Community ecological services utilized	Highlighting the role of local food systems and adaptive self-reliance in maintaining food security during crises.
Health	- Limited healthcare access for COVID-19 and other conditions.	- Strict adherence to safety protocols (masks, hand washing)	Emphasizes community resilience and social

Journal of Ecohumanism
2025
Volume: 4, No: 1, pp. 4397 – 4410
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v4i1.6331

	- High infection rates among elderly members (70% aged 40+). - Mental health stress from isolation and economic strain.	- Vaccination campaign participation - Social support via digital communication (e.g., messaging apps)	capital in addressing health challenges.
Income	- Income losses were about 30–50%, with 25% having no alternative income sources. - Severe financial strain on members relying solely on enterprise income.	- Integration of vegetable gardens around households. - Participation in government subsidy programs (e.g., co-payment initiatives). - Borrowing and resource-sharing within the community.	Resilience through diversification of income sources and temporary reliance on institutions.

Discussion

This study examined the coping strategies employed to address the challenges of the COVID-19 pandemic on an agricultural enterprise in Khon Kaen Province, Thailand. The findings revealed that while agriculture has long been recognized as the "country's essential backbone" (Asian Development Bank, 2020), policy measures specifically tailored to mitigate the pandemic's threats were largely absent (World Health Organization Thailand, 2022). Consequently, significant coping strategies such as reducing dietary quantity, reallocating resources, and modifying behaviors were primarily self-initiated, reflecting the resilience and adaptability of the respondents in navigating pandemic-induced disturbances.

The challenges faced by respondents, including restricted market access, escalating production costs, and shifts in consumer behavior, emphasize significant vulnerabilities within agricultural systems. In response, respondents implemented adaptive measures such as reducing production levels, lowering daily payments, adjusting work hours, and adopting digital marketplaces to mitigate disruptions. These practices (Table 3) exemplify the principles of resilience theory, illustrating an ability to adapt existing practices and develop new ones to cope with dynamic and unforeseen conditions (Folke et al., 2016; Darnhofer, 2021). Resilience, particularly in agricultural systems, is crucial for maintaining stability in the face of uncertainty. It encompasses not only the capacity to withstand and recover from external disturbances but also the ability to capitalize on such experiences to advance robustness and continuous learning (Panpakdee et al., 2021).

The pandemic's consequences on food security and nutritional diversity caused respondents to rely more on self-produced food and community-based ecological services. These behaviors mitigated the financial and logistical challenges of external food purchases. Such strategies align with the broader conceptualization of resilience in socioecological systems, emphasizing the essence of self-reliance and localized food systems in enhancing food security during crises, particularly when centralized institutions are slow to respond (Panpakdee & Palinthorn, 2021). Resilience theory further posits that individuals and communities modify their behaviors and resource allocations in response to shifting socioecological conditions (Darnhofer, 2021). The observed coping strategies underscore the crucial role of local resource utilization and behavioral flexibility in safeguarding food security.

The pandemic also imposed physical and mental health challenges, with respondents experiencing fatigue due to illness, isolation, and economic strain. Their engagement in government vaccination campaigns and use of digital communication tools to maintain social connections reflect both problem-focused and emotion-focused coping strategies. These approaches address not only physical health concerns but also the psychological impacts of prolonged stress, consistent with the Transactional Model of Stress and Coping (Fonseca et al., 2019; Wolfers & Utz, 2022). This model highlights the crucial role of social capital and community resilience in stress mitigation, emphasizing the significance of social support in alleviating negative emotions and providing resources during crises (Partow et al., 2021). The strong social networks among respondents, nourished through long-term membership in the enterprise and kinship ties, further facilitated emotional and practical support, reinforcing the significance of communal bonds in building resilience (Massayamas & Silpchar, 2020).

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Additionally, respondents integrated vegetable gardening and participated in government co-payment programs to diversify income and enhance financial stability. These strategies are congruent with resilience and economic theories, which highlight relying on institutional subsidies and diversifying income sources as significant approaches to avoid financial risks (Neadkhun et al., 2023). Nonetheless, the study underlines the importance of being cautious when relying on outside funding. Short-term subsidies, while beneficial for immediate relief, often lack sustainability and are vulnerable to policy shifts (Do, 2023). Overdependence on such support can undermine farmers' motivation to pursue self-sufficiency and develop innovative income-generating strategies, increasing vulnerability to future disturbances and hindering long-term sustainable development (Darnhofer, 2021).

Conclusions

This study examines the challenges and coping strategies of respondents during the COVID-19 pandemic, highlighting the profound disruptions of pandemic-related restrictions. Because of these disruptions, which also raised manufacturing costs and limited market access, production had to be lowered to meet the dwindling demand from consumers, especially for non-essential goods like rice crackers. Food security was notably affected, as respondents faced diminished income and restricted market access, resulting in decreased availability and diversity of food. Health-related challenges were also evident, with respondents, particularly those over 40 years old, exhibiting heightened vulnerability to COVID-19 and associated health complications. Fear of contracting the virus further limited access to essential medical services, exacerbating physical and mental health concerns and negatively impacting business operations. Significant income losses were also observed, with almost all respondents reporting a drop in their incomes. The absence of alternative income sources for a significant portion of participants underscored the high financial vulnerability within the community.

In the face of these challenges, respondents primarily employed self-initiated coping strategies. These included reducing remuneration and working hours while avoiding employee dismissals to deal with production and trade constraints. To mitigate food security challenges, respondents reduced dietary diversity and leveraged ecological services such as foraging for wild foods. Income constraints were alleviated through integrating high-value crops and vegetable gardens around households, as well as participation in government co-payment programs. These strategies emphasize the resilience and ingenuity of respondents in navigating the multifaceted impacts of the pandemic.

Despite the agricultural sector's key role as the "backbone of the country," the lack of targeted policy measures during the pandemic left respondents heavily reliant on their resources and adaptive capacities. This observation highlights the need for a comprehensive reassessment of policy frameworks to uphold agricultural communities during crises. Policy interventions should address income stability, production, trade, food security, and health challenges holistically, strengthening resilience and sustainability in future crises.

Acknowledgement

The authors would like to thank the KSAE's members for active participate in this study.

Data availability statement

Data will be made available on request.

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