ผลกระทบของทุน 5 ด้าน จากการเปลี่ยนระบบการผลิตข้าวโพดเลี้ยงสัตว์สู่ระบบเกษตรผสมผสานต่อวิถีชีวิตเกษตรกรในอำเภอนาน้อย จังหวัดน่าน

Impact on the Livelihood Assets from the Conversion of Maize Production System to the Integrated Agricultural System in Na Noi District, Nan Province

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บทคัดย่อ

การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อสำรวจคุณลักษณะพื้นฐานทางประชากร ทุน และศักยภาพของเกษตรกรในระบบการผลิต และวิเคราะห์ผลกระทบจากการปรับเปลี่ยนระบบการผลิตข้าวโพดเพื่อการค้ามาสู่การทำเกษตรกรรมแบบกึ่งการค้าและเกษตรผสมผสาน ภายใต้กรอบการดำรงชีวิตอย่างยั่งยืน การวิจัยได้รวบรวมข้อมูลจาก 300 ครัวเรือนของทั้ง 3 ระบบการเกษตร ในอำเภอนาน้อย จังหวัดน่าน โดยใช้ระเบียบวิธีเชิงคุณภาพและเชิงปริมาณ ผลการศึกษาแสดงให้เห็นว่าจำนวนคนงานในภาคเกษตรในครัวเรือนของทั้ง 3 ระบบมีจำนวนเฉลี่ยใกล้เคียงกัน ระบบเกษตรผสมผสานมีเกษตรกรที่อายุน้อยและมีการศึกษาสูง มีรายได้ เงินออม และมีสัดส่วนในการถือครองที่ดินสูงที่สุด ในขณะที่การเกษตรเชิงพาณิชย์มีที่ดินถือครองโดยเฉลี่ยต่ำที่สุด มีค่าใช้จ่ายประจำปีและหนี้สินที่เกิดจากต้นทุนในการผลิต สำหรับการเกษตรกึ่งพาณิชย์ให้ผลลัพธ์ที่เป็นกลางระหว่างระบบอื่นๆ เมื่อพิจารณาผลลัพธ์

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แล้ว สามารถสรุปได้ว่าการเปลี่ยนมาใช้เกษตรผสมผสานจะช่วยเพิ่มรายได้ของเกษตรกร ลดค่าใช้จ่าย ปรับปรุงการชำระหนี้ เพิ่มทุนโดยรวมเพิ่มความมั่นคงทางอาหารและส่งเสริมการเกษตรที่ยั่งยืนโดยฟื้นฟูคุณภาพของดิน น้ำ และอากาศ ช่วยให้เกษตรกรปรับตัวเข้ากับการเปลี่ยนแปลงของสภาพภูมิอากาศโลกเพื่อตอบโจทย์การพัฒนาการเกษตรที่ยั่งยืนต่อไปในอนาคต

คำสำคัญ: ทุนดำรงชีพ ข้าวโพด เกษตรผสมผสาน เกษตรเพื่อการค้า

Abstract

The study aims to explore the demographic attributes, assets, and farmer's potentialities across three agricultural systems and examine the consequences of transitioning from a precedent maize production system under the DFID's sustainable livelihood framework. Understanding livelihood assets can reveal an approach to poverty reduction and the differences in production models suitable for the local context, emphasizing self-reliance in food and sustainable income generation, and aiding local agencies in planning community development. The research gathered data from 100 households for each farming system in Na Noi District, Nan Province. The research employs both qualitative and quantitative methodologies. The results show that integrated farming has younger, higher-educated farmers with a significant portion of their income from agriculture. Commercial farming has the lowest average landholding and highest annual expenses and debts due to the costs of commercial crop production. Semi-commercial farming provides intermediate outcomes between the other systems. Upon results consideration, it can be inferred that switching to integrated agriculture increases farmers' incomes, reduces expenses, improves debt repayment, boosts overall capital, enhances food security, and promotes sustainable agriculture by restoring the quality of soil, water, and air and helping farmers adapt to climate change.

Keywords: Livelihood assets, Maize, Integrated farming, Commercial farming

Introduction

Commercial agriculture involves large-scale crop cultivation to supply raw materials to the agricultural industry and generate profit through domestic and international sales. This economic drive has led to a significant and rapid expansion of monoculture production (Kumari et al., 2015;

Alves, D. D. O., & De Oliveira, L., 2022). Monoculture farming, characterized by the repeated cultivation of a single crop on the same land, increases efficiency, but poses significant environmental risks, including soil nutrient depletion, heightened the disease susceptibility, deforestation, and soil degradation. These practices underscore the need for sustainable farming alternatives. Large-scale commercial farms exacerbate these issues, contributing to deforestation, and restricting small-scale farmers' access to arable land, thereby impeding progress toward achieving SDGs 13 and 15 (Salaheen & Biswas, 2019, pp. 23-32; Tom-Dery et al., 2023).

In Thailand, monoculture drives deforestation, reducing forest from 43% to 31% in five decades (Royal Forest Department, 2022; Sattraburut et al., 2024). Extensive headwater forests are systematically cleared for monoculture, especially maize for livestock. Northern Thailand is experiencing significant controversies due to changing cropping patterns, particularly the expansion of maize monocropping to serve the global livestock industry, these led to deforestation and the conversion of forest land to chemically-intensive maize farming. These changes have resulted in environmental issues: forest encroachment and annual field burning. Additionally, these changes have given rise to social problems, including farmer indebtedness (Charoenratana et al., 2021).

Monocrop agriculture, particularly maize production for the livestock industry, has expanded to 324,466 acres in Nan province, driven by seed availability, agrochemicals, and market access (Office of Agricultural Economics, 2014; Pongkijvorasin & Teerasuwannajak, 2015; Pampasit & Pampasit, 2018; Priyanud Chuensin, 2021). This expansion has caused environmental degradation, including decreased biodiversity, deforestation, and soil depletion, along with economic challenges like increased dependency on external inputs, declining incomes, and rising household debt (Kitchaicharoen et al., 2015; Suk-ueng & Pa-lha, 2021). The excessive use of agricultural chemicals, with 81,000 tons imported every six months, has further deteriorated land, water, and air quality, raising long-term health risks (Tantisirivit, 2017). In Na Noi District of Nan Province, maize cultivation spans 36,542 acres, accounting for 16.7% of the province's total maize-growing area (Office of Agricultural Economics, 2014). Government agencies are promoting agricultural diversification by introducing crops such as rubber and oil palm and integrated farming practices involving vegetables, rice, and fruits for household consumption.

Numerous studies utilized the British Department for International Development (DFID) Sustainable Livelihood Assets Framework to assess and improve livelihoods in their respective regions including Priyanud Chuensin (2021) used the Sustainable Livelihood Assets Framework (DFID) and the Theory of Change to identifying enabling factors for starting alternative farming in the highlands of Na Noi District, Nan Province to classify farming typologies and assessed the livelihood assets of 222 households using PRA tools, group discussions, and surveys. The results found farmers had good access to natural assets, part-commercial farms had better human assets, and physical assets needed improvement. Six enabling factors for alternative farming adoption were identified, including sustainable agriculture policies and role models. Fahad et al. (2022) evaluated multidimensional poverty status of poor households in Ha Giang province, Vietnam. They conducted household surveys in three rural districts and used the DFID framework to assess deficiencies in livelihood assets. The study revealed that the households were deficient in natural, social, and financial capital, classifying most as multidimensionally poor. The study emphasized the importance of distinguishing poverty dimensions for effective poverty reduction programs. Gupta (2023) assessed livelihoods in rural hilly areas of Almora District, Uttarakhand, India from Selecting four villages based on their Mission Antyodaya Ranking and used PRA tools, group discussions, and surveys. Data was analyzed using Principal Component Analysis (PCA). They concluded Maulekh had the highest livelihood scores, while Garkot Talla had the lowest. The study proposed practical and strategic interventions to address immediate and long-term challenges.

The DFID Sustainable Livelihood Assets Framework has been applied in various studies to assess and improve livelihoods in different regions. According to DFID guidelines, sustainable livelihood changes should be evaluated across five key assets: natural resources, physical assets, financial assets, social assets, and human assets. This evaluation involves comparative analysis, surveys, interviews, and economic modeling. Consequently, this study applied the DFID Sustainable Livelihood Framework to assess the impact of shifting from maize monoculture to diversified farming systems on these assets, thereby contributing to improved planning policies and the promotion of sustainable agriculture.

Methodology

Study Area and Sampling Size

A purposive sampling method was selected for this study from 300 maize farmers in Na Noi District (Figure 1) categorized into three groups based on their changes in farming practices. The first group transitioned from only maize cultivation to more integrated agricultural systems for over three years. The second group shifted from solely growing maize to semi-commercial production, incorporating other cash crops such as rubber, oil palm, and teak, alongside rice cultivation for household consumption, starting in 2003. The third group moved from complete maize cultivation to full commercial production, growing crops like rubber, teak, and oil palm in conjunction with maize since 2003.

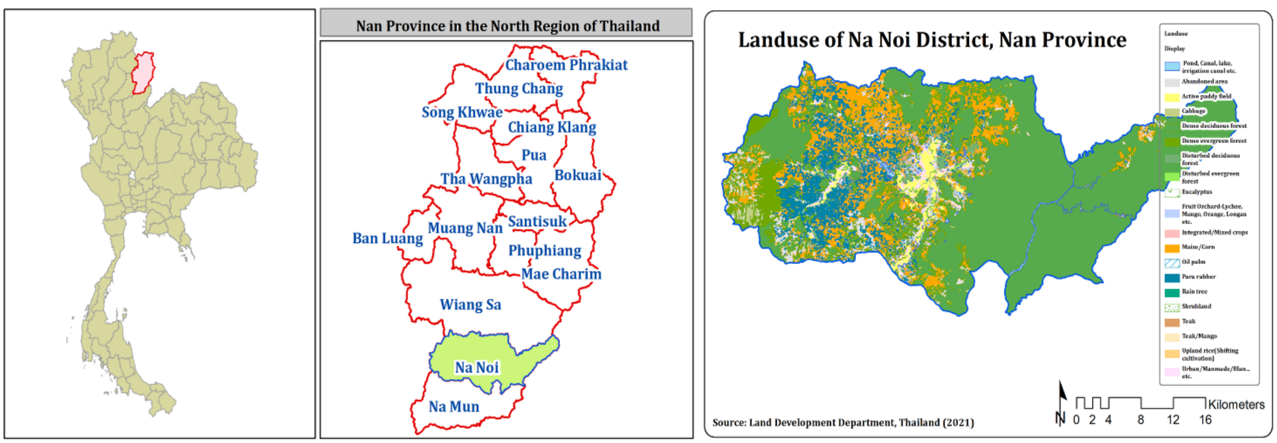

Figure 1 The landuse patterns in Na Noi District, Nan province, in northern region of Thailand.

Data Analysis

The research employed both quantitative and qualitative methods. A quantitative data was collected through semi-structured questionnaires with a 5-level Likert scale (Likert, 1961) was used to collect data on the five assets and potentiality, based on the outline in the DFID guideline. Three experts validated the relevant livelihood assets questionnaires using the IOC value, selecting questions with an index of 0.50 or higher. Adjustments were made based on expert feedback before testing reliability, which was confirmed with a Cronbach's Alpha Coefficient of 0.75. Qualitative data were collected by study area survey, household survey, meeting, in-depth interviewing, and focus group discussions with leading farmers and village/community leaders. Descriptive and inferential statistics were employed, including a paired-sample T-test and a One-Way ANOVA (F-Test) to assess variations and compare differences in average capital and potential across different farmer groups (Cronbach, 1990; Vanichbuncha & Vanichbuncha, 2015).

Results

Agricultural Context

The Na Noi District in Nan Province comprises eight sub-districts with a total of 68 villages and 10,983 households. The local population is mainly predominant, with a minority representation of the ethnic Hmong. The area's economy relies heavily on agriculture, with maize, rice, mung beans, soybeans, cabbage, and various vegetables being the main crops, along with livestock such as pigs, cows, water buffalo, ducks, and chickens. Despite agricultural extension and development services aiming to improve market opportunities and household incomes, increased use of chemical inputs has raised production costs. This, coupled with low productivity and market prices, has driven the expansion of maize cultivation into forested areas through slash-and-burn practices, leading to degraded land fertility and soil erosion. These actions have also encroached on National Conservation Forests, contributing to natural disasters during the rainy season. In response to the challenges faced by maize dependency, government agencies have proactively guided farmers towards alternative production systems. By 2003, the introduction of rubber and other perennial trees, including teak and oil palm, was implemented alongside the promotion of rice cultivation. These strategic shifts have fostered the emergence of three distinct agricultural practices in the practices: (1) Integrated farming (Group 1), which harmonizes short-term and long-term crops across various farmlands; (2) Semi-commercial farming (Group 2), which emphasizes cash crops coupled with subsistence rice production; and (3) Commercial farming (Group 3), primarily focused on cash crops such as maize, rubber, teak, and oil palm. Additionally, foraging forest products continue to provide supplementary sustenance and income for the local population.

Demographic Characteristics

Each household in the three farmer groups typically consists of three members by average involved in farming. Group 1 is mostly younger laborers with an average age of 49.68 years and higher earnings and savings. Their average annual income is 4,110.37 USD, with average savings of 206.91 USD. Agriculture contributes to 57.30% of their total earnings. Group 3 has the highest average household debt of 8,749.19 USD per year and relies heavily on purchased food. They also have increased expenditure on farming inputs and are exposed to risks associated with natural disasters and economic fluctuations.

Assets and Its Potentiality

On the five assets of assets and their potentiality, i.e. natural assets, physical assets, financial assets, social assets, and human assets of the three groups in the sample, before and after changes in production systems took place. F-test (One Way ANOVA) and T-test were employed to investigate the differences in the five assets among the three groups of farmers. The results of our testing at a 0.05 level of statistical significance show that before the changes took place, there were no significant differences in the five assets among the three groups as shown in Table 1. This explained that the study area had limited infrastructure before the production system changed. Farmers had few alternatives and mainly grew maize, relying heavily on external factors and capital. This led to high chemical use, environmental impact, and household debt. Limited access to knowledge and extension services worsened the situation. After the farmers implemented different production systems, no distinct changes and no significant differences in assets and potential were found among the three groups of farmers at the 0.05 level of statistical significance (Table 2).

Table 1 Results of Between Groups Differences on the Five Assets and Potential Before and After Changes in Agricultural Systems

Assets and Potential		Group 1 (Integrated)	Group 2 (Semi-Commercial	Group 3 (Commercial)	Test
		$\bar{X}$ (S.D.)	$\bar{X}$ (S.D.)	$\bar{X}$ (S.D.)	F (P-Value)
Physical	Before(1)	3.05[a] (1.52)	2.98[a] (1.32)	2.52[b] (1.07)	4.90* (.008)
	After(2)	3.61 (1.27)	3.55 (1.06)	3.26 (0.98)	2.87 (.058)
Natural	Before(1)	3.42 (1.10)	3.59 (1.02)	3.73 (0.77)	2.45 (.088)
	After(2)	3.83[a] (0.85)	3.62 (0.92)	3.25[b] (0.72)	12.52* (.000)

Table 1 Results of Between Groups Differences on the Five Assets and Potential Before and After Changes in Agricultural Systems. (Continued)

Assets and Potential		Group 1 (Integrated)	Group 2 (Semi-Commercial)	Group 3 (Commercial)	Test
		$\bar{X}$ (S.D.)	$\bar{X}$ (S.D.)	$\bar{X}$ (S.D.)	F (P-Value)
Financial	Before[(1)]	1.85	2.07	1.76	1.44
		(1.38)	(1.46)	(1.17)	(.239)
	After [(2)]	2.88[a]	2.36[a]	2.38[b]	4.97*
		(1.51)	(1.39)	(1.06)	(.008)
Human	Before[(1)]	2.84	2.94	2.58	2.25
		(1.24)	(1.28)	(0.93)	(.082)
	After[(2)]	3.59	3.31	3.44	1.80
		(1.13)	(1.13)	(0.91)	(.167)
Social	Before[(1)]	2.63	2.64	2.59	0.05
		(1.45)	(1.38)	(1.31)	(.956)
	After[(2)]	3.26	2.97	3.17	1.09
		(1.54)	(1.43)	(1.26)	(.339)
Five Assets	**Before[(1)]**	**2.76**	**2.84**	**2.63**	**0.75**
		(1.32)	**(1.28)**	**(1.04)**	**(0.475)**
	After[(2)]	**3.32**	**3.16**	**3.22**	**0.48**
		(1.24)	**(1.17)**	**(0.97)**	**(0.620)**

Notes: * Indicate the difference between groups, at 0.05 level of statistical significance.

(1) Before changes in agricultural systems. (2) After changes in agricultural systems.

a b c Significant difference.

In a study comparing the assets and potential of three groups of farmers before and after changes in production systems, F-test (One Way ANOVA) and T-test were used to analyze differences in natural, physical, financial, social, and human assets. Before the changes, there were no significant differences (at 0.05 level of statistical significance) in the assets among the groups, as shown in Table 1. Limited infrastructure and resources led to similar choices and high dependency on external factors and capital. After the changes, no significant differences in assets were found among the groups, as shown in Table 2. This suggests that the changes did not significantly impact the distribution of assets among the farmers.

However, after the agriculture pattern changes took place significant increases in the five assets of capital were found at 0.05 level of statistical significance, (Table 2). Development in infrastructure, such as the availability of electricity, improved road system and irrigation, had enabled farmers in the area greater access to factors of production and final product markets. Infrastructure improvements combined with extension services from the government sector had opened up more options for farmers. A great number of farmers were found to change their ways of thinking about production leading to more integrated systems put into practice. Several collective actions were observed as farmers realized the benefits of working together as groups. Farming groups formed include groups on rubber growers, maize growers, organic vegetables, and sustainable economy. As active groups, these farmers can access government extension services, secure capital, and exchange information and knowledge related to production and marketing. All these factors combined have led to a great reduction in the use of chemicals and great improvements in their livelihood.

Livelihood Assets and Impact from the Changes in Agricultural Systems

The change of capital in all five assets study found significant differences in physical assets among Commercial Production, Integrated Farming, and Semi-Commercial groups at the 0.05 level of statistical significance (Table 1). Indicators included access to electricity, clean water, road conditions, mobile phone ownership, and internet access. Infrastructure was underdeveloped, with many farmers still focusing on maize production. Improved infrastructure and extension services led to more diverse farming practices. Post-change analysis (Table 2) showed no significant differences in assets among the groups, but comparisons before and after the changes revealed significant increases in physical assets for all groups. The Integrated Farming group notably improved productivity through new knowledge, expanded marketing channels, and investments in better watering systems and electricity use, with reduced maize production and chemical use.

In natural assets, the study found no significant differences such as soil fertility, water availability, and environmental suitability for crop diversification among the three farmer groups at the 0.05 level of statistical significance (Table 1). Farmers' reliance on external inputs for maize cultivation negatively impacted soil fertility and the environment. Post-change analysis revealed significant differences in natural assets, with the Integrated Farming group showing improvements in soil fertility, water, and environmental diversity, while the Commercial Production group had less favorable natural assets (Table 2). This disparity is due to higher production costs and increased reliance on chemicals in commercial farming, adversely affecting soil and environmental quality.

Table 2 The Results of Testing on Differences of Farmers Livelihood Assets Before and After the Changes Agricultural Systems.

Assets and Potential	Group 1 (Integrated) (n=100)			Group 2 (Semi-Commercial)			Group 3 (Commercial) (n=100)		
	Before(1)	After(2)	Test	Before(1)	After(2)	Test	Before(1)	After(2)	Test
	$\bar{X}$ (S.D.)	$\bar{X}$ (S.D.)	t (P-Value)	$\bar{X}$ (S.D.)	$\bar{X}$ (S.D.)	t (P-Value)	$\bar{X}$ (S.D.)	$\bar{X}$ (S.D.)	t (P-Value)
1) Physical	3.10 (1.52)	3.61 (1.27)	13.72* (.000)	2.98 (1.32)	3.55 (1.06)	15.93* (.000)	2.52 (1.07)	3.26 (0.98)	29.22* (.000)
2) Natural	3.42 (1.10)	3.83 (0.85)	11.87* (.000)	3.59 (1.02)	3.62 (0.92)	1.77 (.080)	3.73 (0.77)	3.25 (0.72)	22.68* (.000)
3) Financial	1.85 (1.38)	2.88 (1.51)	13.24* (.000)	2.07 (1.46)	2.36 (1.39)	16.50* (.000)	1.76 (1.17)	2.38 (1.06)	27.99* (.000)
4) Human	2.84 (1.24)	3.59 (1.13)	23.33* (.000)	2.94 (1.28)	3.31 (1.13)	14.27* (.000)	2.58 (0.93)	3.44 (0.91)	36.25* (.000)
5) Social	2.63 (1.45)	3.26 (1.54)	16.82* (.000)	2.64 (1.38)	2.97 (1.43)	16.21* (.000)	2.59 (1.31)	3.17 (1.26)	25.31* (.000)
Five Assets (1-5)	**2.76 (1.32)**	**3.32 (1.24)**	**25.60* (0.000)**	**2.84 (1.28)**	**3.16 (1.17)**	**20.61* (0.000)**	**2.63 (1.04)**	**3.22 (0.97)**	**33.40* (0.000)**

Notes *indicate differences in assets before and after the changes when T-test, at 0.05 level of statistical significance.

(1) Before changes in agricultural systems. (2) After changes in agricultural systems

The subsequent capital asset category is financial assets. The analysis indicated no significant differences between the three groups of farmers in terms of savings, funding sources, access to financial institutions, regular income, farming income, and loans prior to the modifications of the farming system, as demonstrated at the 0.05 level of statistical significance in Table 1. Dependence on external production factors for maize cultivation led to high debts. Post-change, significant differences emerged in financial assets, with the Integrated Farming group showing notable improvements. Diversified farming reduced external dependency, mitigated risks, and increased income and savings. In contrast, the Commercial Production group continued to face higher household expenditures and reliance on external food sources (Table 2).

When considering differences in human assets among the three farmer groups, they were assessed based on production skills, use of local resources, application of local knowledge, crop production experience, access to agricultural information, and training opportunities. Before the changes in farming systems, no significant differences in human assets were found at the 0.05 level (Table 1), likely due to minimal application of local knowledge and high chemical dependency, which adversely affected farmers' health. After implementing changes, no significant differences were observed between the groups (Table 2). However, comparisons of pre- and post-change data revealed significant improvements in human assets for all groups. Increased collective actions, more meetings, and better information dissemination enhanced farmers' knowledge and management capabilities.

Finally, the assessment of social assets among the three farmer groups examined technical support, community cooperation, cultural event organization, labor exchange, and produce or land rent exchanges. No significant differences in social assets were found before or after the changes in agricultural systems at the 0.05 level (Table 1). This consistency may be due to ongoing participation in social and cultural events. However, post-change improvements included continued event participation, increased cooperation, enhanced support from government agencies, and the emergence of new groups such as the Organic Farming Group, Mango Production Group, and the Royal Project Group.

Conclusion

Changes in agricultural systems have demonstrated the potential to enhance all five aspects of assets for all three groups of farmers. Nevertheless, it was noted that the commercial farmers, had relatively minimal improvement in physical assets. This may be attributed to their previous engagement in mono-cropping with extensive use of chemicals for a long period. The accumulation of chemical residue in their farming areas consequently inhibited significant improvements in the physical assets of this group. The findings of our study indicate that transitioning from exclusively cultivating maize to more diversified farming practices has resulted in increased income, expanded cropping options leading to higher assets, and the safety of food production for household consumption effect increased food security level. Consequently, this shift has led to reduced household expenditure and an improved ability to repay debts. Furthermore, the change in farming systems has led to the enhancement of soil fertility with positive implications for the environment, thereby promoting sustainability in farming.

The research conducted on farmers in Na Noi District, Nan Province revealed that the shift from traditional maize monocropping to integrated agricultural systems led to various asset improvements, such as better access to farming information, reduced reliance on chemicals, enhanced soil fertility, and improved household food security. Several studies, including those by Glowacka (2016), Boonthueng (2013), Thongngam et al. (2014, p. 272–278), and Kura et al. (2016), support the benefits of integrated farming.

The enhancement of physical assets can improve agriculture production, transportation, and sales possibilities. According to Chappell & LaValle (2011), integrated practices led to a 20% increase in essential services access for farmers, while Singh et al. (2020) noted a 15% rise in mobile phone ownership among diversified farmers, improving market access. Garbach et al. (2017) observed a 25% improvement in soil fertility, reducing chemical inputs. Giller et al. (2021) found a 30% reduction in input costs and a 25% increase in net income for farmers using integrated systems. Additionally, Khumalo (2018) reported a 22% increase in the level of education among farmers, influencing the likelihood of starting a cooperative group, and Pretty et al. (211, p. 5-24) noted a 15% boost in social cohesion through group farming initiatives.

The findings suggest that sustainable agricultural development requires enhanced agricultural systems with greater diversification and reduced chemical use. Collaboration among farmers, group farming, and networking can enhance farmer potential. Policymakers should promote integrated farming systems, provide subsidies for organic fertilizers, invest in rural infrastructure, and encourage community participation and cooperative farming models to enhance farmers' livelihoods and sustainability across regions. Agencies related to policy, land allocation, land ownership, and water management should be involved in development plans to ensure access to farmland and sufficient water for agriculture. This aligns with Limnirankul et al. (2014), Wongput (2016), Sangchyoswat et al. (2019), and Panpakdee & Limnirankul (2018). Small-scale farmers' livelihood assets highlight the challenges and benefits of alternative farming in Na Noi and similar areas, as noted by Chuensin et al. (2022). Therefore, promoting alternative farming systems requires careful attention to livelihood assets. Future studies should focus on agricultural systems that balance production and local consumption, including marketing strategies for imports and exports, to develop systems suitable for the area's resources, labor, and economic value, reducing the need to import food crops.

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