

**THE DEVELOPMENT OF SUSTAINABLE FARMING THROUGH AGRICULTURAL
COOPERATIVES IN CAMBODIA- CASE STUDY IN PREY KABBAS, TAKEO
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THE DEVELOPMENT OF SUSTAINABLE FARMING THROUGH AGRICULTURAL COOPERATIVES IN CAMBODIA- CASE STUDY IN PREY KABBAS, TAKEO PROVINCE

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ABSTRACT

One of Cambodia's major agricultural problems is the improper and excessive use of agrochemicals. The heavy use of the chemical has contributed to soil and water supplies degradation, and significantly damaged the ecosystems. It is recommended from the World Bank Report (2015) to strengthen sustainable agriculture in Cambodia for future agricultural growth. This study aims to determine the contribution of agricultural cooperative to promote sustainable rice farming and the development challenges of agricultural cooperatives. This study is based on the survey conducted in Prey Kabbas District, Takeo province, in July 2019. Mixed methodology was employed, and three agricultural cooperatives that supported sustainable farming were selected. A total of 140 farmers were randomly selected and interviewed using a semi-structured interview-based. This study found that most of the selected agricultural cooperatives are adopting sustainable rice farming by using high resistance variety and utilizing at least fifty percent of natural materials in the field. Three factors provided by agricultural cooperatives include financial support, social capital, and technical support have facilitated farmers to practice sustainable farming. However, some significant challenges hindered the operation of agricultural cooperatives. All key stakeholders must strengthen agricultural cooperatives to improve rural livelihood and promote sustainable agriculture for future agricultural growth.

Keywords: Agricultural cooperatives, Cambodia, challenges, development, sustainable agriculture

INTRODUCTION

Cambodia has experienced rapid growth of the agriculture sector and, accordingly, a profound transformation of the rural society, from traditional subsistence to commercial agriculture. While intensification occurs chaotically in some regions with a recent boost in fertilizer use and a slow but steady rise in food production, their production system depends on outdated technologies coupled with lack of capital, market information, infrastructure, and high production cost. Most Cambodian farmers use agriculture to meet their daily consumption needs and cultivate almost exclusively rice using traditional farming practices (Diepart 2010; Srean et al. 2018). Small and variable (depending on seasonal weather conditions) productions make farmers extremely vulnerable economically (Ministry of Planning, 2013). Besides, Cambodia is also considered one of the countries in Southeast Asia that are positively affected by climate change. From the enormous floods in 2011 to the prolonged droughts in 2019, Cambodian farmers have increasingly exposed to the adverse effects of climate-related risks, both in crop growth and pest and disease outbreak.

Increasing awareness of the negative environmental and farming impacts of conventional farming has led to a drive for more sustainable farming systems. A variety of scientific studies on sustainable farming techniques such as Integrated Pest Management (IPM), Farmer Field Schools (FFS), and, more recently, low-input farming systems such as the Rice Intensification System (SRI) are ongoing in Cambodia (Alice B., 2008). Organic farming has expanded across Cambodia since the late 1990s, and now there are many organizations supporting organics, including non-governmental organizations (NGOs), international donation agencies, private businesses, and government offices. The Royal Government of Cambodia has also established organic farming as a priority sector (UNESCAP, 2002), to achieve food stability, diversify rural livelihoods, and gain access to value-added markets. To ensure Cambodian agriculture's future growth, it is essential to strengthening sustainable farming (World Bank, 2015).

Even though the sustainable farming system such as organic farming has the potential for targeting niche markets and creating high farming incomes, it is reported that little of Cambodian farm household chose to practice this system. One way to develop sustainable farming is to promote through agricultural cooperatives, facilitating members both financially and socially. This study aims to determine agricultural cooperatives' contributions to promote sustainable farming and its challenges, based on interviews with ACs members. It also aims to identify the differences in socio-economic characteristics between members of agricultural cooperatives and non-members as well as the differences in costs and returns.

MATERIALS AND METHODS

This study is conducted in Prey Kabbas District, Takeo province. Takeo province is known as one of the most significant rice-producing areas in Cambodia and eighty-three percent of the population engaged in agricultural sector as reported in district department of agricultural in Prey Kabbas, 2018. Consequently, this area is regarded as low diversification in farming systems, and it is easy to prone to natural disasters such as drought and flood every year. With such a poor farming condition, farmers are suggested to implement agricultural methods that are more resistant to floods and reduce agrochemicals to mitigate the environmental crisis.

This study employed both primary and secondary data. Three Agricultural cooperatives that promoted sustainable farming in the study area were selected: Reaksmeay RongReung Agricultural Cooperative (RR AC), Chomnoum Chomreun Phal Agricultural Cooperative (CC AC), and Sdok Sdom Agricultural Cooperative (CC AC). A total of 140 farmers contained 30 ACs members from each agricultural cooperatives, and 50 non-members were randomly selected and interviewed using a semi-structured interview. Qualitative data were also derived from agricultural cooperatives, department of agricultural, fisheries, and forestry offices in Prey Kabas District and Takeo province, online journals, reports, and other sources.

This study utilized a mixed-method, combination of qualitative and quantitative analysis. The mixed-method selected to serve the objective, which aimed to understand agricultural cooperatives' efforts to promote sustainable farming techniques.

RESULT AND DISCUSSION

Structure of Studied Agricultural Cooperatives

Under the current Royal Government policy, all three agricultural cooperatives have truly embraced the sustainable farming movement and have started their business with the same initial services

that provide farm members with credit, high resistance seeds, and natural fertilizers. New emerging businesses were found in the SS AC and CC AC. According to Table 1, CC AC offered additional marketing to its members by buying crops from them and selling to middle-men or exporting to neighboring countries, such as Vietnam. At the same time, SS AC also provided additional services to its members by purchasing paddy, offering dry and milling facilities, producing organic rice wine and animal feeds, and selling their organic goods to five natural stores in Phnom Penh. These existing and new businesses have benefited farm members in many ways, incredibly motivating them to utilize more natural-based agricultural inputs than agrochemical products.

Table 1. General profile of study agricultural cooperatives

	RR AC	CC AC	SS AC
Establishment years (years)	2014	2013	2013
Initial members (members)	131	12	61
Current members (members)	145	70	265
Current capital (USD)	12,500	36,000	650,000
Initial members fee (USD)	0	0	0
Share (USD/share)	25	25	25
Businesses	Credit and input supply	Credit, input supply, and marketing	Credit, input supply, marketing, drying paddy, milled rice, and processing

Source: Field Survey, 2019

Socio-economic characteristics of study farmers

The basic characteristics of the interviewed farmers are presented in Table 2. Table 2 showed that the age and farming backgrounds of ACs members and non-members were not substantially different. The result also showed no major different between members and non-members in terms of planted land; however, it is reported that members of ACs have marginally greater family members than non-members. Having extended family members, but small planted land would likely low in hired labor costs in farm operations. Besides, ACs members were likely to obtain higher education and owned more cattle than non-members. This suggested that it is easier for ACs members to adopt sustainable farming than non-members. Overall, the socio-economic characteristics between ACs members and non-members shared quite a similar background. Therefore, the changes in their agricultural output and income enhancement could be attributed to the memberships of the agricultural cooperative.

Table 2. Socio-economic characteristics of each study AC members

	AC members	Non- members	T-test (t stat)
Numbers of households (HH)	90	50	
Average family size (person)	4.63	3.89	2.90 *
Average age (years old)	51.24	49.89	0.48
Years of education (years)	7.87	6.58	2.11 *
Years of farming experience (years)	31.13	28.42	0.97
Average planted area per HH (ha)	1.01	1.05	-0.12
Average numbers of owned cattle (heads)	1.3	0.64	2.42 *
Average off-farm income (USD/month)	113.75	71.15	1.15

Source: Field survey, 2019

*p<.05

Contributions of Agricultural Cooperatives to promote sustainable farming to members

Three key factors that agricultural cooperatives used to promote sustainable farming were financial support, technical support, and social capital. The distribution of opinions and benefits obtained by the respondents is explained mainly in the descriptive analysis.

Financial support

Lack of capital has been a significant challenge for farm households in the study area (Bunthan and Yamada, 2019). Two main financial advantages given to members from the agricultural cooperatives were observed.

Advantage to credit

It is observed that members of ACs have better access to credit than non-members (Table 3). Credit service in agricultural cooperatives offered loans for members who wish to purchase natural farm inputs from the cooperatives without any interest rate. ACs members might also have access to loans with low interest rates and no collateral required for other agricultural purposes, given that the majority of Cambodian farmers live on land without official title. However, the amount of loans that farmers able to take was still minimal following the performance of each agricultural cooperative (less than 250USD). Although access to loan services from agricultural cooperatives is illegal for non-members, some of them are still able to get this service. Due to high-interest rates, no official land title, and uncertainly on farm output and price, non-members had difficulty accessing loans and payback. Although access to input supply stores did not require any collaterals, however, there was no timely payment, so non-members needed to sell their products as soon as they harvest with low prices to pay back in time. Theoretical and conventional reasoning, it is said that higher access to credit will result in higher agricultural output (Francis O. et al., 2019 and Sothorn K., 2020).

Table 3. Percentage of ACs members and non-members accessed to credit

Type of Credit	Members (n=90)	Non-Members (n= 50)
Formal*	90 (100%)	23 (46%)
• Banks	2 (2%)	2 (9%)
• MFIs	8 (9%)	9 (39%)
• Cooperatives	80 (89%)	12 (52%)
Informal	0	27 (54%)
• Relatives/Neighbors	0	2 (7%)
• Input Supply Stores	0	25 (93%)

Source: Field survey, 2019

Note: * The loan interest rate of Banks and MFIs is around 1.5% - 1.8% monthly, while agricultural cooperatives are from 1% - 1.3% monthly.

Advantage to natural farm inputs

High cost and unavailable natural materials have been identified as the significant constraints in adopting sustainable farming in the study area (Bunthan and Yamada, 2019). To promote this practice, ACs have provided natural fertilizer, natural bio-liquid fertilizer, and high resistant seed to

members at a lower price than the chemical ones under the Boosting Food Production Program of the Royal Government of Cambodia. As shown in table 4, ACs members found to spent a lot less on fertilizer compare to non-members. ACs also have supported farmers to produce aromatic rice variety with high resistance to pests and floods in order to cut down on the unnecessary usage of agrochemical products. 0.25 USD per kg is given to seed producers, and an agreement between seed producer and agricultural cooperatives is set to sell seed with a quality guarantee at a price of 0.40 USD per kg. Seed usually costs 0.65 USD per kg; with this program, it is sold to ACs members; only 0.45 USD per kg. Within 0.45 USD per kg, 0.05 USD per kg profit goes to agricultural cooperatives. Besides, study cooperatives also collaborated with other private fertilizer companies to stock up the natural fertilizers for their members without any additional transaction cost.

The paid material cost of non-members found to be significantly higher compared to ACs members (Table 4). Paid material costs were the ones that directly affected the farmers' financial conditions. The high paid material cost could disrupt farm production activities and put farmers in debt. This suggested that agricultural cooperatives had played a massive role in encouraging farmers to pursue a sustainable farming system and minimize their farm operation cost while conserving the environment.

Table 4. Costs of farm inputs between AC members and Non-members

Item	AC members		Non-members		T-test (T-stat)
		Share of total material cost (%)		Share of total material cost (%)	
Number of HH (HH)	90		50		
Paid purchased seed (USD/ha)	4.22		11.83		5 1.62
Imputed cost of keeping seed (USD/ha) ⁽¹⁾	36.02		70.13		32 -4.06 *
Chemical fertilizer (USD/ha)	32.02		53.19		24 -2.77 *
Paid organic fertilizer (USD/ha)	40.33		8.41		4 2.86 *
Imputed cost of organic fertilizer(USD/ha) ⁽¹⁾	15.08		10.74		5 0.90
Pesticide (USD/ha)	7.68		18.12		8 -2.79 *
Weedicide (USD/ha)	10.50		21.97		10 -3.95 *
Diesel (USD/ha)	24.54		21.31		10 0.76
Water charge (USD/ha)	2.93		4.81		2 -0.54
Paid material cost (USD/ha)⁽²⁾	121.59		139.79		63 -1.33 **
Total material cost (USD/ha)⁽³⁾	173.30		220.51		100 -3.77 *

Source: Field survey, 2019

*p<.05, **p<.01

Note: ⁽¹⁾ Imputed cost referred to the non-cash cost of items that farmers did not use their actual cash to purchase.

⁽²⁾ Paid material cost is calculated by summing up all cash expenses of agricultural inputs.

⁽³⁾ Total material cost is obtained by adding up all the cost of agricultural inputs both cash and non-cash expenses.

Technical Supports

Training and demonstrations from ACs board members played an essential role in educating and spreading sustainable farming techniques to members. As shown in table 5, the percentage of training participation between ACs members and non-members was significantly different. Educating members with practical information is always the main goal of studied agricultural cooperatives, so this would explain why ACs members have more opportunities to join training more frequently than non-members.

ACs members are reported to comprehend in livestock management and the harmfulness of using chemical product techniques better than non-members. ACs members are seen to use more natural fertilizers (animal waste, manure, and natural fertilizer) in their farm operation. In terms of pest control, members were seen not to apply insecticides much as they chose seed variety with high resistance to pests. Besides, some pest management techniques were found among ACs members by mixing cooking

oil with detergent to spray on the pests directly, and some tended to plant herbs around their field to frighten the insect away. Non-members, on the other hand, depended almost solely on insecticide applications.

Table 5. The training that ACs members and non-members have attended

Training Subject	Detailed Contents	AC Members (%)	Non AC members (%)
Soil Management	Conservation tillage Mulches, cover crops	43	0
	Compost making	60	32
Pest, weed, and disease management	Selection of high resistant seed IPM Intercropping and crop rotation	63	30
Livestock management	Animal vaccination, feeds and cage or pen	23	6
Safety use of agrochemical	Hazardous and proper use of agrochemicals	76	15

Source: Field survey, 2019

Social Capital

The relationships provided by the agricultural cooperatives in the study area have assisted farm members to receive better benefits from various key stakeholders and supported them to adopt sustainable farming. Almost all of ACs members have attested that without being part of the agricultural cooperative, they could not have begun practicing sustainable farming, nor could they receive such benefits. Two kinds of relationships were found within ACs: direct relationship and indirect relationship.

With respect to the direct relationship, AC members and local authorities' relationship was identified. It is found that ACs board members work closely with local authorities to build their farm members' capacity and strengthen their organization. Both authorities and ACs board members always cooperate with each other in order to bring new programs, subsidies, and training from both public and private agencies to farm members. This good relationship with local authorities would improve their food security, knowledge development, and financial support in the study area. Non-members, on the other hand, did not have many opportunities to engage closely with the local authority. They tended to work as individuals and seek information through their friends and neighbors who have been undergone training before.

The indirect relationship between ACs farmers and consumers also existed. Source of the market is very important to farmers especially to sustainable rice farmers. Marketing officers of agricultural cooperatives directly transported their natural goods to the contract stores monthly, and they always report their obtaining information back to their members such as consumers preference, feedback, and market price to members in monthly meetings. Beside sharing updated information, members are asked to update their farming performances, share their concerns, and help each other to strategize their future farming plan as well. Although, ACs members share the same information monthly, only those who produce organically can receive better price negotiation and avoid the fluctuating price by local middlemen.

These direct and indirect relationships have helped ACs member to build better social capital, obtain more accurate information and better negotiate with market price than non-members. At the same

time, these also help to promote sustainable farming by providing additional marketing sources to members as well.

Economic returns between ACs member and Non-members

Rice farming is used to observe the disparities in costs and returns between members and non-members of agricultural cooperatives, as it is mainly produced in the study area (Table 6). Concerning the economic returns, this study examined indicators such as gross revenue, gross margin and net profit of each group's rice farming. Gross revenue was calculated by multiplying paddy yield with paddy price. Gross margin was obtained by deducting gross revenue deducting intermediate inputs and hired labor, and net profit was calculated by deducting costs of family labor, costs of owned land, and depreciation cost from gross margin. In addition, T-test analysis with two-sampled assuming unequal variances was applied in this study as well.

As shown in table 6, the rice production of ACs members was significantly more profitable than non-members in terms of gross margin, which not included non-cash costs. Although there was no significant difference in yield productivity per hectare between these two groups, the total cash expense of non-members was substantially higher than members. In terms of net profit, it is found that there was no significant difference between the two. In this specific study area, farmers both members and non-members, rather than raising livestock and obtaining animal manure by themselves, were more favorable to purchase cattle manures or processed natural fertilizers instead. Also, ACs members, particularly organic rice farmers, tended to employ workforce labors over machines. They were afraid to mix their paddies with others if they use the same machine rental service such as combine harvesters and some machines like planting machine are not available yet. This resulted in higher labor cost. Overall, in the same farmland unit, with the aids of agricultural cooperatives, members would ensure greater profit than non-members if they could approach a more integrated farming system.

Table 6. Costs and returns of rice farming categorized by ACs members and non-members

Variables	AC members	Non-members	T-test (T-stat)
Number of HH (HH)	90	50	
Paddy yield (ton/ha)	3.73	3.58	0.63
Paddy price (USD/ton)	293.31	275.51	1.38 **
Paid material cost (USD/ha)	121.59	139.786	-1.33 **
Total material cost (USD/ha)	172.69	220.65	-3.77 *
Total labor cost (USD/ha)	249.78	161.69	2.83 *
Total Job commission (USD/ha)	145.30	178.97	-2.28 *
Cash land rent (USD/ha)	6.77	0	1.79 *
Owned land rent (USD/ha)	72.25	72.25	-
Depreciation cost (USD/ha)	91.35	33.05	2.04 *
Total cash expense (USD/ha)	301.03	332.37	-1.55 **
Total expense (USD/ha)	738.14	667.08	1.74 **
Gross revenue (USD/ha)	1094.05	977.33.	2.10 *
Gross margin (USD/ha)	754.99	599.93	2.56 *
Net profit (USD/ha)	431.07	431.58	-0.01

Source: Field Survey, 2019

*p<.05, **p< .01

Challenges of Agricultural Cooperatives

Despite mentioned benefits that ACs have provided to their members, still, numbers of challenges have restrained their performances and hindered their ability to meet members' needs. Some of those significant challenges are explained in detailed below (Table 7).

a. Shortage of capital and credit facilities

Although members reported being pretty satisfied with the access to credit; however, more than 80 percent of them wished to access to bigger loan than what ACs endows currently (Table 7). ACs leaders claimed that the key reason for establishing the cooperative was to mobilize the saving of money to invest in their cooperatives' operations. Still, the capital savings of the cooperatives did not satisfy the needs of their members. In most cases, farmers could only borrow up to \$250 from ACs, and only a few farmers could borrow more than that. As some members of ACs were still in the categories of small-sized farmers with no official land title, most of them could not afford to take loans from microfinance institutes with high-interest rates. This indicated poor farmers in the group might not be able to practice sustainable farming, even though they have learned farming techniques from their cooperatives and do have the means to put them into practice. Moreover, some techniques were over farmers' budgets (biogas), and animal manure and labors in the study area were quite hard to obtain and pricey.

b. Impractical farming techniques and marketing power

Some literature has stated that sustainable agricultural techniques are not always applicable in members' areas, implying that technical services do not always respond to AC members' needs. More than half of interviewed ACs stated that they did not get the results as demonstrated in training despite following the professional guidelines. This was due to the immense complexity in applying the instructions and the lengthy time for the taught techniques' outcome.

Lack of collective marketing also stopped farmers from accessing more markets and getting better output prices. Although organic rice is a high-value-added crop, only a few members and one agricultural cooperative in the study area adopted them. Other sustainable rice is not niche markets as organic rice and shares the same price with other conventional rice farming systems. This might discourage farmers in the study area from adopting other sustainable farming systems besides organic farming.

c. Illiteracy and limited knowledge of AC committee and farm members

Low capacity of human resources, including limited leadership and poor bookkeeping, financial management, and communication skills, is also identified as a critical factor for ACs in the study area as well. This made it challenging to find educated or even literate candidates to be elected or selected as leaders or management members. In some ACs, committee members were unable to read or write, lacked public speaking experience, and had inadequate planning capacity, but were nonetheless elected because of the absence of alternate candidates; this could impede the overall performance development of ACs. Given the members' limited awareness, they found it difficult to understand the cooperatives' role and function, let alone the legal structure for ACs. This is a critical problem that quickly leads to distrust, especially among members and between members and the AC management committees over financial records. Although leaders and committee members had rich experiences in farming, they lacked in agribusiness knowledge and organization management. ACs are only as strong as the level of skills of their members. For instance, manager-members require bookkeeping, leadership, communication, techniques, and agribusiness management. At the

same time, members need to learn about relevant and necessary farming techniques such as sustainable farming techniques and group work.

d. Limited participation from members and weak enforcement of internal regulations

The study noted that low participation from members is a general issue faced by ACs, as depicted by more than 50 percent claiming this problem (Table 7). Farmers appeared not to attend the monthly sessions, repay money late, and lose confidence in attending community events, the chief and committee members of the ACs said. For this, there were several explanations. First, members who deeply in debt to the ACs tended to avoid taking part in ACs’ activities. Second, some members were so busy working off-farm jobs that they did not have enough time to participate. Third, the AC leaders needed to strike a balance between rule enforcement and tolerance when some members did not conform to the ACs’ rules. The management was too intimate for members to apply the rules for unity or for fear of displeasing or losing members. This is typical in small organization bodies where the representative and participants establish a sense of personal connection (Chanrith N., 2018).

Table 7: Challenges affecting the performance of ACs

Challenges	Responses from ACs member		
	Yes	No	Don’t know
Shortage of capital and credit facilities	81%	19%	0
Lack or unavailable of marketing service	79%	11%	0
Impractical provided knowledge and techniques	78%	22%	0
Lack of external supports	70%	30%	0
Members’ illiteracy	55%	44%	0
Do not respond to members’ needs	53%	41%	6%
Lack of members’ participation	52%	48%	0
Lack of leadership and work capability	49%	50%	1%
Poor bookkeeping/financial management	47%	43%	0%
Poor enforcement of internal regulation	47%	39%	4%
Poor communication with local authority	28%	58%	14%

Source: Field survey, 2019

CONCLUSION

The sustainable farming technique was found to be effectively contributed by agricultural cooperatives in the studied area. Although members of agricultural cooperatives reported that there were no differences in paddy yields and net profit relative to non-members, there were some positive impacts on farm operation cash costs. Besides, ACs members would certainly ensure better profit if they could utilize all the natural resources around their houses and access to more agricultural machines.

These impacts have benefited members through training them in sustainable farming techniques with less use of agrochemicals, providing them with natural materials, assisting them with loans at low-interest rates, entry to the natural goods market, and developing relationships and alliances to produce greater products at lower prices.

Yet, many constraints hindered the development of agricultural cooperatives in the studied area. Agricultural cooperatives' limited ability to extend credit and market services have hindered many ACs members from adopting sustainable and ensuring their productivity. Other vital challenges for ACs in the study areas are limited planning skills, marketing power, lack of educated management members, lack of external support, and weak enforcement of internal rules and regulations.

At the very least, this study offered crucial insights into and essential evidence on the effects of participation in agricultural cooperatives on the implementation of sustainable farming and the significant challenges facing by agricultural cooperatives. Strengthening agricultural cooperatives to boost rural well-being effectively and foster sustainable farming for potential future agricultural development is a feasible and rational imperative for all primary stalk holders.

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