Calvary Journal of Business and Economics
Vol.2, No. 3, 2025: 231-244

The Situation of Farmer's Vegetable Production in Lors Thmey Program of iDE Organization in Takeo Province, Cambodia

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A R T I C L E I N F O

Keywords: Bio-Fungicide, GAP Method, Brown Spot Disease, Organic Method, Rice

Received : 3 February
Revised : 22 April
Accepted: 20 May

A B S T R A C T

Climate change poses a serious threat to Cambodian agriculture, impacting crop yields, cultivation feasibility, irrigation, and pest/disease control. iDE, a long-standing development NGO, has implemented various programs to address these challenges, including one focused on climate-resilient vegetable cultivation. This study conducted in Takeo Province assessed the progress of 145 contract farmers participating in iDE's Lors Thmey Program. Results indicate that farmers, motivated by peer success, have adopted modern agricultural practices, including multiple planting, deep plowing, and lime application. Cucumber is a popular crop, though diseases and pests remain significant obstacles. Farmers primarily rely on technical assistance for waste management and utilize soluble fertilizers with drip irrigation. Seaweed cultivation has emerged as a particularly profitable venture, contributing to increased household income and reduced migration. However, rising agricultural debt, limited land, capital constraints, and adverse weather conditions pose challenges. Despite these obstacles, farmers, with continued technical support, express a strong desire to expand their cultivation and tap into both domestic and international markets

INTRODUCTION

According to the FAO (2013), the global population is projected to increase from 2 billion to 9 billion by 2050, necessitating a 70% increase in agricultural production to feed an estimated 40% of the world's population. To meet this demand, a 90% increase in agricultural output is anticipated through intensified production cycles and improved cultivation techniques, while the remaining 10% will come from expanding agricultural land. As agricultural land expands, so too does the production of traditional vegetables. Farmers, market policy researchers, and the general public are increasingly interested in traditional vegetable production. However, this sector faces numerous challenges, including climate change, global warming, land grabbing, urban development, and the rise of pests and diseases. Historically, the agricultural population was older, and agricultural policy was shifting towards horticulture (Andreas, 2014).

Approximately 30% of the global population resides in Asia. Many cities in the Asia-Pacific region are vulnerable to food supply shortages due to issues like poor quality and significant food loss (Greg et al., 2008). Consequently, Southeast Asian countries must prioritize increasing agricultural production while minimizing losses, waste, and environmental impact. To address these challenges, agricultural solutions should focus on enhancing productivity and profitability, producing health-beneficial products, advancing crop protection technologies, supporting local cultivation through research, optimizing the vegetable production chain, and fostering strong partnerships with the private sector. Smallholder farmers can be empowered through readily accessible information and business skills training to connect with distributors and marketers (Hughes et al., 2015).

LITERATURE REVIEW

Cambodia, a Southeast Asian nation, is particularly vulnerable to floods and droughts. This vulnerability stems from the reliance of its population on natural resources and the dominance of agriculture, including animal husbandry, crop production, and rice cultivation, as primary livelihoods (Oxfam, 2007). Cambodia's agricultural sector, the backbone of the nation's economy, sustains over 80% of its population. Cambodian farmers cultivate vegetables as a supplementary crop, particularly during the dry season following the rice harvest (Ministry of Planning, 2008). This practice aims to enhance food security, bolster family income, and contribute to national economic growth. However, these traditional cultivation methods often yield insufficient produce to meet family needs (Touch & Edwin, 2007). Farmers' limited understanding of vegetable cultivation techniques, such as pesticide and chemical fertilizer use, has led to soil degradation and challenges in maintaining optimal soil composition. Additionally, factors like low consumption rates, intense competition from imported vegetables, the limited water-holding capacity of sandy loam soils, and a lack of knowledge about modern agricultural technologies hinder the development of vegetable production. These factors result in production variability influenced by unpredictable weather patterns, including heavy rainfall, floods, and irregular hot-humid conditions. Post-

harvest practices, including fertilizer and agrochemical application, often fall short of technical standards (MAFF, 2012).

This study focuses on three primary objectives: 1) Assessing the status of farmers' technical implementation of vegetable production, 2) Analyzing changes in farmers' livelihoods before and after program participation, and 3) Identifying potential and challenges associated with vegetable production.

METODOLOGI

Location of study

The study was conducted from September 1, 2020, to June 30, 2023, in five districts of Takeo province: Samrong, Treang, Borey Chulsar, Kirivong, and Koh Andet. The study enrolled 145 new contract farmers. The COVID-19 pandemic in 2020 and 2021 significantly extended the study period.

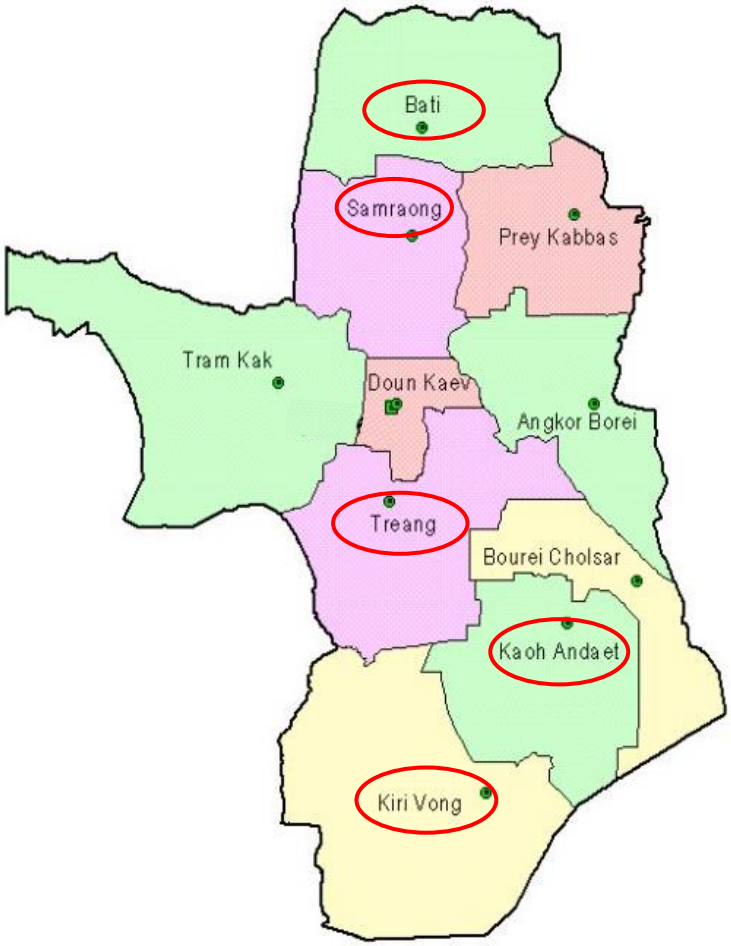

Figure 1. Map of Takeo Province and Targeted Location of Study

Materials

Data collection primarily relied on questionnaires, pencils, and pens. Motorbikes were used as transportation to facilitate interviews with farmers, while computers were utilized for data entry, analysis, and report writing.

Sampling selection method

Purposive sampling was carried out to select the target provinces and districts for research. The interviewees were contracted farmers from five districts. The total number of families selected to study was 145 families. The sample of farmers to be interviewed was randomly selected.

Table 1. Number of Samples in Each District

Province	District	Contract farmers	Samples	Percentage
Takeo	Samrong	99	63	43.45%
	Treang	24	16	11.03%
	Borey Chulsar	27	17	11.72%
	Kirivong	53	34	23.45%
	Koh Andet	24	15	10.35%
Total		**227**	**145**	**100%**

Sampling Selection Method

The first step, we collaborated with program staff to gather essential information, including target areas, farmers, program activities, and promoted techniques. We also conducted preliminary interviews with target farmers to collect baseline data on cultivation practices, pre- and post-program conditions, and challenges faced in vegetable production. This information was used to develop a questionnaire. To refine the questionnaire, we conducted pilot interviews with five farmers. This allowed us to assess the questionnaire's clarity and effectiveness, verify data accuracy, and make necessary adjustments. A team of five agriculture graduates conducted these pilot interviews over a week. Before the main data collection phase, interviewers received training on the study's objectives, questionnaire content, and effective interviewing techniques. To ensure data accuracy, we conducted individual interviews with farmers who had firsthand experience in vegetable cultivation. This approach allowed us to collect reliable information from all 145 farming families.

Data Collection and Data Analysis

The data collection for this study is divided into two categories:

a. Primary data: This data comes from surveys and face-to-face interviews with farmers. Interviews were conducted through a pre-arranged list of questions, with closed-form questions and open-form questions.

b. Secondary data: This data is collected through theses, dissertations, documents in the library, international magazines, and new software files.

Collected data were analyzed in descriptive statistics, calculating the mean and percentage. We perform all analysis using a computer, specifically Microsoft Excel and SPSS Version 24.0.

RESULTS AND DISCUSSION

The Status of Farmers' Technical Implementation of Vegetable Production

Farmers participating in the Lors Thmey Program possess significant experience and expertise in planting techniques, enabling them to adapt to the challenges posed by climate change. The program's focus on technical training empowers farmers to achieve high yields and reasonable profits. Training topics include nursery management, planting, soil preparation, irrigation, mulching, fertilization, pest and disease control, harvesting, packaging, and plant hygiene. Additionally, farmers have adopted new agricultural inputs such as drip irrigation, plastic mulching, netting, and soluble fertilizers to mitigate the effects of climate change. These innovative practices have led to increased cultivation areas, higher yields, reduced labor requirements, improved climate resilience, and year-round crop production.

The result showed that Frequency analysis reveals that new farmers tend to favor fruit crops over leafy vegetables and tubers. Cucumbers were the most popular choice, accounting for 30.97% of plantings. Bitter gourd and wax gourd followed, with 16.31% and 15.69% respectively. Other popular choices included longbeans (9.29%), tomatoes (6.40%), spong gourd (5.78%), long eggplants and round eggplants (4.95% and 2.06%), chili (3.98%), corn (3.10%), and various other crops (1.47%).

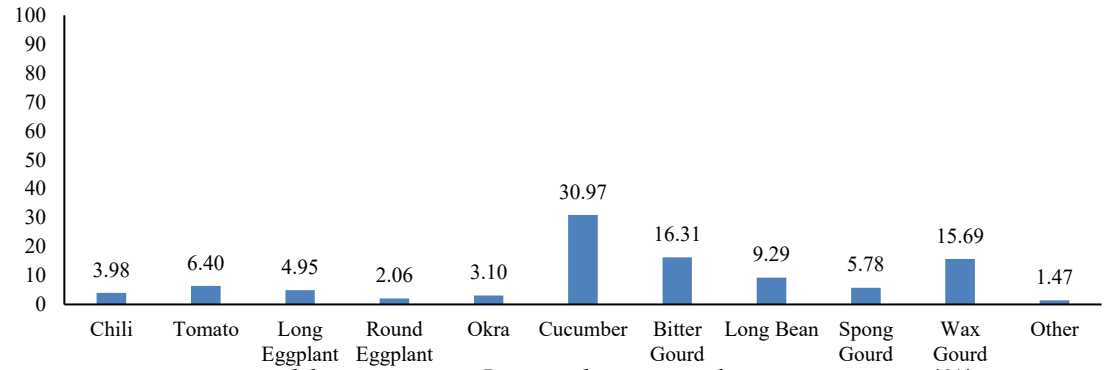

Figure 2. Vegetable Varieties Grown by Lors Thmey Farmers (%)

The descriptive statistical analysis reveals an average vegetable yield of 41 tons per hectare per crop cycle. Wax gourd and cucumbers produced with an average yield of 41 tons per hectare and 33.10 tons per hectare, respectively. Other significant crops and their average yields per hectare include: bitter gourd 27.25 tons, long bean 25.06 tons, sponge gourd 22.02 tons, tomatoes 18.50 tons, long eggplant 13.30 tons, chili 12.11 tons, and okra 9.80 tons.

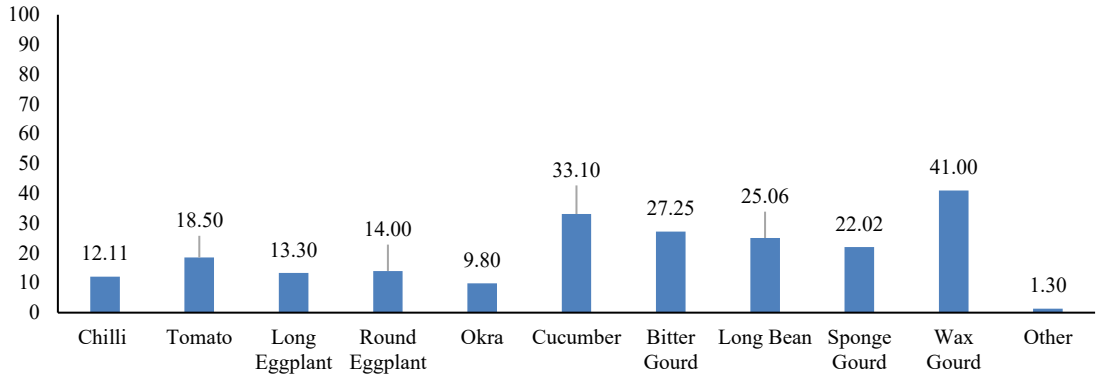

Figure 3. An Average Vegetable Yield Per Hectare Per Crop Cycle (Tons/Hectare)

Frequency analysis reveals a diverse range of fertilizer practices among farmers, encompassing both natural and chemical options. Notably, 32.15% of farmers utilize soluble fertilizers in conjunction with drip irrigation systems. Chemical fertilizers, particularly NPK, are widely adopted by 31.08% of farmers, primarily for soil mulching during preparation. Manure usage, while common among 29.15% of farmers, is slightly less prevalent than chemical fertilizers. Additionally, 7.61% of farmers produce and apply organic fertilizers. Synthetic fertilizers, however, appear to be absent from farming practices in this region.

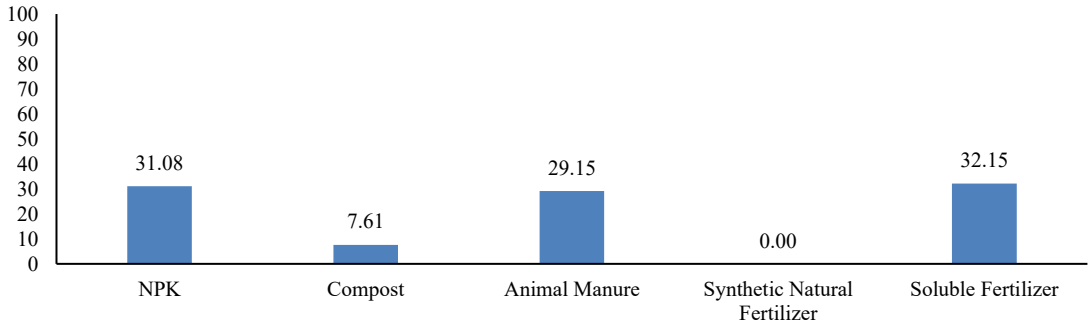

Figure 4. Types of Fertilizer that Farmers Used (%)

For farmers' pest control methods, frequency analysis reveals that farmers employ a variety of methods to manage pests and diseases. When crops are affected, the most common approach is seeking technical assistance, adopted by 36.68% of farmers. Manual removal is also widely used, accounting for 29.73% of responses. Chemical treatments are considered by 29.34% of farmers as a potential solution. Natural remedies are the least preferred method, with only 1.93% of farmers opting for this approach. Additionally, 2.32% of farmers utilize a combination of methods to address pest and disease issues.

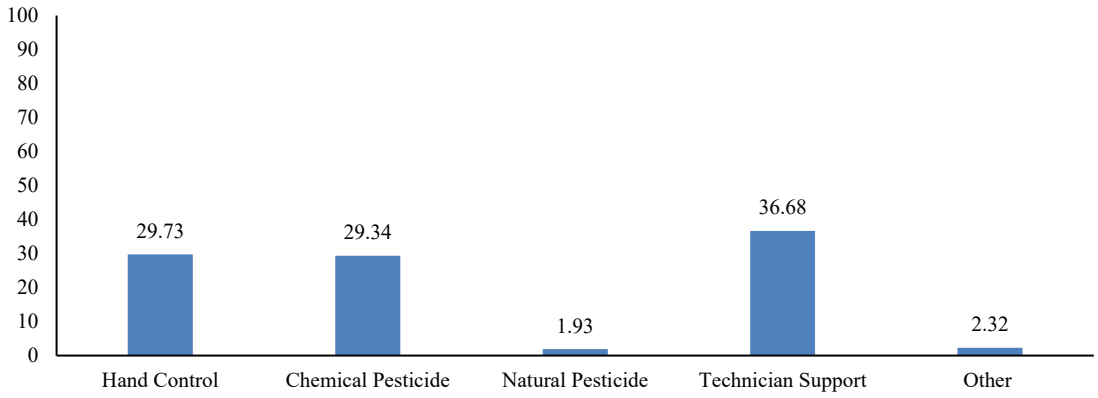

Figure 5. Practical Solutions to Counteracting Harmful Pests

Frequency analysis indicates that farmers encounter a range of pests, with catapillar being the most prevalent at 20.07%. Thrips and whiteflies follow closely, each accounting for 19.34% and 18.45%, respectively. These pests pose significant threats to crops, as they both suck plant sap and transmit viral diseases. Other notable pests include aphid (11.96%), redspidermite (11.15%), ladybug (9.45%), and various other insects (7.08%). Stinkbug, however, is the least common pest, with a prevalence of only 2.51%.

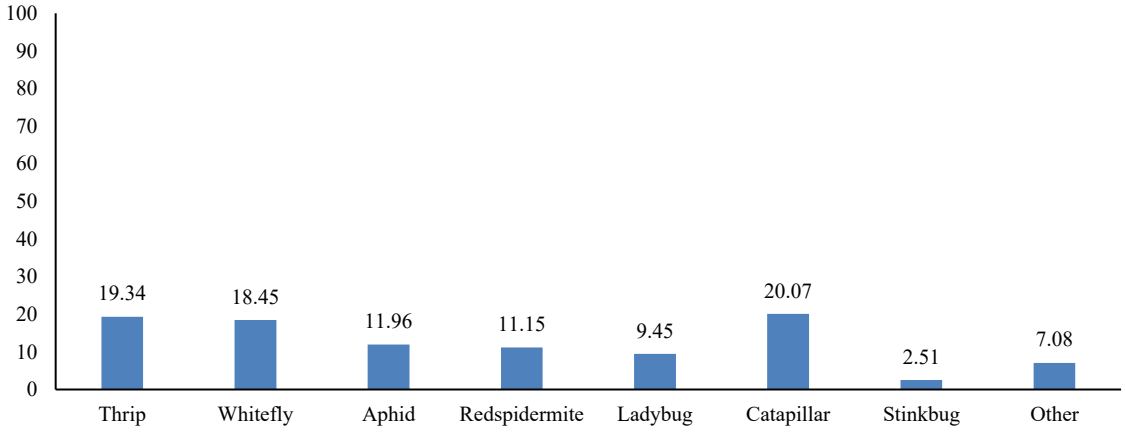

Figure 6. Practical Solutions to Counteracting Harmful Pests

For the presence of disease on farmers' vegetable crops, frequency analysis indicates that fungal diseases pose the most significant threat to farmers' crops, affecting 49.18% of respondents. Viral infections follow closely, impacting 30.16% of farmers. Bacterial infections and nematode infestations are less prevalent, accounting for 14.43% and 6.23%, respectively.

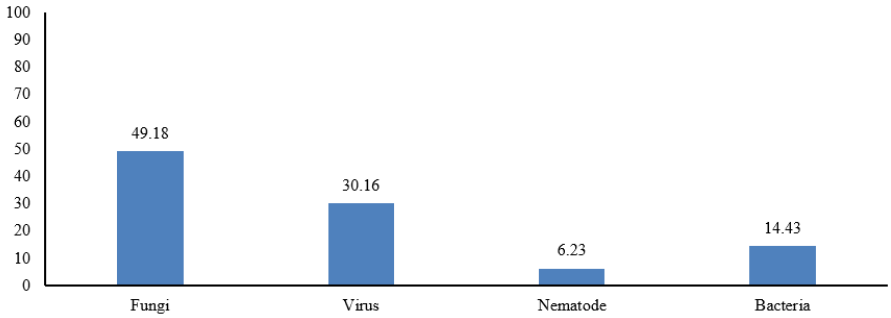

Figure 7. The presence of Disease on Farmers' Vegetable Crops

The Farmers' Livelihoods Before and After Program Participation

After participating in the Lors Thmey Program, many farmers have transitioned from subsistence vegetable farming to commercial production for market supply. This shift has significantly increased their annual household income from vegetable cultivation, rising from 226,500 Riel to 8,215,400 Riel. Farmers have also expanded their cultivation areas, converting vacant or residential land into productive vegetable plots. This has increased the average cultivated area per family from 0.08 to 0.26 hectares. Additionally, the program has reduced out-migration, with the percentage of migrant farmers decreasing from 50% to 35.3%. Improved living standards and social factors have led to increased ownership of televisions and motorcycles. Furthermore, farmers have invested in agricultural equipment, such as pumps, motors, and spray tanks, to enhance their farming practices. However, this increased prosperity has also led to higher household expenses, particularly in areas like food, education, and community participation.

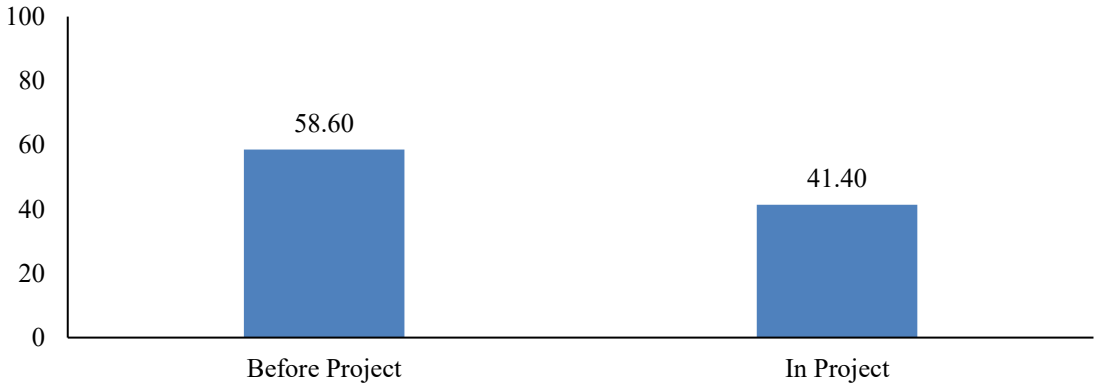

Figure 8. The Situation of Farmers' Migration in Studied Area

Frequency analysis indicates that participation in the Lors Thmey Program has significantly reduced migration among farmers. Before joining the program, 58.60% of farmers engaged in labor migration. However, after participating, this figure decreased to 41.40%.

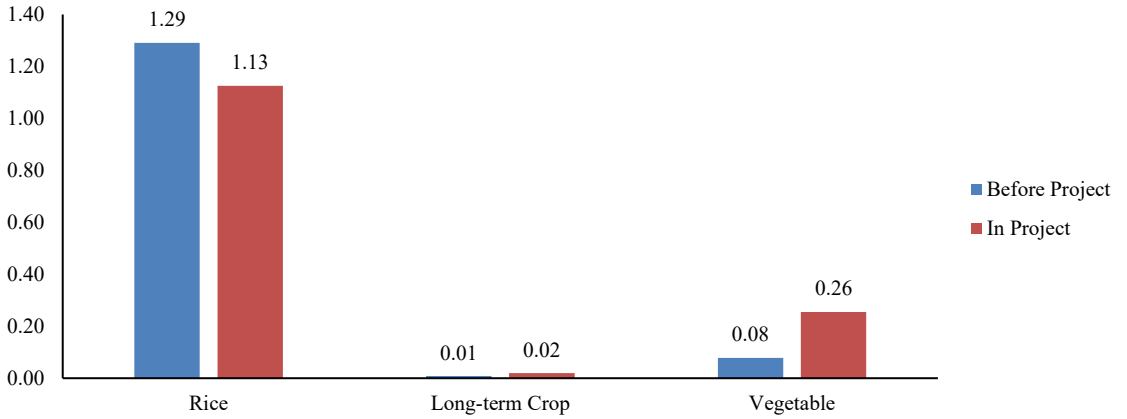

Figure 9. The Average of Farmers' Production Land (Hectare/Family)

A statistical analysis comparing the average land use patterns of farmers before and after participating in the program reveals significant changes. Notably, the cultivated area has increased substantially, rising from an average of 0.08 hectares per family to 0.26 hectares per family. Similarly, the area under plantation has also increased, albeit to a lesser extent, from 0.01 hectares to 0.02 hectares per family. Conversely, the area of farmland has decreased from 1.29 hectares to 1.13 hectares per family.

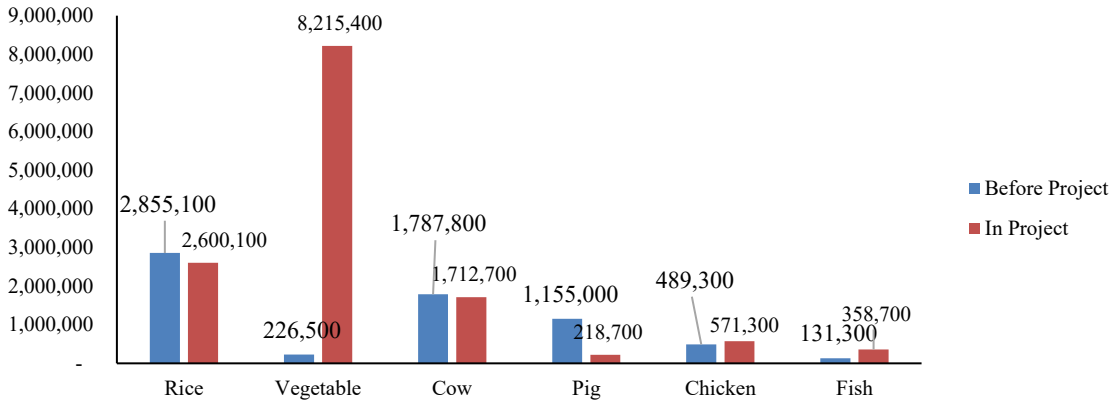

Figure 10. The Average Income From Agricultural Production (Riel/Family)

Statistical analysis reveals a significant increase in average annual income for farmers, particularly from vegetable cultivation. Before joining the program, average annual income from vegetable cultivation was a modest 226,500 Riel per family. However, after participating, this figure soared to 8,215,400 Riel per family. While less substantial, income from fish farming also increased, rising from 131,300 Riel to 358,700 Riel per family. Other income sources, such as rice cultivation, cattle raising, and chicken farming, experienced minor fluctuations. Rice cultivation income decreased slightly from 2,855,100 Riel to 2,600,100 Riel, and cattle raising income declined from 1,787,800 Riel to 1,712,700 Riel. Conversely, chicken farming income increased modestly from 489,300 Riel to 571,300 Riel. A notable decline occurred in pig farming income. Before the program, the average income from pig farming was 1,155,000 Riel per family.

However, after joining the program, many farmers abandoned pig farming, leading to a significant decrease in income to 218,700 Riel per family.

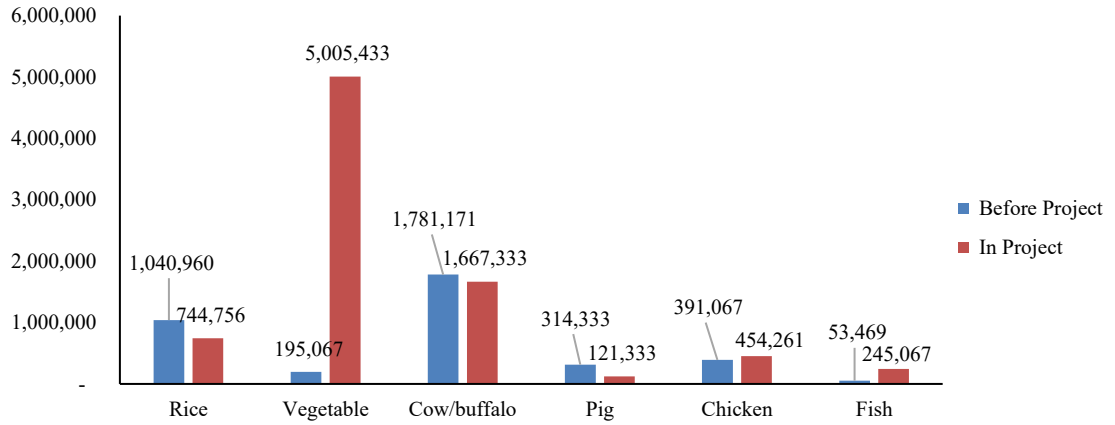

Figure 11. The Gross Profit from Agricultural Production (Riel/Family)

A statistical analysis of annual profit margins reveals that crop production has the highest profitability among all agricultural activities. Before participating in the program, the average profit from vegetable cultivation was a modest 195,000 Riel per family. However, after joining the program, this figure surged to a significant 5,005,400 Riel per family. Similarly, fish farming also witnessed increased profitability, rising from 53,400 Riel to 245,000 Riel per family. Chicken farming also experienced a slight increase, from 391,000 Riel to 454,200 Riel per family.

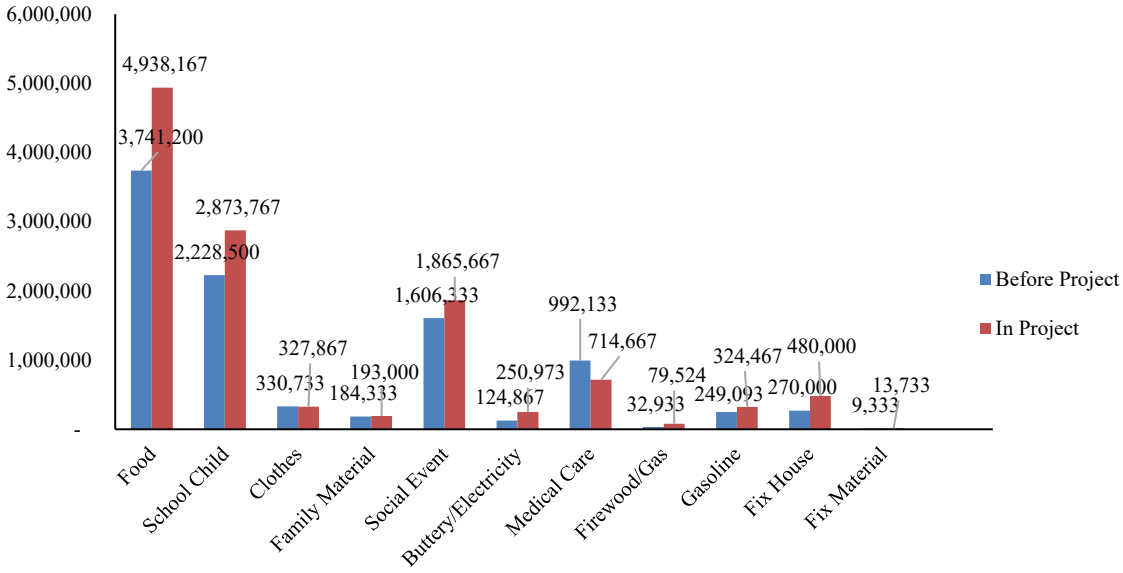

Figure 12. The Total Expense in Their Families (Riel/Family)

The statistical analysis reveals significant changes in household expenditure patterns among farmers after participating in the Lors Thmey Program. While some expenses increased, others decreased.

Food expenses increased significantly, rising from an average of 3,741,200 Riel to 4,938,100 Riel per family per year. Similarly, education costs increased from 2,228,500 Riel to 2,873,700 Riel. Other expenses that increased include participation in community programs (from 1,606,300 Riel to 1,865,600 Riel), home repairs (from 270,000 Riel to 480,000 Riel), fuel and gasoline (from 249,000 Riel to 324,400 Riel), electricity (from 124,800 Riel to 250,900 Riel), and household appliances (from 184,300 Riel to 193,000 Riel). Conversely, some expenses decreased. Clothing expenses declined slightly from 330,700 Riel to 327,800 Riel per family. More significantly, spending on healthcare, cigarettes, and alcohol decreased substantially, dropping from 992,100 Riel to 714,600 Riel per family.

The Potential And Challenges Associated With Vegetable Production

Most farmers express a keen interest in expanding their vegetable cultivation. Despite having access to free land and water resources, many struggle to sustain year-round production. A significant 98% of farmers who have adopted the Lors Thmey Program have gained additional technical knowledge and skills to facilitate expansion. Farmers generally prefer to cultivate vegetables in both dry and wet seasons. However, potential farmers face various challenges, including market access, crop diseases, and climate change.

- *Available water sources for expanding vegetable production*

Frequency analysis reveals that access to irrigation water is a significant factor in farmers' ability to expand their crops. Approximately 63.3% of farmers have access to irrigation water, enabling them to consider expansion. However, 36.7% of farmers lack access to irrigation water, limiting their potential for crop expansion and supplementary income generation.

- *Available capital for expanding vegetable production*

Frequency analysis indicates that capital is a significant constraint for farmers seeking to expand their cultivation. Only 24.70% of farmers participating in the program have sufficient capital to expand, while the remaining 75.30% lack the necessary financial resources.

- *Available technical supports*

Frequency analysis reveals that nearly all farmers participating in the program have access to additional technical support for expanding their cultivation or introducing new crops. Specifically, 98% of farmers can access program-provided technical assistance. Only a small minority (2%) of farmers in remote areas with limited program presence face difficulties in accessing this support.

- *Farmers's interesting on expanding vegetable production*

Frequency analysis indicates that a significant majority of farmers, 86.7%, are interested in expanding their cultivation. Only 13.3% of farmers expressed disinterest in further expanding their crop production.

- *Challenges for farmers' production*

Frequency analysis reveals that farmers face multiple challenges in their agricultural production. Capital shortage is the most significant obstacle, affecting 25.76% of farmers. Adverse weather conditions, such as droughts or

floods, impact 23.35% of farmers. Water scarcity is another major issue, affecting 19.97% of farmers. Labor shortages pose a challenge for 15.46% of farmers. Other factors, such as pests, diseases, distance to plantations, disabilities, and miscellaneous issues, have a less significant impact on farmers' production.

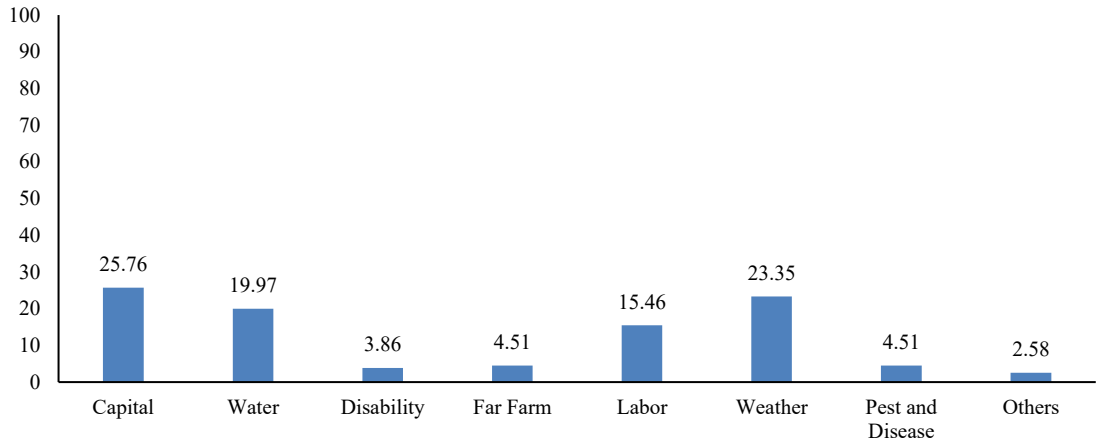

Figure 13. The Challenges for Farmers' Production (%)

CONCLUSION AND RECOMMENDATION

The Lors Thmey Program has provided farmers with valuable skills in vegetable cultivation, including land preparation, seed selection, planting, care, and harvesting. These skills have enabled farmers to adapt to climate change and reduce labor demands, as tasks like weeding, irrigation, and fertilization have become more efficient. As a result, farmers can now cultivate vegetables year-round and produce high yields to supply both local and regional markets.

Vegetable cultivation has become a significant source of income for participating farmers. Increased income has allowed them to improve their household's financial situation, covering expenses such as food, clothing, education, and household appliances like motorcycles, televisions, and mobile phones. Farmers have also optimized land use by cultivating vacant land and growing vegetables on rice fields after the harvest. This has contributed to reduced migration and improved livelihoods for farming families.

While farmers aim to expand their vegetable cultivation, they face several challenges. Market access, crop diseases, irrigation, and climate change remain significant obstacles. However, nearly all farmers have access to additional technical support from the program, which can help them overcome these challenges and further enhance their vegetable production.

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to Associate Professor Dr. Serey Mardy and Assistant Prof. Kang Tithya, researchers at Svay Rieng University for his invaluable guidance and insightful comments throughout my research

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