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# Impact of Farmer Organisations on Food Security: The Case of Rural Cambodia

**THENG Vuthy, KEO Socheat, NOU Keosothea, SUM Sreymom and KHIEV Pirom**

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**CDRI**
☞ 56, Street 315, Tuol Kork, Phnom Penh, Cambodia
✉ PO Box 622, Phnom Penh, Cambodia
☎ (855 23) 881 384/881 701/881 916/883 603
🖷 (855 23) 880 734
E-mail: cdri@cdri.org.kh
Website: www.cdri.org.kh

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## ACRONYMS AND ABBREVIATIONS

AC Agricultural Cooperative
ATT Average Treatment Effect on the Treated
FA Farmer Association
FC Farmer Community
FG Farmer Group
FGD Focus Group Discussion
FO Farmer Organisation
HH Household
HHH Head of Household
IVY International Volunteer Yamagata
KII Key Informant Interview
MAFF Ministry of Agriculture, Forestry and Fisheries
MOI Ministry of Interior
NGO Non-government Organisation
OLS Ordinary Least Squares
OAE Office of Agricultural Extension
PDA Provincial Department of Agriculture
PSM Propensity Score Matching

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# EXECUTIVE SUMMARY

This study assesses the impact of participation in farmer organisations (FOs) on the food security of rural households in Cambodia. The study was started in November 2010 and completed in June 2012. The study set out to: (1) examine the roles, operations and challenges of FOs in improving household food security; (2) analyse the household characteristics that determine participation in FOs; (3) assess the impact of FOs on the food security and livelihoods of poor rural people; and (4) provide recommendations for changes in the legal and regulatory framework for FOs.

Due to their predominance in Cambodia, the study concentrates on three FO types: farmer group (FG)–informal with 10-30 members; farmer association (FA)–more than 30 members, either informal or formal if registered at the Ministry of Interior; and agricultural cooperative (AC)–business-oriented, registered at the Provincial Department of Agriculture (PDA) and generally have more than 30 members.

The study employed qualitative and quantitative methods. To examine the roles and operation of FOs and their challenges, qualitative information was gathered from focus group discussions with FO members and key informant interviews with stakeholders in the four provinces of Kampot, Kampong Thom, Battambang and Svay Rieng, which have a high density of operating FOs. The quantitative approach applied propensity score matching[1] to assess the impact of FO participation on food security, using the agricultural productivity (value of production and profit) of rice and livestock as proxies. Cross-sectional survey data was collected on approximately 330 FO member households, randomly selected from the three FO sub-sectors FG, FA and AC in the proportion of 50:30:20 percent, and 369 non-member households selected from the same villages in the selected communes using systematic random sampling to form the control group.

## Main Findings

***Descriptive statistics and qualitative data*** from the surveys suggest that one main role of FOs in Cambodia is to encourage the habit of saving and to provide cash credit to members at better interest rates with a flexible repayment schedule. In addition, FOs offer opportunities for members to learn about agricultural techniques through training and other extension services provided by supporting agencies (i.e. NGOs and PDA), which in some cases provide "in-kind" inputs for crops and livestock production. However, all FO types in the study areas have low capital savings for lending to their members.

As most of the FOs in Cambodia were established by support agencies, they are unlikely to operate independently. The FAs and ACs evolved from FGs, which are commonly managed and coordinated by a committee (leader, deputy leader, treasurer, secretary) elected by FO members. FOs' missions vary largely according to the objectives of their support agencies. This study found that the AC has a more coherent management structure given its formal status. The main constraints on the operation of FOs are shortage of credit capital, illiteracy of members, limited diffusion of agricultural techniques, low participation, insufficient farmland, poor group

[1] Propensity score matching (PSM) is used to match observations or households between member groups and non-member (control) groups based on observable common characteristics.

structure, lack of external support (limited access to information and services), poor leadership (partisanship and low accountability), limited capacities for planning and management (low educational attainment), and lax enforcement of internal rules. These issues indicate the critical roles that external support agencies could play to improve the functioning of FOs in Cambodia. NGOs and the Office of Agriculture Extension (OAE) of PDA actively support the efforts of FOs in the study areas but private sector involvement is lacking.

The Ministry of Agriculture, Forestry and Fisheries (MAFF) has been actively promoting ACs through the OAE of PDA. The primary objectives are to (1) enhance farmers' agricultural gains (i.e. share the benefits of economic growth); (2) strengthen marketing through collective selling and buying; (3) encourage farmers to work collectively and strengthen links between local businesses and investors; and (4) facilitate the access to and transfer of agricultural knowledge to farmers. MAFF has drafted a law to update the existing Royal Sub-decree on Agricultural Cooperatives to include support strategies aimed at protecting and creating more advantages for farmers.

***Empirical results*** reveal that the age of household head is positively associated with the propensity to participate in FOs, but a household is less likely to participate if the household head is older than 54 (pooled sample and subsample),[2] with the exception of FGs where household head age is not a determinant. It was also observed that FA members have a higher proportion of female-headed households. The unemployed status of household heads has a negative effect on FO participation, implying that as household heads become older (average age of 54) they are less likely to join an FO. With respect to household size, FG and FA member households are larger than non-member households, suggesting that member households need to set aside their labour to engage in collective work; AC member households are smaller than non-member households are. The results confirm that extending credit is the main activity of FOs in Cambodia, although we are not able to prove a causal relationship between household access to credit and the propensity to participate in FOs.

Households with productive agricultural assets are likely to participate in an FO (pooled sample). The value of household assets is positively related to participation in FOs, but the relationship turns to negative when asset value is greater than around 13 million riels. This implies that farmers with higher levels of productive capital are less likely to participate in FOs (AC). Education of household heads is not significantly related to FO participation.

The effect of participation in FOs on rice and livestock revenues and profits in the pooled sample and subsamples was empirically determined to identify which FO types significantly impact on members' livelihoods. The results from the cross-sectional data and propensity score matching show that participation in FOs (for the pooled sample)[3] had no significant effect on revenues from rice and livestock production. At subsample level, results indicate that participation in FGs had no significant association with revenues and profits from rice and livestock production, while participation in FAs had positive and significant impact on revenue and profit from livestock but not from rice. Participation in ACs, however, had a positive and significant relationship with rice and livestock production, with both revenues and profits being

[2] The pooled sample involves households from three types of farmer organisations (FO) (agriculture cooperative, farmer association and farmer group) and non-member households; the subsample entails households from each type of FO (AC, FA and FG) and non-member households.

[3] Some studies have used PSM on cross-sectional data to estimate the impact of participation in intervention programmes (see, for instance, Davis et al. 2010; Ali and Abdulai 2010).

significantly higher than non-members'. A comparison of the three FO types shows that AC members' revenues and profits from rice and livestock production are significantly higher than FG members', while FA and FG members have similar agricultural productivity outcomes. Collective action, especially bulk buying and selling, remains limited because majority of FO members access inputs (76 percent) and sell outputs (81 percent) on an individual basis, thereby paying and attaining similar prices to non-members.

We can accept three of the eight hypotheses statistically tested; they are (i) household productive capital is negatively associated with participation in an FO (hypothesis 1b), (ii) AC has positive relationship with members' rice and livestock productivity (hypothesis 2d), and (iii) AC members revenues and profits from rice and livestock production are higher than FG members' (hypothesis 3b).

We conclude that participation in an AC is positively associated with rural household food security through improved rice and livestock productivity. However, we should not ignore the other types of FOs because well-functioning FGs transform into ACs. FOs in Cambodia have not evolved sufficiently to enhance members' access to markets. Lack of collective action means that farm inputs are purchased and outputs sold largely on an individual basis, and the prices paid and attained by FO members are similar to non-members'. Limited institutional capacity and the shortage of capital for credit indicate that most of Cambodia's FOs are not yet self-reliant. NGOs and public sector agencies actively support FOs, but the lack of private sector engagement impedes FOs' ability to operate sustainably. To maintain or augment their impact on members, the private sector, with the public sector creating an enabling environment by promoting contracting schemes, can play a crucial role by providing FOs with access to inputs, markets and services.

**Policy Implications**

Even though they are not yet fully functional, farmer organisations should be supported and promoted as an effective means of improving rural livelihoods. The study findings raise the following for consideration:

- What is urgently needed to help resolve key operational challenges is a range of programmes to build local capacities in skills such as leadership, strategic business planning, financial and human resource management.

- Improved agricultural technical practices should be continually available and respond to FOs' needs. At the same time, policies and strategies to promote broader access to rural credit should be further improved to support FO members' better and greater investment in agricultural production and other business activities rather than drawing on their limited savings and on available lending generally observed in the study areas.

- External support (production techniques and managerial skills/capacity) should be provided over an extended period to allow FOs to learn to be effective and efficient before they start operating independently.

- To promote and advance rural livelihoods through FO participation, capacity building and mechanisms that could help FOs gain access to inputs and produce markets should be enhanced and supported by stakeholders. The contract farming scheme would be a good mechanism for connecting FOs to lower input costs and secure market prices. However,

legal framework on contract farming should be put in place and enforced to protect FO members from exploitation or to prevent any party from reneging on contract agreements.

- Empirical evidence shows that ACs are positively associated with improved food security and that, overall, AC members are better off than FG and FA members and non-members. However, stakeholders should enhance policy that supports and promotes all FO types because well-functioning FGs, for instance, eventually develop into ACs.
- To incentivise the legal registration of FOs with the relevant authority, i.e. Ministry of Interior, Ministry of Agriculture, Forestry and Fisheries or Ministry of Commerce, registration should be eased by reducing the demand for required documents, and expediting and simplifying procedures.

# 1

# INTRODUCTION

In developing countries, large numbers of poor households typically live in rural areas with small-scale farming as their main occupation. The importance of smallholder agriculture has been recognised and demonstrated by both the international donor community and national governments in their pledges to support agricultural development and economic growth. Developing countries commonly implement policies that promote and sustain rural producer organisations (Peacock et al. 2004; Bingen et al. 2003; Chirwa et al.2005). The main rationale behind the establishment of farmer organisations (FOs) is to provide effective and collective support services to smallholders, thus loosening the major obstacles to productivity improvement, and to enhance self-help and collective power to regulate markets. This implies that in theory FOs should be able to strengthen farmers' bargaining power with external buyers and reduce transaction costs, potentially leading to increased incomes and food security and hence sustained agricultural growth and poverty alleviation (Barham and Chitemi 2008; Bachke 2010).

In Cambodia, over 90 percent of the poor live in rural areas and rely on agriculture for their primary sources of livelihood. Agricultural production is predominantly characterised by small-scale farming: about 84 percent of rural farmers work with less than one hectare of land (World Bank 2005, 2009a). The sector is one of the four major pillars of the economy: it contributed about 34 percent of the country's GDP in 2010 (National Accounts Statistics 2011), grew by more than 5 percent in 2008 and 2009, and in 2010 accounted for 27.3 percent of total GDP at constant 2000 prices.

Recent research has identified key constraints on agricultural development in Cambodia and the challenges facing farmers, particularly smallholders. These include poor infrastructure (irrigation and rural roads), insecure land ownership, lack of access to basic agricultural knowledge, technology and extension services, problematic access to external finance in general and rural credit in particular, lack of market information, poor land use planning and natural hazard risk management (flood, drought, insect/pest infestation), and low levels of public investment in agriculture (World Bank 2009b; Theng and Koy 2011).

Some studies suggest that smallholder farmers will not be able to effectively leverage their productivity and bargaining power vis-à-vis larger commercial farms and buyers unless institutional arrangements for smallholders to form rural producer organisations are put in place, as observed in other developing countries (Couturier et al. 2006; Nou 2006; Bingen et al. 2003; Chirwa et al. 2005; Peacock et al. 2004; Abaru et al. 2006; Barham and Chitemi 2008). In principle, the activities of individual farmers are unable to address these problems. In Cambodia, towards supporting smallholder producers and diversified rural livelihoods, a main thrust of government policy is to promote agricultural development that recognises and prioritises smallholder farming and the establishment of FOs as key to rural economic development and poverty alleviation (Chea 2010). Those policy strategies are well articulated and continuously updated in the Rectangular Strategy, the National Strategic Development Plan and the Strategy for Agriculture and Water.

Membership-based concepts such as farmer organisations are new to Cambodian farmers, even though agricultural cooperatives existed in the 1960s before civil war broke out (Couturier et al. 2006). During the 1990s, some international and local NGOs started to rethink the role of smallholder agriculture and include the establishment of FOs in their rural development programmes to enhance agricultural productivity and food security. The government, with assistance from the Food and Agriculture Organisation, took back the initiative on FOs in 1999. The Royal Decree on Agricultural Cooperatives issued in 2001 instituted a formal legal framework recognising FOs and ACs. Since then many FOs have been established with the support of the public sector and NGOs. However, FOs rarely continue when support agencies (NGOs and government sectors) withdraw support and some of those FOs could not sustain their activities (Couturier et al. 2006; Nou 2006; Bingen et al. 2003).

Even though the government has articulated FOs as key to rural agricultural and private sector development, there have been few studies on the effect of FOs on rural livelihoods. Existing studies have tried to determine the status of FOs by assessing the number and different types of organisations, and their formation and registration processes; the emerging and major issues facing existing FOs and the internal and external factors affecting their success; and policy and legal framework for FO development (Couturier et al. 2006; Nou 2006; Ngin 2010; Chea 2010). However, there is no available research on the extent to which FOs in Cambodia impact on rural smallholders' livelihoods, let alone the differing impacts of the various types of FOs and their legal recognition on smallholders' livelihoods. Understanding how smallholder participation in FOs improves farm income would build on knowledge about the FO sector in Cambodia, identifying the tangible benefits FOs are producing for members and the challenges FOs are facing. Better knowledge leads to better practice. Our research findings can usefully guide more informed policymaking and identify effective ways to improve and meet the needs of FOs and better support smallholders for poverty alleviation.

The overall objective of the assessment is to assess the impacts of FOs on the food security of smallholder farmers in order to generate pragmatic evidence that will assist policymakers and practitioners to better support the functioning and operation of FOs for poverty reduction.

The specific objectives of this evaluation are to: (1) assess the impact of FOs on rural livelihoods and food security; (2) explore the role, operation and challenges of FOs in improving household food security; and (3) provide specific recommendations for changes in the legal and regulatory framework for FOs.

The term farmer organisation is clearly defined in order to reflect the scope of the study. We use the general definition employed by Couturier et al. (2006: 13): "Farmer organisations are a collective entity of farmers in a village or in a number of contiguous villages who have come together with common goals for economic benefit related to agricultural activities". In other words, FOs are created by rural farmers and producers to provide services to members to improve rural incomes or employment opportunities in relation to agricultural activities. Specific definitions of specific FO types are elaborated in Section 2.1.

Section 2 reviews international as well as Cambodia's experiences in establishing FOs to promote rural livelihoods and agricultural development. Section 3 details the research methodology employed in this impact assessment. Section 4 presents the detailed empirical findings. Section 5 concludes with a summary of the policy implications and recommendations.

# 2

# LITERATURE REVIEW

The following is an overview of some of the literature on farmer organisations (FOs), with a focus on their main characteristics and purposes, the factors affecting their operation, and the associated government regulatory framework and evaluation framework.

## 2.1. Characteristics and Benefits of Farmer Organisations

Farmer organisations are used as a tool to promote rural development and to ensure food security in a way that complements state development strategies and market approaches. FOs are based on principles of volunteerism, self-help, self-reliance, democracy, equality, equity, solidarity and empowerment (Nou 2006). There is no universal definition of FOs; however, partly defined as community-based organisations, FOs refer to the collective action of smallholder farmers to reach common agricultural goals for food security and livelihood improvement (Bratton 1986).

FOs emerge in one of two ways: they can be self-organised, or they can be initiated by external agencies. These models share some pros and cons in implementation. Some scholars (e.g. Ostrom 2000) argue that self-organised FOs tend to work more sustainably than externally initiated ones because of the former's tendency to make and adhere to clear rules, and because of a high level of social capital in terms of mutual trust and cooperation among group members. In contrast, Dasgupta and Beard (2007) argue that externally initiated organisations are still functional as long as the principles to form the groups are based on broad participation, democratic decision making and transparency.

FOs have diverse services and functions including access to production facilities and equipment, technical information and advice, inputs (seeds, fertilisers, feed, pesticides, fuel), markets (transport, trading, market information), financial means, provision of social services (health insurance, literacy) and natural resource management (Bingen et al. 2003; Peacock et al. 2004; Chirwa et al. 2005). These functions and services that are accessible to FO members can be grouped into three main categories, which also serve as useful indicators for the evaluation: production assets, production services including access to markets, and food production (Bratton 1986).

***Access to production assets:*** To observe the impacts of FOs on access to production assets, Bratton (1986) posed such research questions as: Can FOs help to alleviate the basic resource constraints faced by household members at the level of production? In what ways, if any, do FOs change the production practices of their members? The production assets of farmer groups can be land, labour, draught power or tools, depending on the type of FO. Bratton (1986) suggests looking at the impacts of FOs on land use (exchange, lending or borrowing) and the size of landholdings that belong to members and non-members. However, exchange of labour and draught power among rural people is no longer such a common practice in some developing countries; for instance, in Cambodia the balance has shifted from exchange towards financial returns from hiring or lending.

***Access to production services:*** Production services refer to any services offered by a group to improve agricultural production; these include extension, credit, input supply and market outlets (Bingen 2003; Peacock et al. 2004). The impacts of FOs on production services can be observed by addressing two main questions (Bratton 1986): Can a collective organisation facilitate the distribution of scarce services to farmers? By coming together, can a group of farmers create effective demand and attract central agencies to their locality (Bratton 1986).

Extension services (on production techniques) can be delivered by government extension workers, NGOs or programmes, or private (fertiliser) companies (Bingen et al. 2003; Peacock et al. 2004). By being involved in FOs, farmers are more likely to have frequent contact with extension workers through training or public meetings (Chirwa et al. 2005). Sometimes they seek advice from other farmers who have experience of previous extension training. Membership in FOs possibly provides farmers more chance of receiving services from these people. Having received technical advice from multiple sources, some information or services may become redundant. Even so, duplication may help increase the reliability of information and services (Bratton 1986).

Credit is scarcer than technical advice, particularly for smallholders. Farmers who join FOs often hope to access credit. FO members can have more access to credit through loans from other members, or sometimes from other agencies such as microfinance institutions (MFIs) (World Bank 2002; Bingen 2003). Further, FO members' use of borrowed money and loan repayment rates are more efficient than non-members' (Bratton 1986).

Input supply is a critical factor in improving agricultural productivity. Smallholder farmers cannot afford the high cash outlay involved in buying modern inputs such as improved seed and fertiliser. They often have no choice but to pay high prices for unreliable and inferior quality supplies and there is little that farmers acting individually can do to improve this situation (Bratton 1986). Literature shows that FO members are significantly more likely to have access to inputs such as fertiliser than are non-members (Bingen 2003; Peacock et al. 2004). The cost of inputs though bulk ordering by a group (i.e. FO members) is lower than through small and piecemeal purchases by individuals because of cheaper bulk road haulage rates and lower per unit transport costs (Bratton 1986; Chirwa et al. 2005).

Market outlets are important. Farmers may produce crops in excess of demand, and so need markets to sell their surplus. FOs can help by buying crop produce from farmers at a reasonable price and then selling it to private traders, or sometimes FOs can facilitate private traders to come to communities by encouraging farmer members to grow more produce to sell in bulk (Rweyemamu 2003; Barham et al. 2008). With regard to market access, two interrelated aspects are important: distance to markets and transport costs. Distance affects transport costs and therefore the level of access by farmers to markets. FOs can help achieve economies of scale, lowering transport costs for their members and thereby promoting greater access to more markets (Bratton 1986; Bingen 2003).

***Access to food production:*** Impact assessment of participation in FOs on food production requires the estimation of land productivity, production land size and total household production, which in turn can be translated into value of production and sales and then into income (Bratton 1986). Types of crops can be divided into main food crops and cash crops. Other household activities such as livestock raising, which largely contributes to household food production, should also be included (Davis et al. 2010). Recent studies on the impact of FOs and the

services they provide on farmer-members also use total household agricultural production as a measureable indicator (Miyata et al. 2009; Bachke 2010).

As Bratton (1986) pointed out, the collective action of rural producers' organisations cannot serve as a panacea or a stand-alone tool to address food security and poverty without the support of well-developed states and markets. States must allow independent farmer groups to exist and promote programmes to support them, while markets should provide selective incentives to correct smallholders' uncompetitive positions. FOs are better at achieving efficiency rather than equity in the distribution of benefits. Efficiency is seen in terms of productivity gains or the involvement of middle farmers, not only the better-off (Bratton 1986; Bernard and Spielman 2009; Barham and Chitemi 2009). The poorest remain excluded, however (Thorp et al. 2005).

The membership-based concept and practice of farmer organisation as a means to achieve agricultural development, food security and poverty reduction at the grassroots level has a long and varied history in Cambodia. From its first beginnings in the early 1990s, about 13,017 FOs had been established by 2005, over 60 percent of which had been formed since 2000 (Couturier et al. 2006). Presently, five different types can be characterised: farmer group (FG), farmer community (FC), farmer association (FA), agricultural cooperative (AC),[4] and farmer federation. The main type is the FG (80 percent), followed by FC (13.6 percent) and FA (5 percent). Following is a description of their key characteristics:

- ***Farmer group:*** grassroots-level informal group; recognised by local authorities only (village chief, commune council); small size with 5-30 members (sometimes more); objective is mutual assistance between members.
- ***Farmer association:*** formal or informal set-up; formal groups are recognised by law and registered at the Ministry of Interior, while informal groups are not recognised by law and not registered but are recognised by local authorities; groups are large with 30 to 150 members; objectives are mutual assistance among members and economic benefits; it is a collective of many farmer groups from contiguous villages.[5]
- ***Agricultural cooperative:*** formal status; recognised by law and registered at the Provincial Department of Agricultural Extension; large group with 30 to 150 members; main objective is economic benefit; often brings together several farmer groups in an area or contiguous areas.

## 2.2. Factors Influencing Farmer Organisations' Formation, Management and Activities

Much of the literature addresses the factors affecting the operation of FOs in developing countries. To frame this study we primarily focus on the constraints or challenges and the factors affecting the operation of FOs. We focus first on the challenges and then on the successes.

An early study by the Food and Agriculture Organisation (FAO 1996) points out that the key constraints on strengthening the internal capacities of FOs in Cambodia are similar to those observed in other developing countries. They include (i) the paternalistic role of the state in the management of FOs, (ii) a top-down attitude towards FO leaders and government officials, and (iii) FO membership's weak capital base and low sense of ownership.

[4] A recent CDRI study indicates that about 200 ACs had been established by 2010 (Chea 2010).

[5] Most of the FOs in this study sample are not recognised by law and not registered at the Ministry of Interior, being recognised only by local authorities.

The challenges facing the operation of FOs in a developing country can generally be classified into two groups: organisational, and environmental or contextual (Chirwa et al. 2005).

***Organisational challenges*** relate to FO members' multiple involvement as owners and suppliers of capital, as clients, and as employees (for some). These roles can lead to conflicting interests, which do not arise in the same way in NGOs or private companies. The nature of these conflicts will vary with the regulations under which FOs operate, i.e. their own articles or by-laws, and national laws relating to different forms of association. For instance, the scale and pricing of services offered to members can lead to conflicts of interest within a group. Members may be more interested in access to low cost services, either through low prices or the payment of dividends in proportion to the use of services rather than capital investment. Other organisational challenges include problems of collective action arising from apathy and lack of involvement or cooperation in problem-solving and group activities; free-riding (where an individual shirks responsibility and tries to gain benefits from collective action without incurring some of the costs); lack of basic literacy and business skills; and low accountability coupled with a tendency for the misuse of FOs' resources by FO leaders.

***Environmental or contextual challenges*** in developing countries include common agricultural and natural resource problems (poor soil, water shortage, uncertain rainfall); poor health status; poor services (absent, late, poor quality and/or unreliable input and output markets; financial, technical and regulatory services obtainable only on unfavourable terms); poor infrastructure (roads, telecommunications); unfavourable macroeconomic environment (high interest rates and prices, trade and general economic uncertainty); low level of wealth and economic activity in rural areas; low levels of literacy; and weak and inappropriate institutional environment (poor security, difficulty separating FO leadership and management from the influence of local authorities and politics, weak enforcement of regulations for FO governance). These issues worsen many of the organisational challenges faced by FOs as they can increase uncertainty around and reduce the benefits of participation in FOs.

Smallholders and FOs in Cambodia are hampered by diverse constraints. Chief among these are the effects of natural disaster on production, limited capacity and knowledge of farmers, lack of collective action by farmers, problematic access to financial resources, absence of output markets, lack of collaboration with local authorities, weak law enforcement (or state support in the case of resource management communities), farmers' reluctance to accept new practices or learn from extension services, and delay in loan repayment (savings and credit groups) (Couturier et al. 2006). A recent CDRI study found that FOs were unable to access loans directly from banks and other financial institutions due to strict loan conditions (Chea 2010). Other challenges facing FOs are the difficulty of registering with local authorities, poor relations with some support agencies, weak institutional capacity and low capacity of members, low participation by women farmers, and poor accounting and general management skills.

The greater the challenges facing FOs, the greater the need for external support from government and development agencies, as experienced in many developing countries. Without external support many FOs are unlikely to survive, limiting their potential impact on livelihood improvement and food security (World Bank 2002; Bingen et al. 2003; Chirwa et al. 2005).

***Success factors:*** the literature highlights the many factors that contribute to the successful operation of FOs in developing countries (Crowley et al. 2005). These include clear objectives and response to membership needs; equitable participation in decision making, i.e. members have an equitable stake in their organisation; effective two-way communication between members

and leaders; members voluntarily invest some of their resources in the organisation; efficient and transparent financial management; strong governance procedures (group size and structure, leadership, internal rules); scope and diversity of organisations' activities (meeting emerging needs through new activities, capacity building, increased negotiating power, access to production capital); scaling-up and links to other organisations (Crowley et al. 2005; Kachule et al. 2005).

An Important aspect contributing to an organisation's success and sustainability is the trust between members and the management committee (Hansen et al. 2002). However, trust takes time and effort to build and is easily broken (Pomeroy et al. 2001; Pretty 2003). Farmers' trust grows as they achieve successful collaboration with leaders. Trust requires good communication and open dialogue between leaders and members to clarify the needs and expectations of farmers. Furthermore, trust is built when leaders share decision making with members, respect concerns, needs and knowledge, and are transparent in their management (Tewari and Khanna 2005). Trust among FO members was also found to be a factor in improving collective marketing performance (Barham and Chitemi 2008).

Some literature spotlights the success of Cambodian FOs, which is much the same as that of FOs in other developing countries. Factors influencing the success of FOs in Cambodia include clear structure and regulations, members' compliance with internal regulations, strong management and leadership, support from local authorities, responsiveness to farmers' needs, members' active participation, and having or creating their own usable resources (Couturier et al. 2006). To ensure their success and sustainability, FOs also need self-determined/voluntary group membership, savings and intra-lending norms determined by the group rather than imposed from outside, a growing savings corpus (i.e. continuous and regular contributions), links to commercial credit, and support services (training and microplanning) (Tourism and Leisure 2009). Other success factors are local authority participation, external support (both technical and resources), and market access (Ros 2010). Again, trust among members and members' sense of ownership helps to promote cooperation between farmers and leaders that in turn impacts on the success of an organisation's collective work (Ros 2010).

### 2.3. Government Legal and Regulatory Framework

The government has put in place legal framework to support FOs such as the Farmer Association (FA), Farmer Water User Community, Agricultural Cooperatives (AC), Union of the Agricultural Cooperative and the Pre-agricultural Cooperative, Community Forestry, Village Animal Health Workers Association and Fishery Community. National legislation (top policy papers), i.e. the Rectangular Strategy and the National Strategic Development Plan among others, also recognise the crucial role FOs play in reducing poverty, increasing agricultural productivity and improving food security. Various ministries administer these legal frameworks. The Ministry of Interior is responsible for the legal registration of FAs. The Ministry of Agriculture, Forestry and Fisheries is in charge of the registration of ACs, farmer water user communities, forestry communities, village animal health workers associations, fishery communities and contract farming. The Ministry of Commerce has the mandate over business associations, and the Ministry of Industry, Mines and Energy has responsibility for registering small and medium enterprises. However, only ACs and forestry communities are supported by a sub-decree; the others are simply supported by their respective draft sub-decree or *prakas*[6].

[6] Ministerial or inter-ministerial regulations that are used to implement any specific provisions within higher-level legislative documents. They are often used to issue guidelines that are necessary for the implementation of a law or sub-decree.

A recent evidence-based policy analysis of farmer organisations in Cambodia suggests that ACs and FGs have been playing very important roles in helping farmers to access financial services that offer loans at interest rates lower than the rates charged by private moneylenders, thus contributing to poverty reduction (Chea 2010). ACs and FGs provide various services to their farmer-members such as credit, savings, agricultural inputs and farming techniques. However, both ACs and FGs face external challenges in supporting their members (Chea 2010). Those challenges include inadequate legal framework; absence of a pro-poor financial policy for FOs; limited technical and financial assistance from supporting agencies (government agents, development partners); insufficient policy to support ACs; absence of price protection policy for agricultural produce; lack of official guidelines on the establishment and functioning of farmer groups; absence of legal framework on audit quality; and weak support from local authorities.

### 2.4. Framework for Evaluation of Farming Organisations

The literature review suggests that the concept of farmer organisation has been widely used by support agencies and governments to assist farmers and rural people in improving agricultural productivity, food security and household income generation in tandem with state provision of various regulatory frameworks to support the operation of FOs, and identifies some key benefits and challenges. The potential benefits of FO membership include access to training services, production inputs and market links. The capacities of FOs are classified into technical (ability to handle tasks) and strategic (decision-making and managerial skills). Building up the capacity of FOs is generally based on several complementary activities: training, implementation, evaluation and reflection.

However, benefits will not accrue to members unless FOs can deal with key challenges (organisational and contextual) during their establishment and operation. Other common problems faced by FOs are not having enough money to carry out activities, taking on too many activities (and/or non-economic activities), running activities ineffectively, and reaping limited benefits.

Benefits and challenges are often at the core of the problem of FO development in Cambodia, yet little is known about FOs' overall impact on households. This study's examination of FOs focuses on the benefits i.e. impact of participation, and challenges during FO establishment and operation, and the role of agencies and government regulatory framework. The study employed mixed methods. Qualitative methods explored in detail information on the establishment and challenges of FOs, and the roles of support agencies and government regulatory framework. Quantitative tools and techniques captured and analysed the impact of participation in FOs on household food security using agricultural productivity (value of production) and profit as proxies (Bratton 1986; Miyata et al. 2009; Bachke 2010; Davis et al. 2010).

# 3

# METHODOLOGY

## 3.1. Defining the Assessment Indicators

There are number of proxies for food security such as food production, household income and expenditure, calorie consumption and nutritional status (Riely et al. 1999). However, the selection of a proxy depends on the availability of survey data. We originally planned to use agricultural productivity and agricultural cost and income with a focus on rice, livestock and vegetables as the proxies for food security because these are critical to food production in Cambodia. However, instead of analysing total agricultural productivity,[7] we decomposed this variable into rice, livestock and vegetables so as to detect the impact of farmer organisations (FOs) on the performance of households in each FO sub-sector.

## 3.2. Data Collection Methods

Impact assessment requires both quantitative data and qualitative information. Quantitative data was derived from a household survey of FO members and non-FO members. Qualitative information was gathered through key informant interviews (KIIs) with selected stakeholders and focus group discussions (FGDs) among FO members.

***Household survey:*** A structured questionnaire was used to gather information on FO member and non-member households. Quantitative data was obtained on the following topics: demographics; housing condition, durable assets and land ownership; crops/livestock outputs and inputs, and other non-farm activities; access to credit and loans; pre-harvest and post-harvest techniques and services; and FO membership. Household heads, the spouses of household heads or other adult family members were interviewed face-to-face. Sixteen enumerators were hired and trained to collect primary data; field-testing was conducted using a structured household survey to ensure the quality of the data collected. Four interview teams, each composed of four members with one team leader/supervisor, were formed. The team leaders were trained in the method for selecting sample households, and in managing the quality of their teams' work. To facilitate data collection and the selection of sample households, the team leaders worked closely with one provincial extension officer (field facilitator). Standard cleaning and coding was applied to data collected in the survey, then data entry was done using SPSS. Data analysis was carried out using STATA package.

***KIIs and FGDs:*** The KIIs were conducted using a semi-structured set of purposively open-ended questions. Topic guides and prompt statements were used to elicit information in the FGDs.

[7] Agricultural productivity is defined as the value of production or revenue per unit area for crops and per household for livestock.

### 3.3. Sampling Procedures

#### *Household Survey*

Since we could not access an updated list of FOs in the selected study locations, existing lists of FOs in the four provinces were used as a sampling frame. Three steps were taken to obtain the sample. The first involved the selection of 54 FOs based on simple random sampling and proportional to the number of FOs located in each province.[8] The number of sample FGs, FAs and ACs was calculated on the proportion of 50:30:20 percent, respectively, of the total selected FOs, resulting in 29 FGs, 15 FAs and 10 ACs (Table 3.1). The FOs selected for study concentrate on the production of crops (rice), livestock and vegetables.

Table 3.1: Selection of Sample FOs Proportional to Total Number of FOs in Targeted Provinces

| Provinces | Existing FOs in targeted areas | | | | Selected FOs for study | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | FG | FA | AC | FG | FA | AC | **Total** |
| Kampong Thom | 328 | 217 | 100 | 11 | 7 | 5 | 3 | **15** |
| Battambang | 411 | 210 | 156 | 45 | 9 | 6 | 4 | **19** |
| Svay Rieng | 573 | 533 | 36 | 4 | 10 | 2 | 1 | **13** |
| Kampot | 143 | 115 | 18 | 10 | 3 | 2 | 2 | **7** |
| **Total** | **1455** | **1075** | **310** | **70** | **29** | **15** | **10** | **54** |

Source: Authors' elaboration from information provided by PDA, CDRI Survey 2011

The second step was to identify the target districts in each province. In each province, we selected two to three districts with the highest densities of the three FO types. The exception was Svay Rieng province where FGs were predominant in just a few districts and only small numbers of FAs and ACs were present in some districts. Because of this, one district with a high number of FGs and another with both FAs and ACs were chosen. After selecting the target districts, the FGs, FAs and ACs in each district were listed with their corresponding locations; the sample FGs, FAs and ACs were then drawn from the list using systematic random sampling (Table 3.2).

The third step was the selection of sample households. Based on the literature, FGs are small and informal (5 to 30 members), and FAs and ACs are large and formal (30 to 150 members). For the survey of FO member households, five, seven and eight members were randomly selected from each randomly selected FG, FA and AC, respectively. For the survey of non-FO members (comparison group), using the village household list, six to nine households were selected by systematic random sampling from the same villages or communes that the FO members were selected from. The total survey sample comprised 699 households: 330 FO members and 369 non-FO members (Table 3.3).

[8] The total sample size of 54 FOs was agreed between CDRI, the World Bank and AusAID.

Table 3.2: Location of Sampled FOs and Survey Households in Targeted Districts

| Province | District | Commune | FOs | | | FO member HHs | | | Non-member HHs | Grand total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | FG | FA | AC | FG | FA | AC | | |
| Kg Thom | Kampong Svay | Tbaeng | 2 | 1 | 1 | 10 | 7 | 8 | 28 | **53** |
| | | Trapeang Ruessei | 1 | 1 | 1 | 5 | 7 | 8 | 22 | **42** |
| | | San Kor | 2 | | | 10 | 0 | 0 | 12 | **22** |
| | | Kampong Kou | 1 | 1 | | 5 | 7 | 0 | 13 | **25** |
| | Stungsen | Sroyov | 1 | 2 | 1 | 5 | 14 | 8 | 29 | **56** |
| ***Total*** | | | ***7*** | ***5*** | ***3*** | ***35*** | ***35*** | ***24*** | ***104*** | **198** |
| Battambang | Thma Koul | Ta Meun | | | 1 | | | 8 | 9 | **17** |
| | | Ou Taki | 4 | 1 | | 20 | 7 | | 31 | **58** |
| | | Kouk Khmum | | 1 | | | 7 | | 7 | **14** |
| | Aek Phnom | Preaek Luong | 1 | 2 | 1 | 5 | 14 | 8 | 29 | **56** |
| | | Peam Aek | 3 | 1 | | 15 | 7 | | 25 | **47** |
| | Sangker | Ta Pon | 1 | 1 | | 5 | 7 | | 13 | **25** |
| | | Ou Dambang Pir | | | 1 | | | 8 | 9 | **17** |
| | | Norea | | | 1 | | | 8 | 9 | **17** |
| ***Total*** | | | ***9*** | ***6*** | ***4*** | ***45*** | ***42*** | ***32*** | ***132*** | **251** |
| Svay Rieng | Svay Chrum | Kouk Pring | 2 | | | 10 | | | 12 | **22** |
| | | Ta Suos | 2 | | | 10 | | | 12 | **22** |
| | | Pouthi Reach | 1 | | | 5 | | | 6 | **11** |
| | | Chambak | 1 | | | 5 | | | 6 | **11** |
| | | Kampong Chomlong | 2 | | | 10 | | | 12 | **22** |
| | | Kraol Kou | 2 | | | 10 | | | 12 | **22** |
| | Kampong Rou | Samyaong | | 1 | 1 | | 7 | 8 | 16 | **31** |
| | | Preah Ponlea | | 1 | | | 7 | | 7 | **14** |
| ***Total*** | | | ***10*** | ***2*** | ***1*** | ***50*** | ***14*** | ***8*** | ***83*** | **155** |
| Kampot | Chhuk | Chhuk | 1 | | | 5 | | | 6 | **11** |
| | | Satr Pong | 1 | 1 | 1 | 5 | 7 | 8 | 22 | **42** |
| | Chum Kiri | Snay Anhchit | 1 | | | 5 | | | 6 | **11** |
| | | Srae Samraong | | 1 | 1 | | 7 | 8 | 16 | **31** |
| ***Total*** | | | ***3*** | ***2*** | ***2*** | ***15*** | ***14*** | ***16*** | ***50*** | **95** |
| **Grand total** | | | | | | **330** | | | **369** | **699** |

Note: number of non-member households: FG=6; FA=7; AC=9

Table 3.3: Number of Surveyed Farmer Organisations and Households by Province

| Provinces | FOs | | | FO member HHs | | | Non-member HHs | Total HHs |
|---|---|---|---|---|---|---|---|---|
| | FG | FA | AC | FG | FA | AC | | |
| Kampong Thom | 7 | 5 | 3 | 35 | 35 | 24 | 104 | **198** |
| Battambang | 9 | 6 | 4 | 45 | 42 | 32 | 132 | **251** |
| Svay Rieng | 10 | 2 | 1 | 50 | 14 | 8 | 83 | **155** |
| Kampot | 3 | 2 | 2 | 15 | 14 | 16 | 50 | **95** |
| **Grand total** | **29** | **15** | **10** | **145** | **105** | **80** | **369** | **699** |

### *KIIs and FGDs*

Approximately 30 KIIs and six FGDs were conducted. Two FGDs were held in both Kampong Thom and Battambang, and one each in Svay Rieng and Kampot. FGD participants (six to nine persons per FGD) were randomly selected from the sample FOs.

## 3.4. Analytical Framework, Study Hypotheses and Empirical Analysis

The unit of analysis for this study is the household as the impact of FOs on food security is generally observed at this level (Miyata et al. 2009; Davis et al. 2010; Bachke 2010). In the empirical literature, participation in an FO is based on the models of binary or dichotomous choice, where a household member chooses to participate in an FO when she or he perceives benefits from participation (for further details, refer to equation 1 in Appendix 1).

As noted by Thorp et al. (2005), the poor may be less likely to form a group in the first place and the poorest might be excluded in successful groups due to their lack of assets and limited access to networks and markets. In Cambodia, however, FOs are basically dependent on support agencies because farmers' management skills and general level of education are limited (Couturier et al. 2006). Observations during the qualitative study seem to partly contradict the argument of Thorp et al. (2005) because FO participation in Cambodia can help farmers with limited assets (collateral) to access credit at a lower interest rate. Thus, the first set of hypotheses is:

**Hypothesis 1a:** Households with higher levels of human capital are less likely to participate in FOs, while poor households with lower levels of human capital are more likely to do so.

**Hypothesis 1b:** Households with higher levels of productive capital are less likely to participate in FOs, while poor households with lower levels of productive capital are more likely to do so.

The dependent and explanatory variables of the empirical framework and the definitions of the elements of equation 1 (in Appendix 1) are specified in Tables 4.5, 4.6 and 4.7 in Section 4.

To link the participation behaviour of households to the potential outcomes of participation, we adopted a risk-neutral form that maximises profit $\pi$ through increased agricultural productivity (Bachke 2010; Ali and Abdulai 2010; Davis et al. 2010; Appendix 1).

Given the above explanation, it is hypothesised that:

**Hypothesis 2a:** FO members' revenues and profits from rice and livestock production are likely to be higher than those of non-FO members.

**Hypothesis 2b:** The revenues and profits from rice and livestock production among FG members are more likely to be higher than among non-FO members.

**Hypothesis 2c:** The revenues and profits from rice and livestock production among FA members are more likely to be higher than among non-FO members.

**Hypothesis 2d:** The revenues and profits from rice and livestock production among AC members are more likely to be higher than among non-FO members.

The analytical framework enables us to explain the quantitative impact of FO participation but the effects of different types of FOs on members' livelihoods cannot be reflected in the

framework. However, anecdotal information from the qualitative study indicates that some FAs and ACs are legally recognised by the government, possibly providing them with more incentives than the FG, which brings us to the third set of hypotheses:

**Hypothesis 3a:** FA members' revenues and profits from rice and livestock farming are likely to be higher than that of FG members.

**Hypothesis 3b:** AC members' revenues and profits from rice and livestock production are more likely to be higher than that of FG members.

Testing the above hypotheses entailed application of the propensity score matching (PSM) approach,[9] backed up by ordinary least squares (OLS); detailed technical explanation is presented in Appendix 1.

### 3.5. Limitations of the Study

Given that the FO samples are relatively small and draw only on some FO types in selected locations, the study findings may not be "generalisable" to reflect the issues of the FO sector in Cambodia as a whole. Some caution would need to be taken in further extrapolating the findings to wider groups and locations.

None of the sample FAs were officially registered at the Ministry of Interior, being recognised only by local authorities. Based on the earlier definition, FAs informal status might limit their business activities; hence the effect of membership could have been underestimated. Therefore, the findings can reflect only the impacts of the FAs surveyed for this study.

A small number of households in both sample and control groups engaged in vegetable production; about 25 percent (98 out of 365) of non-members had cultivated vegetables during the year prior to the survey compared with 40 percent (133 out of 330) of members. In addition, matching the subsample FG, FA and AC members with non-members rendered the sample smaller still, and the matching did not reduce the bias of covariate differences. This meant that the research team could not include the vegetable sub-sector in the empirical analysis. The empirical analysis therefore includes only rice and livestock sub-sectors as proxies for agricultural productivity variables. All three sub-sectors are presented in the descriptive analysis, however.

[9] Some studies have also used PSM on cross-sectional data to assess the impact of participation in intervention programmmes (see, for instance, Davis et al. 2010; Ali Abdulai 2010)

# 4

# RESULTS AND DISCUSSION

## 4.1. Qualitative Findings

### *4.1.1. Reasons for Participation in Farmer Organisations*

In the key informant interviews and focus group discussions, majority of farmer group (FG), farmer association (FA) and agricultural cooperative (AC) members expressed that their primary reason for membership is to build savings, and to borrow money at lower interest rates (2-3 percent per month) and reduce their dependence on moneylenders, who charge high interest rates, or microfinance institutions (MFIs). A particularly important benefit is that members, especially self-help groups, can access short-term emergency loans at no interest, for instance to cover healthcare costs or to pay school fees or buy school materials. This is consistent with previous CDRI study, which also found that the main activities of ACs and FGs are savings and credit services, encouraging FO members to access low interest loans for investment in agriculture (Chea 2010). Chea's household survey confirms that credit access is a positive and significant determinant to assess the impact of rural household participation in FOs (see Section 4.1.2).

Improving agricultural productivity through technical assistance and inputs provided by support agencies is another important reason for participating in FOs. Technical assistance includes training on how to improve crop production (rice and vegetables) and livestock management, while inputs support includes seeds, livestock and baby poultry (chicks, ducklings), free or on credit, and some capital support (some FAs and ACs). In a few cases, it was found that support agencies (NGOs and the Office of Agricultural Extension [OAE]) helped with market access by facilitating market linkages between FOs and major buyers, for instance restaurants and a casino. This was found only in Svay Rieng province, where the NGO International Volunteers Yamagata (IVY) and the OAE have helped FOs to make contracts with a casino to buy their vegetables at agreed prices and amounts twice a week. This kind of market accessibility is not common in the other study areas (see Box 1).

Box 1: Example of a Successful Vegetable Association in Svay Rieng Province

The Svay Rieng Vegetable Supply Association is a farmer group in Svay Rieng province. Its approximately 273 members come from 40 villages. Facilitated by the International Volunteer Centre of Yamagata (IVY), the association was established in 2008 but has yet to be certified and recognised as a registered association by the Ministry of Interior or Ministry of Agriculture, Forestry and Fisheries. The association aims to improve members' agricultural productivity and help them to access markets to sell their produce. Before the association was formed, the main problem that farmers had was lack of technical knowledge to improve cultivation and marketing of their produce. Related to market, some farmers had no option other than to sell their vegetables at markets near their villages where produce fetches lower prices, and sometimes they had surplus which they could not sell (oversupply of vegetables).

All association members receive assistance from IVY, which cooperates with the Office of Agricultural Extension to seek markets for their produce, such as a casino in Bavet (on the Cambodia-Vietnam border) which buys 300-400 kg of their organic vegetables twice per week (on Mondays and Thursdays).

The main activities of the association are to produce vegetables, mainly tomatoes, cucumbers, yard long beans, morning glory and egg plants, and market the outputs. The association's main clients are the casino in Bavet and one restaurant in Phnom Penh; members individually sell any remaining produce at the local market near their village. Almost all the members are household- vegetable producers. They take turns in selling vegetables to the regional collectors in order to supply the casino. If the members whose turn it is have not produced enough to meet the orders, the regional collectors make up the shortfall by buying vegetables from the next growers on the rota.

The great successes of the association relate to marketing, pricing and increasing the number of vegetable producers in the locality. Members are able to sell their produce to the casino at higher prices than they can get on local markets. Further, they have more time for other business activities because they are paid directly in cash when the regional collector picks up their produce (association). If farmer-members are left with produce surplus to the casino's requirements, they are able to sell it at local markets in or near their villages where organically grown vegetables fetch about 200 to 300 riels (USD0.05 to USD0.07) per kg more than imports from Vietnam. Local people only buy Vietnam-grown vegetables if the local organically produced vegetables have sold out. One new development considered positive progress for this association is the agreement to supply a restaurant in Phnom Penh with organic vegetables once a month. These positive changes are remarkable achievements for the association and its support agency, both of which have made efforts to respond to members' needs.

One of the main factors underlying this group's success is the *positive incentive* provided to its leaders and members, which motivates them to participate fully in the association's activities. Besides the profit they make from growing vegetables, each management committee member is given a cell phone, USD5 per month for a pre-paid phone card, and a monthly salary of about 30,000 riels (USD7.5), while each regional leader receives USD2 per month for a phone card. The association also tries to encourage its members by giving gifts to those who produce a lot of vegetables for the association; so far, several farmer-members have received a T-shirt in acknowledgment of their effort and commitment. Other strong elements of the association's success and farmers' active participation are *honesty*, *good relationship*s and *good cooperation* among members and the support agency.

Members derive other benefits from the association, thereby strengthening its function, operation and success. For instance, members can buy agricultural inputs such as equipment, materials and seeds from the support agency; access technical support and advice on how to grow vegetables; and learn how to overcome cultivation problems from model farmers and selected association members trained by IVY (one per village). With IVY as its support agency, the association can also get an interest-free loan of about USD4000 for capital to run the business (buying vegetables from members and supplying the casino). The association provides other necessary equipment such as baskets to store vegetables and a vehicle for collecting and delivering vegetables.

Even as the association has improved, it still faces many challenges. Technical knowledge on vegetable cultivation is still limited among members and the few knowledgeable farmers directly trained by IVY cannot provide enough useful technical knowledge or even support all the members. Some households still lack capital to buy inputs to improve their agricultural productivity, especially vegetable growing.

The association is currently seeking extra markets, especially restaurants and other markets in Phnom Penh where demand for vegetables is higher and prices are better. In order to ease business operations and build trust with outsiders, especially with clients for contract farming, the association plans to upgrade to agricultural cooperative status by registering at the Department of Agricultural Extension in Svay Rieng.

In short, key to the success of the Svay Rieng Vegetable Supply Association are: (i) addressing the needs of association members (marketing); (ii) the role of the support agency in assisting and strengthening the association since its formation, providing technical assistance, capital inputs, essential equipment and the means to start and support its main business activities; (iii) positive incentives provided to the management committee and outstanding members so as to encourage active participation in the association's business; and (iv) honesty, good relationships and good cooperation among members and the support agency. Despite its strengths and successes, this association still faces many problems – several members' lack of capital to buy inputs for farming, and lack of technical knowledge to improve productivity.

Besides the economic benefits, farmer members in the study areas joined an FO because of the benefits of building good relationships and mutual help in the community, learning about improved agricultural practices from each other and sharing experiences. The study also found that some FO members joined the groups by unwillingly following others in their villages, while others had no clear understanding about the concept of farmer organisation. These farmers had been told that their livelihoods would be improved after joining the group (FO), but once they joined most of them were reluctant to participate in group activities; hence the overall low performance of the organisations.

### *4.1.2. Who Mostly Participates in Farmer Organisations*

The qualitative interviews revealed that most of the FOs in the surveyed areas were formed by support agencies (e.g. government agents, international and local NGOs). Therefore, the farmer-members of these FOs are likely to reflect the objectives of the initiating agencies. For instance, support agencies like CARITAS, Rural Poverty Reduction Programme, Village Support Groups, and/or IVY target the provision of special services and livelihood improvement initiatives at particular groups such as poor farmers, people with disabilities, and women-headed households. For this reason, the latter have been purposively selected to join FOs such as FGs and/or FAs. CEDAC[10] and World Vision take a different approach in that poor or rich community members, regardless of their social standing, can participate in the groups on a voluntary basis and as long as they respect the rules and regulations. This indicates that said support agencies believe that farmers with different levels of social status (rich, medium and poor) work well as a group, and can complement each other in such a way as to improve livelihoods, especially for the poor. This thinking is also evident in the post-market liberalisation in African countries where poor smallholders form producer organisations to improve agricultural productivity, food security and smallholders' access to market (Dorsey and Muchanga 1999; World Bank 2002; Chirwa et al. 2005). However, some studies show that the poorest members in such groups benefit the least from membership, or are exploited (Bingen et al. 2003; Thorp et al. 2005).

There was no evidence of exclusion or exploitation of the poorest in the sample FOs, but the results did reveal a critical failure in that due to lack of assets and capital, low educational attainments and weak management skills, FOs are working with only the poorest farmers, especially informal farmer groups. Learning from past failures, some support agencies have changed their approach: for instance, CARITAS now welcomes volunteer farmers with poor or medium well-being status wanting to participate in their FOs in order to sustain their development programme. Similar shortcomings have also been found in some African countries where FOs were unsuccessful because membership comprised only the poorest farmers (Thorp et al. 2005).

> …at the start of this association, *Angkar Arkpiwat Setrey* [a women's development organisation] accepted only the poorest as group members, farmers who had no farmland, no proper house, or lived in a thatch-roofed house. Later on, the association included poor to medium farmers, who have 3 rais [4800m²] of farming land, raise livestock, but have limited resources [money] to send children to school or buy materials for their house. Rich farmers are not allowed to participate in our group; if they already have a good livelihood, they will not be allowed to join... (FA Leader, Battambang)

[10] Centre for Study and Development in Agriculture of Cambodia

### *4.1.3. Steps in Establishing Farmer Organisations*

Majority of the FOs were initiated by outsiders (government agents, NGOs); none of the sample FOs were self-established (Table 4.1), whereas more than 60 percent were reportedly established by support agencies. That FOs are established in different ways, depending on the type of support agency, was also reported in the semi-structured interviews.

Table 4.1: Agencies Supporting Farmer Organisations

| | Farmer group | | Farmer association | | Agricultural cooperative | | All FOs | |
|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % |
| Support agency/NGO | 100 | 68.97 | 65 | 61.90 | 39 | 48.75 | 204 | 61.82 |
| Local authority | 20 | 13.79 | 18 | 17.14 | 25 | 31.25 | 63 | 19.09 |
| Self-established | - | - | - | - | - | - | - | - |
| Do not know | 25 | 17.24 | 22 | 20.96 | 16 | 19.00 | 63 | 19.09 |

Source: Survey conducted by CDRI in May 2011

**Farmer groups (FGs)** were formed in two ways: before introducing agricultural technical training (e.g. how to grow rice, vegetables, raise animals); and after training had been extended. Membership is voluntary and members are expected to respect the group's rules and regulations.

After training, the typical process of forming an FG is reportedly as follows. *First,* the support agency consults local authorities (commune and village chiefs) to introduce the FG concept and to inform them about the development project plan for their commune and village. If the discussion with the authorities is successful, the support agency requests their help to gather farmers in the village to attend agricultural technical training at a specific date and time. The farmers invited to the training are selected depending on the development objectives, particularly according to the support agency's strategies.

*The second step* to FG formation entails the conduct of agricultural technical training by support agency staff. As part of or at the end of training activities, support agency staff introduce the FG concept to the participants and find out what they think about it and whether they are interested in setting up a group. Interested participants gather to form a group facilitated by support agency staff; FGs generally have less than 30 members. Next, an election to choose the group's management committee including a leader, deputy leader (optional), treasurer, and secretary is held; all members have a vote. After electing the management committee, group members are encouraged to build up the group's objectives and to set rules and regulations for its functions and operations, including core activities: savings, credit schemes, rice cultivation, vegetable growing, livestock rearing, rice banks and/or cattle banks. *The third step* takes place after all the necessary arrangements for the group formation have been agreed upon; at this point, the group must be introduced to local authorities (commune and village chiefs) so as to be recognised and to confirm the outcome of the earlier meeting between the support agency and local government – that a farmer group has been established in the community. Once the group has been recognised by the local authorities, it is able to take action to follow its own objectives.

**Farmer Associations (FAs),** although these groups of farmers call themselves an "association" they are not legally recognised as such because they have no certificate nor are they registered with the Ministry of Interior. Generally, the process of their establishment and their functions and operations are very similar to FGs', but FAs have more than 30 members. However, in some areas FGs are gradually attempting to transform their functions to become an AC or FA. Albeit the law does not recognise them, this transformation could help the organisations as they adopt complex management and administration procedures that will facilitate their eventual legal registration (see Box 2).

Box 2: Example of the Functions and Operations of a Highly Complex Farmer Group as an "Association"

The Svay Rieng Vegetable Supply Association, with about 273 members from 40 villages, has three levels of management: a group of leaders (one for each farmer group), 14 zone leaders, and a management committee of seven members.

> First time around, I was elected to be the group leader of a self-help group. After that, I was elected to be one of the 14 zone leaders. Then I was elected to the farmer association committee. (FA leader, Svay Rieng)

The group holds a monthly meeting with the committee members in order to report on all the association's activities, such as the amount of vegetables that have been sold per month.

To become a member of the association, it is necessary to pay a one-off fee of 5000 riels on joining, to have land for growing crops and vegetables, to be a hard worker and to be prepared to produce more vegetables to supply clients' demands.

> We keep a record book and note everything related to the activities of our association members. Every two months, the 14 zone leaders are invited to join the management committee meeting. As a general rule, no matter how rich or poor they are, we accept all those who apply for membership if they have land to grow vegetables. (FA leader, Svay Rieng)

Two different forms need to be filled in to become a member of this association: one is the member's background information, signed with the member's thumbprint; the other is the contract between the member and the association, including the list of vegetables she or he has been assigned by the association to produce.

Note: The membership fee of 5000 riels is paid only once on joining and is effective for the member's lifetime, thus membership fee is considered as nil (member cost=0)

**Agricultural cooperatives (ACs)** have mainly evolved from farmer groups that passed the evaluation of the Provincial Department of Agriculture (PDA) or Ministry of Agriculture, Forestry and Fisheries (MAFF). An AC, according to the AC Draft Law, is an economic enterprise based on agriculture. It adopts the cooperative principles of the International Cooperative Alliance (http://ica.coop/en/whats-co-op/co-operative-identity-values-principles), a set of guidelines by which cooperatives put their values into practice: (1) Voluntary and Open Membership, (2) Democratic Member Control, (3) Member Economic Participation, (4) Autonomy and Independence, (5) Education, Training and Information, (6) Co-operation among Co-operatives and (7) Concern for Community (these principles are detailed in the draft AC law).

According to the third AC Draft Law, there are five important steps involved in the process of establishing an AC as summarised below:

**Step 1:** *Introduce cooperative concepts to farmers.* The support agency collaborates with the OAE to help FG members understand the registration procedure and the Royal Sub-decree on Agricultural Cooperatives by conducting orientation and training courses. Ordinarily, this orientation and training is held in all the villages where the AC members live; the training takes one day in each village.

**Step 2:** *Introduce the Royal Decree on the Establishment and Functioning of ACs and model statute of AC to farmers.* The FG convenes a meeting of all members to elect five members to sit on the Board of Directors and three members for the Board of Auditors.

**Step 3:** *Conduct a meeting with farmers to select candidates for the Board of Directors and Supervisory Committee, and propose logo, names, business types, shared values, membership fees, statute of cooperative and others.* The OAE has to provide one more training course on the Royal Sub-decree on Agricultural Cooperatives to the elected directors and auditors in order to explain the AC model and legal registration procedure.

**Step 4:** *Conduct first general meeting to discuss and adopt the proposed items in step 3 to set up the AC.* The first meeting, to which guests such as the provincial and district governors, local authorities (commune and village chiefs), provincial agricultural officers and support agencies are invited, is held to finalise agreements and documents such as internal rules and regulations with all members.

**Step 5:** *Facilitate elected Board of Directors and Supervisory Committee to prepare required documents to get registration certificate.* All statutes and other documents approved in the meeting together with the application form are filed at the PDA. Once the PDA has issued a certificate, the FG is legally recognised as an AC. The PDA sends the documents to MAFF, which holds the list of registered ACs.

Key informants and focus group participants noted that cash credit and savings are the main activities of FOs in the study areas. Other activities such as cow and rice banks, agricultural inputs trading (fertiliser, seeds, seedlings, fingerlings, equipment), small-scale businesses (grocery shops, general stores, handicrafts) are not active. Agricultural production (rice, vegetables, and livestock) is done on an individual basis, as is the selling agricultural produce. Collective marketing was rarely observed in the study samples.

These findings suggest that the establishment of FOs varies according to their type, and support agencies play a critical role in assisting their establishment. Although the process varies according to the support agency's strategies and objectives, some commonalities were observed. Most of the well-organised and strong farmer groups had been encouraged to register with the relevant authority so that the government would recognise them. Overall, the FAs and ACs in the study areas have mostly evolved from FGs, which in turn originated from self-help groups.

### *4.1.4. Existing Legal Framework and its Benefits*

Establishing farmer organisations is one of the Cambodian government's strategies for addressing agricultural sector constraints, and is seen as a mechanism for encouraging the development of sustainable activities and facilitating relationships with both local and international organisations (Chea 2010). The legal framework sets out that ACs can be legally registered under MAFF and FAs under MOI. The FGs are recognised only by local authorities. The major benefit to

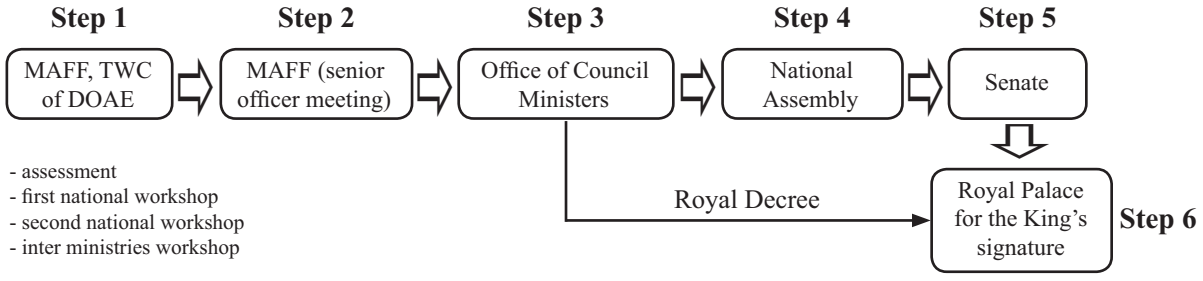
registration is that legal recognition makes them (FAs and ACs) eligible for other benefits from government as well as from outsiders and even other support agencies, such as in bidding for projects (e.g. providing agricultural training courses to other communities). Legal status also attracts other institutions' interest in terms of further mutual objectives and business activities. However, although there is legal framework to support registration, only ACs are supported by Royal Sub-decree (by law), whereas the FAs are still supported by a *prakas,* dated 1994. An interview with a government official in charge of registering FAs revealed that the government is working on a draft law to promote civil society, including FAs. The interviewee added that they only know how many FAs are registered, but not what activities these registered FAs are involved in, and when FAs change their status and their name, they do not report the information to the registration department. Field observations and key informant interviews confirmed that although many FOs are legally registered as an FA at MOI, their activities and structure are more akin to an NGO.

MAFF has recently been promoting ACs in order to: (1) enable farmers to gain advantages from agricultural development (sharing economic growth); (2) encourage farmers to work collectively;(3) solve problems as a group; (4) gather human resources; (5) strengthen marketing through collective selling and buying; (6) forge business links with investors; and (7) transfer agricultural techniques and services to farmers. In addition, MAFF has drafted a law for the ACs to upgrade the existing Royal Sub-decree, adding other support strategies to protect and create more advantages for farmers.

> …Government is willing to establish legal framework for agricultural cooperatives in Cambodia so as to improve Cambodian farmers' productivity and livelihoods, and to protect and empower farmers. However, government does not force existing farmer organisations to register legally as a bona fide agricultural cooperative; it is on a voluntary basis. (MAFF, Phnom Penh)

There are six steps through which the AC Law must pass (Figure 1). At the time of study (May 2011), the draft law was at the second stage, awaiting MAFF approval before being put to the Office of the Council of Ministers. It is noted that the Royal Sub-decree on AC establishment did not go through the National Assembly and Senate.

Figure 1: Steps in Establishing the Law on Agricultural Cooperatives




Note: TWC = Technical Working Committee; DOAE = Department of Office of Agriculture Extension

### *4.1.5. Role and Challenges of Support Agencies*

Support agencies are the public sector institutions and NGOs that assist and sustain the functions and operations of FOs. Study results show that most FOs are formed by support agencies (Table 4.1), which then take a critical role in assisting the operation of FOs including capacity

building (technical and management skills), facilitation and follow-up, networking, and inputs provision (agricultural materials and capital). For FGs, FAs and ACs, market access assistance is much less active because farmer-members still largely sell their produce and buy inputs on an individual basis (see empirical analysis below for further detail).

In the literature, private sector or commercial companies are said to play a significant role in supporting FOs (providing inputs, credit and technology, and buying outputs through contract farming) (Kachule et al. 2005). However, only two types of support agency were found in the study areas: public sector (OAE of PDA), and NGOs and development partners (such as those created by International Fund for Agricultural Development [IFAD]). The PDA is a representative of MAFF, which is responsible for providing long-term support to ACs by facilitating their formal registration, operation, implementation, market access and benefits sharing.[11] In addition, MAFF provides capital and agricultural technical training courses to operating ACs. The OAE of PDA invites major clients (big restaurants, casinos and hotels) to visit the communities where FOs are located as a way of showcasing farmers' produce and promoting marketing assistance, which could eliminate price exploitation by intermediaries and strengthen producers' bargaining power for better prices with buyers and traders.

> …I think that Svay Rieng Office of Agricultural Extension of Provincial Department of Agriculture is helping our team a lot. They have helped us to complete all the registration forms and write our cooperative's statute. Moreover, it has provided 1,000,000 riels [USD246][12] as input capital as well as agricultural techniques. Our cooperative is still receiving assistance from the PDA. (Leader of AC, Svay Rieng)

This is a good example of support for an AC located in one of the study areas. However, market access assistance and capital input provision to ACs from PDA are not common in the other study areas. The credit support could be taken to imply that these ACs have insufficient capital to run their activities, and thus PDA has stepped in to support their operations. On the negative side, the decision making and governance of grassroots organisations may be influenced by the public sector, though the ACs reported that their governance is not interfered with.

NGOs, as part of their development mandate and mission, play an important role in improving rural livelihoods in Cambodia by promoting agricultural production and market access. The establishment of rural community producer groups implies that NGOs can easily access and help smallholders to improve their livelihoods. In addition, building FOs and allowing them to operate independently may be a good rural development initiative in developing countries such as Cambodia. Study findings show that NGOs provide assistance to all three types of FO, captured in the assessment in the form of agricultural technical training and inputs (seeds, livestock, agricultural equipment), but active support to access input and output markets remains largely absent.

The findings also reveal that when an NGO's programme ends, it tries to find another organisation or local authority (government) to take its place so as to ensure FOs' sustained functions and operations. This suggests that support agencies play a significant role in the sustainable implementation of grassroots organisations, and may also reflect the fact that the

[11] In this case, the Provincial Department of Agriculture (PDA) assists agricultural cooperatives (ACs) to make sure that the profits are distributed equally among members, but does not interfere in ACs' activities or decision making.

[12] At the time of study, USD1=4060 riels.

FO sector in Cambodia is still in its infancy and unlikely to survive independently. This is a common problem besetting the operation of FOs in developing countries, including some African and Asian countries. Many FOs disappear after support is withdrawn, especially input supplies (Bingen et al. 2005; Thorp et al. 2005).

### *4.1.6. Challenges in Setting up and Registering Farmer Organisations*

#### *Establishment-related Challenges*

Despite the formation of many farmer organisations in the study areas, membership-based organisation remains a new idea for many farmers. They do not fully understand what FOs are about and sometimes they did not even know that FOs had been established in their village. In addition, some FOs had failed and left villagers with bitter experiences; this can have negative impacts on new FOs such that people are reluctant to join.

A major concern related to FO establishment is the selection of qualified representatives for the FG, FA and AC management committees. In addition, some farmers are reluctant to join because affiliation with an AC requires paying a membership fee and/or buying at least one share, which some poor farmers are unable to afford. Survey results show that about 43 percent are unable to join FOs due to lack of capital to fulfil membership requirements (Table 4.2). Empirical analysis of the propensity to participate in an FO also found that AC members are slightly better off than members of FGs and FAs.

Table 4.2: Reasons for Unwillingness to Join Farmer Organisations (n=330 households)

| Reasons | Yes | | No | |
|---|---|---|---|---|
| | n | % | n | % |
| Lack of information about participation | 202 | 55.34 | 163 | 44.66 |
| Lack of time; commitment | 168 | 46.03 | 197 | 53.97 |
| Lack of capital | 158 | 43.29 | 207 | 56.71 |
| Will join after seeing good results | 101 | 27.67 | 264 | 72.33 |
| Venue is far from home | 32 | 8.77 | 333 | 91.23 |
| Others (leadership not good enough, no one selected to lead, no FO in the neighbourhood) | 50 | 3.425 | 1410 | 96.575 |

Source: Survey conducted by CDRI in May 2011

Setting up just one AC is time consuming and entails a huge logistical exercise, especially gathering members to meetings. It necessitates many meetings for members to agree on rules and regulations for their future cooperative, and for the management committee to be trained on accounting, financial management, bookkeeping and leadership. In addition, there are costs involved in organising a general meeting and inviting stakeholders like a provincial or district governor, OAE representatives and NGO staff to inaugurate the new AC. Fortunately for some ACs, their support agencies cover the costs of this general meeting and other expenses related to the registration process.

#### *Challenges in Legal Registration*

ACs have to register at MAFF while FAs can be registered at MOI or the Ministry of Commerce. There are no registration requirements for FGs, but all FGs are informed or recognised by local authorities (village and commune). Qualitative findings reveal that even though it is easier to register legally as an AC, many FGs are dissatisfied with the time consuming procedures and

the number of documents they need to complete for MAFF. FGs would not be able to complete the required registration documents without assistance from support agencies.

The ease of registration depends on government policy and the supporting agencies that help FGs to transform to an AC or FA. Presently, MAFF is promoting the AC concept through the PDA (OAE), so it is likely that many FGs will register to become an AC rather than an FA. In addition, the legal framework for ACs can be registered at the provincial authority (PDA), which is much easier than doing so at the MOI. FA registration can only be done at ministry level. Registration also requires many documents. Key informant interviews confirm that there is little or no extra benefit (incentive) for legally registered FAs compared with non-registered FAs. Most FAs interviewed are not registered, yet they can still operate in the same way as a registered FA. Furthermore, some respondents from FAs and ACs expressed concern that they would have to pay tax or other fees if they were to register with the ministry.

### *4.1.7. Capacity Constraints on Farmer Organisations*

From the survey, FOs face many challenges that restrain their performance and hinder their ability to meet members' needs. Some major challenges are: shortage of credit capital, lack of adequate farmland, poor group structure, members' illiteracy, lack of external support (access to information and services), leadership problems, limited knowledge about planning, and lack of good leadership and partisanship. Qualitative findings are consistent with those of the survey, as presented in Table 4.3.

Table 4.3: Challenges Affecting the Performance of FOs (percentage of HHs reporting, n=330)

| Challenges | Facing challenges | | | Level of severity | | |
|---|---|---|---|---|---|---|
| | Yes | No | DK | 1 | 2 | 3 |
| Lack of common objectives | 36.06 | 63.03 | 0.91 | 47.06 | 31.09 | 21.85 |
| Poor group structure | 50.30 | 48.79 | 0.91 | 39.76 | 38.55 | 21.69 |
| Lack of good leadership | 51.82 | 48.18 | 0.00 | 43.86 | 26.90 | 29.24 |
| Poor enforcement of internal regulations | 61.21 | 38.48 | 0.30 | 50.50 | 32.67 | 16.83 |
| Poor book keeping/ financial management | 36.36 | 61.82 | 1.82 | 26.67 | 40.83 | 32.50 |
| FO does not respond to members' needs | 62.12 | 37.58 | 0.30 | 45.85 | 34.63 | 19.51 |
| Lack of members' motivation to take part in collective action | 45.15 | 54.85 | 0.00 | 39.60 | 38.93 | 21.48 |
| Members' illiteracy | 79.39 | 20.00 | 0.61 | 34.35 | 30.15 | 35.50 |
| Lack of external support (access to information and services) | 70.61 | 27.27 | 2.12 | 31.76 | 41.20 | 27.04 |
| Poor communication with local authority | 27.58 | 71.52 | 0.91 | 27.47 | 29.67 | 42.86 |
| Jealousy among members | 38.79 | 60.61 | 0.61 | 39.06 | 32.81 | 28.13 |
| Limited knowledge about planning | 63.94 | 34.85 | 1.21 | 44.55 | 38.86 | 16.59 |
| Impractical knowledge and techniques provided by supporting agencies | 68.79 | 30.30 | 0.91 | 35.68 | 42.73 | 21.59 |
| Lack of farmland | 79.70 | 20.30 | 0.00 | 30.80 | 22.05 | 47.15 |
| Shortage of capital and credit facilities | 82.73 | 16.67 | 0.61 | 27.84 | 32.97 | 39.19 |
| Lack of partisanship | 27.58 | 72.42 | 0.00 | 19.78 | 34.07 | 46.15 |

Note: DK: Do not know; 1=somewhat serious; 2=serious; 3=very serious

### *a) Lack of Credit Capital*

In the survey, about 83 percent of the respondents (i.e., FO member households) said that their FOs did not have enough money to provide loans to members (Table 4.3). Similar observations were gleaned from the KIIs and FGDs. FO members indicated that the major reason for forming a group was to mobilise savings capital to invest in agricultural activities; however, the organisations' capital savings could not meet the needs of their members. Thus, many FO members often get agricultural inputs (equipment, fertiliser, seed, livestock) on loan from support agencies or traders and pay for them after harvest. Many members also access MFI loans, despite the high interest rate, to invest in agricultural production, including rice, vegetables and livestock. This indicates that the poorer members in the group might be unable to access some important inputs, and despite having learned new agricultural techniques from their FOs or support agencies, do not have the means to put them into practice to improve crop productivity.

### *b) Illiteracy and Limited Knowledge of FO Members*

Besides the lack of credit facilities, a critical problem faced by FOs in the study areas is the low capacity of human resources, including limited leadership and poor book keeping, financial management and communication skills. This makes it difficult to find educated or even literate candidates to be elected or selected as leaders and/or managers. In some groups, the leader was unable to read or write, lacked public speaking skills and had limited planning skills but was still elected due to the lack of alternative candidates; this could hinder the overall improvement of FOs' performance. Given their limited knowledge, farmer-members find it difficult to understand the group's function and operation let alone the legal framework for FOs.[13] This is a critical issue that can easily lead to mistrust, especially over financial records, among members and between members and the FO management committee. In addition, FOs are only as strong as the level of skills of their individual members. For example, manager-members require skills like book keeping, leadership, communication, facilitation and agricultural technologies, while farmer-members need to learn about agricultural techniques and group work.

### *c) Limited Participation from FO Members and Poor Enforcement of Internal Regulations*

The study noted that low participation from members is a general issue faced by FOs, as depicted by the 45.2 percent claiming this problem (Table 4.3). Key informants and focus group participants elaborated further saying that shortcomings include sporadic attendance at meetings and depositing money late. There are three reasons for this. First, members who are deeply in debt to the FO tend to avoid taking part in FO activities. Second, some members are so busy working far away from the village that they do not have enough time to participate. Third, the FO leaders need to strike a balance between rule enforcement and tolerance when some members do not conform to the FO's statute and rules.

Activities that require collective group effort were one of the difficulties observed in FOs in the study areas, according to some 45.2 percent (Table 4.3). This especially applies to work relating to agricultural production, including livestock farming and vegetable growing. These kinds of activities need some members to contribute more, such as putting more time and effort into the FO's operation and management. The problems that commonly arise from working in a group mostly relate to benefits distribution, jealousy and trust. Working in a group seems

[13] The legal framework is too complex for farmers to know and understand the formal status of farmer organisations.

to have more problems than working individually where the benefits belong to the individual household and do not have to be shared with others.

***d) Limited Knowledge of Agricultural Techniques and Marketing***

Observations from the survey show that about 69 percent of members find the agricultural techniques they had been taught to be far from feasible in practice (Table 4.3). Qualitative findings also suggest that agricultural techniques are not always applicable in members' areas or are only partly adopted due to lack of inputs, implying that technical services do not always respond to FO members' needs. Some members said that despite following the technical guidelines, they did not get the results demonstrated in the training; this was mainly due to great difficulty in applying the guidelines. For instance, in their livestock (cattle, pigs) and poultry (chickens, ducks) raising, FO members struggled to manage pig and chicken diseases using the traditional techniques taught by their FOs or support agencies; their livestock raising almost failed completely due to the ineffective disease control methods they had learned. Key informants and FGD participants did say that the animal management techniques they had learned are good enough to improve productivity if their livestock stays healthy. Regarding vegetable cultivation, disease, insect infestation, lack of capital and lack of high land (above wet season flood level) hamper yield improvements, while lack of collective marketing stops growers from accessing more markets and getting better output prices. Although vegetables are a high-value-added crop, only a few FO members and non-members grow them. This is partly due to their lack of access to higher land, and because vegetables are a high maintenance crop, need a lot of water and are susceptible to insects, pests and disease (see the empirical analysis section for details).

***e) Mistrust***

Trust is most important for FOs to work effectively and sustainably, but generating or earning members' trust is one of the most daunting challenges facing FOs in Cambodia and other developing countries (Pomeroy et al. 2001; Hansen et al. 2002; Pretty 2003; Ros 2010). Low human capital and poorly skilled FO management committees are the key problems creating mistrust in FOs. Mistrust in FOs mostly stems from improper financial record keeping and the limited capacity of group leaders. Nepotism and poor management also can lead to jealousy and mistrust. Most group members depend on the support agencies (local NGOs) that they have been involved with to monitor all financial records. They expect the facilitators assigned by the NGOs to assist the groups whenever they face problems, and especially to monitor their groups' financial records every month. This indicates that there is space for support agencies to improve mediation and help to build trust among members and between members and leaders. The survey findings suggest that the level of trust in the FOs with regard to financial management (savings, lending, financial records) is high: 42-46 percent of FO members responded, "definitely trust" (Table 4.4). This result contradicts the qualitative data, however. There are two possible reasons for the differences between qualitative and survey findings. First, farmers might have underreported because trust is an abstract and sensitive issue. Second, unlike the semi-structured interviews, the survey did not enable enumerators to probe deeply into the answers given.

Table 4.4: Level of Trust (percentage of HHs reporting)

| Level of trust | Level of trust | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Can members in your group generally trust each other in matters of lending and borrowing money? | 0.30 | 3.64 | 15.45 | 35.45 | 45.15 |
| Do you and other members trust the committee with financial management? | 0.91 | 2.73 | 11.52 | 38.79 | 46.06 |
| Do you and other members trust your leader to manage the FO well? | 0.30 | 3.64 | 11.52 | 38.18 | 46.36 |
| Do you and other members and the committee and leader trust the support staff to monitor your FO? (book keeping, financial records…) | 0.61 | 3.64 | 13.64 | 39.70 | 42.42 |

Note: 1=not at all; 2= somewhat trust; 3=normal; 4=trust; 5= definitely trust

Qualitative information from the KIIs and FGDs revealed that limited participation from FO members and improper enforcement of internal regulations are the main challenges for FO operation. Low participation from members is a general issue faced by FOs.

## 4.2. Empirical Findings

### *4.2.1. Descriptive Statistics*

The data used in the analysis was collected during a survey of 699 households in the four study provinces, which have a high density of operational farmer organisations. The data collected included information on household socioeconomic and farming characteristics such as input use, production costs, productivity (yield) and output prices. Four households were dropped from the control group due to outliers, reducing the total to 695 households, 330 of which are FO member households. Table 4.5 presents the definitions and descriptive statistics for the variables used in the empirical analysis.

Estimates show that the average age of household heads is around 48, the mean number of years of education of household head is about 4, and 66 percent of the household heads can read and write. Male-headed households are predominant, comprising about 77 percent of the total sample households. Average household size is about five persons, with a mean dependency ratio of 0.59.

Approximately 72 percent of the households depend on agriculture as their primary income source, and about 65 percent had accessed credit over the 12 months prior to the survey.

On average, the rice yield in the study areas is about 1.89 tonnes per ha, much lower than the national average of 2.75 tonnes per ha in 2008 (Table 4.5) (Theng and Koy 2011). Revenue from rice farming is about 1.7985 million riels (USD443) per ha, with profit of 1.1453 million riels (USD282) per ha.[14] Income from livestock raising is 2.3 times higher than from rice farming, with an average revenue of about 4.2 million riels and profit of 3.6 million riels per year; however, the variation among household revenue from livestock was very high compared to that from rice (Table 4.5). Vegetable growing is the third most important source of household income, providing an average revenue of about 1.63 million riels per 10a (1000 $m^2$) and about 1.41 million riels profit per year.

[14] See Section 3.3 for the cost of rice production; household labour costs are not included.

Table 4.5: Definition of Variables and Descriptive Statistics

| Variables | Description | Sample mean | Standard deviation |
|---|---|---|---|
| ***Outcome variables/dependent variables*** | | | |
| Rice yield | Mean rice output (kg per ha) | 1891.77 | 1070.50 |
| Rice revenue | Rice revenue (0000 riels per ha) | 179.85 | 109.68 |
| Rice profit | Rice profit (0000 riels per ha) | 114.53 | 196.38 |
| Livestock revenue | Livestock revenue (0000 riels) | 419.78 | 589.77 |
| Livestock profit | Livestock profit (0000 riels) | 362.41 | 445.29 |
| Vegetable revenue | Vegetable revenue (0000 riels per 10a) | 163.94 | 307.11 |
| Vegetable profit | Vegetable profit (0000 riels per 10a) | 141.28 | 286.22 |
| ***Independent/explanatory variables (control variables)*** | | | |
| *Head of household characteristics* | | | |
| Age of HHH | Age of household head | 48.44 | 13.10 |
| Education of HHH | Number of years of HHH attended school | 3.97 | 3.35 |
| Literacy of HHH | HHH can read and write(dummy) | 0.66 | 0.47 |
| HHH male | HHH is male (dummy) | 0.77 | 0.42 |
| HHH married | HHH is married (dummy) | 0.82 | 0.38 |
| Unemployment of HHH | HHH is unemployed (dummy) | 0.34 | 0.47 |
| *Household characteristics* | | | |
| HH size | Household size | 5.11 | 1.96 |
| Dependents | Dependency ratio (adults aged 15-65 years) | 0.59 | 0.58 |
| Agri. income source | Agriculture is primary source of HH income (dummy) | 0.72 | 0.45 |
| Credit access | Household access to loan in last 12 months (dummy) | 0.65 | 0.48 |
| *Welfare characteristics* | | | |
| Value of all assets | Total value of assets (0000 riels) | 550.28 | 624.18 |

Note: exchange rate at time of survey was 1USD = 4060 riels; 10a is equal to 1000 $m^2$

Differences in characteristics and statistics between FO members and non-members, and the results of the t-statistics are shown in Tables 4.6 and 4.7. Results of the t-test reveal some apparent differences in household characteristics, in particular education, literacy and unemployment of the household head. There are also significant differences in access to credit, and total value of household assets. There are no statistically significant differences in the average age of household head, household size, dependency ratio, and agricultural income (see Table 4.7 and Tables A2-1 and A2-2 in Appendix 2 for details). Although members' illiteracy is perceived to be one of the main challenges facing FOs, more members than non-members can read and write. This implies that the interviewed FO members are literate, but they find that other members' illiteracy is a constraint on their FO. However, matching members and non-members using propensity score matching (PSM) gives a more comparable sample.

The outcome productivity variables for rice, livestock and vegetables were generally higher in members' households than in non-members'. Members' revenues and profits from both rice and vegetables were likewise higher than non-members' but statistically significant differences were not found. It will be recalled that the mean education of household heads for members is significantly higher than non-members', but this appears to be less of a productivity factor. It is likely that household level characteristics (e.g. credit access, agricultural assets) on which FO members and non-members significantly differ could be contributing to the seemingly

higher revenues and profits among members. Members' revenue from livestock is statistically significantly different, being on average about 883,200 riels (USD218) higher than non-member households' (Table 4.7, pooled sample).[15]

Table 4.6: Mean Differences in Household Characteristics (sample mean)

| Variables | Description | Members | Non-members | Difference | t-Stat |
|---|---|---|---|---|---|
| ***Independent/ explanatory variables (control variables)*** | | | | | |
| *Head of household characteristics* | | | | | |
| Age of HHH | Age of household head | 48.47 | 48.41 | 0.06 | 0.06 |
| Education of HHH | Number of years of HHH schooling | 4.35 | 3.64 | 0.71** | 2.81 |
| Literacy of HHH | HHH can read and write(dummy) | 0.72 | 0.60 | 0.12*** | 3.22 |
| HHH male | HHH is male (dummy) | 0.75 | 0.80 | -0.05 | -1.54 |
| HHH married | HHH is married (dummy) | 0.82 | 0.82 | 0.00 | 0.07 |
| Unemployment of HHH | HHH is unemployed (dummy) | 0.29 | 0.39 | -0.10** | -2.82 |
| *Household characteristics* | | | | | |
| HH size | Household size (number of persons) | 5.21 | 5.02 | 0.20 | 1.31 |
| Dependents | Dependency ratio (to adults aged 15-65 years) | 0.57 | 0.60 | -0.03 | -0.62 |
| Agri. income source | Agriculture is primary HH income (dummy) | 0.71 | 0.72 | -0.01 | -0.41 |
| Credit access | HH access to loan in last 12 months (dummy) | 0.72 | 0.59 | 0.13*** | 3.68 |
| *Welfare characteristics* | | | | | |
| Value of all assets | Total value of assets (0000 riels) | 598.69 | 506.50 | 92.19** | 1.95 |
| | Number of households/observations | 330 | 365 | - | - |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively.

Further analysis by decomposing the sample member households into subsamples, i.e. farmer group (FG), farmer association (FA) and agricultural cooperative (AC), shows different effects of participation in FOs. There are no significant differences with regard to revenues and profits from rice, livestock and vegetables for FG member households compared with non-members. However, there are differences between AC member households and non-members that are significant at the 5 percent level: AC members have higher revenues and profits from both rice and livestock compared to non-members, although that from vegetables shows no statistically significant difference (Table 4.7). Statistically significant differences are also found in livestock revenues and profits between FA members and non-members.

Agricultural land is the most valuable asset for agricultural productivity and livelihoods in rural areas. However, not all the households surveyed have farmland. Table 4.8 shows that 17 member (about 5 percent) and 35 non-member households (about 9.5 percent) reported having no agricultural land. On average, the size of members' agricultural landholdings (1.93 ha) is similar to non-members' (1.81 ha).[16] There are also no significant differences between members and non-members in terms of the number of farming plots they own (Table 4.8). The distribution of land-size categories owned by members and non-members also shows a similar

[15] This figure represents the difference between FO members and non-members. Descriptive statistics on livestock are given in Table 4.7. Ninety-nine percent of member and non-member households raise livestock, thus it did not make sense to compare 1 percent of the non-livestock households sampled.

[16] The sample mean of landholdings is calculated by excluding landless households. The average farm size presented in Table 4.2 is calculated based on all sample households, including landless households, for matching purposes.

pattern: about 37.5 percent of households (in both groups) hold less than 1 ha, about 26 percent hold 1-2 ha, around 11 percent have 2-3 ha and 18 percent have more than 3 ha (Table A2-3 in Appendix 2).

Table 4.7: Mean Differences in Agricultural Productivity Variables (sample mean)

| Outcome variables / Dependent variables | | Members | Non-members | Difference | t-Stat |
|---|---|---|---|---|---|
| **Pooled Sample** | | | | | |
| Rice | Revenue (0000 riels ha) | 186.39 | 173.51 | 12.88 | 1.46 |
| | Profit(0000 riels ha) | 124.38 | 104.99 | 19.39 | 1.23 |
| Livestock | Revenue (0000 riels) | 465.12 | 376.80 | 88.32** | 1.90 |
| | Profit (0000 riels) | 389.89 | 336.35 | 53.54 | 1.52 |
| Vegetables | Revenue (0000 riels per 10a) | 178.25 | 144.24 | 34.01 | 0.83 |
| | Profit (0000 riels per 10a) | 158.45 | 117.63 | 42.82 | 1.08 |
| **Farmer group (FG)** | | | | | |
| Rice | Revenue (0000 riels per ha) | 177.52 | 173.51 | 4.01 | 0.37 |
| | Profit(0000riels per ha) | 106.63 | 104.99 | 1.64 | 0.08 |
| Livestock | Revenue (0000 riels) | 333.89 | 376.80 | -42.90 | -1.00 |
| | Profit (0000 riels) | 306.53 | 336.35 | -29.82 | -0.76 |
| Vegetables | Revenue (0000 riels 10a) | 222.60 | 144.24 | 78.37 | 1.35 |
| | Profit (0000 riels 10a) | 201.03 | 117.63 | 83.40 | 1.56 |
| **Farmer association (FA)** | | | | | |
| Rice | Revenue (0000 riels ha) | 172.24 | 173.51 | -1.27 | -0.10 |
| | Profit (0000 riels ha) | 107.66 | 104.99 | 2.67 | 0.10 |
| Livestock | Revenue (0000riels) | 557.47 | 376.80 | 180.67** | 2.50 |
| | Profit (0000 riels) | 432.70 | 336.35 | 96.35* | 1.78 |
| Vegetables | Revenue (0000 riels per 10a) | 131.02 | 144.24 | -13.22 | -0.25 |
| | Profit (0000 riels per 10a) | 117.12 | 117.63 | -0.51 | -0.01 |
| **Agricultural cooperative (AC)** | | | | | |
| Rice | Revenue (0000 riels per ha) | 219.27 | 173.51 | 45.76*** | 3.38 |
| | Profit (0000 riels per ha) | 176.14 | 104.99 | 71.15** | 2.67 |
| Livestock | Revenue (0000 riels) | 589.75 | 376.80 | 212.95** | 3.19 |
| | Profit (0000 riels) | 490.57 | 336.35 | 154.22** | 2.70 |
| Vegetables | Revenue (0000 riels per10a) | 162.90 | 144.24 | 18.66 | 0.35 |
| | Profit (0000 riels per10a) | 140.09 | 117.63 | 22.47 | 0.47 |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively; 10a is equal to 1000 $m^2$.

Members' landholdings by different types of FO compared with non-members' shows that FO members seem to have larger landholdings than non-members with the exception of FG members who have smaller landholdings than non-members do, but there are no statistically significant differences. That members and non-members have similar size of agricultural landholdings is reflected consistently with no significant difference for crop productivity in the pooled sample, as discussed above (Tables 4.7 and 4.8). This implies that the higher statistical significance in the rice productivity (revenue and profit) of AC members compared to that of

non-members may be due to factors other than size of landholding, for example better access to technology and/or better management of inputs application.

Table 4.8: Agricultural Landholding by Households in Member and Non-member Groups

| Landholding | Members | | | Non-members | | | t-statistic |
|---|---|---|---|---|---|---|---|
| | n | Mean | Median | n | Mean | Median | |
| Landless | 17 | | | 35 | | | |
| Agricultural landholding | 313 | - | - | 330 | - | - | - |
| Average no. of plots per HH | 313 | 3.19 | 3.00 | 330 | 3.15 | 3.00 | 0.29 |
| Agricultural land (pooled sample) | 313 | 1.93 | 1.16 | 330 | 1.81 | 1.07 | 0.71 |
| Agricultural land (FG vs. non-members) | 138 | 1.67 | 1.00 | 330 | 1.81 | 1.07 | -0.65 |
| Agricultural land (FA vs. non-members) | 98 | 2.06 | 1.30 | 330 | 1.81 | 1.07 | 1.03 |
| Agricultural land (AC vs. non-members) | 77 | 2.23 | 1.50 | 330 | 1.81 | 1.07 | 1.53 |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively.

Comparisons of the mean differences in outcome variables, rice and livestock revenues and profits, and other household characteristics between FO members and non-members show that FO members are seemingly better-off than non-members (Tables 4.6 and 4.7). However, these comparisons of mean differences do not account for the effects of other characteristics of the sample households, and thus may confound the results for the impact of participation in FOs (i.e. FO members). Caliendo and Kopeinig (2008) suggest that to obtain a clear picture of the effect of participation on outcomes, systematic differences between covariates (observable variables) of members and non-members should be eliminated, which is done by matching member and non-member households using PSM. The variables included in the model would only be those that influence both members and outcomes, but are not affected by participation in FOs when matching is performed. Furthermore, economic theory, sound knowledge of previous research and the institutional setting in which treatment (FO members) and outcomes are measured should guide the choice of variables (Smith and Todd 2005). The variables used in our propensity score model in this study are based on previous research on the determinants of participation in rural producer organisations. Literature shows that participation in a producer organisation (i.e. FOs) depends largely on household head characteristics, household resource endowments, and household location characteristics (Bernard and Spielman 2009; Miyata et al. 2009; Davis et al. 2010; Bachke 2010). The following section discusses the analysis of participation and outcome variables by PSM.

### *4.2.2. Analysis of Participation Characteristics in Farmer Organisations*

Table 4.9 illustrates the results of logit estimation from equation 1 (in Appendix 1) for the FO participation determinant. As can be seen, age of household head has a positive impact on household participation in FOs. This finding tends to contrast with the recent studies of Bachke (2010) and Davis et al. (2010) in which age is a negative determinant of a household's decision to participate in an FO. The results indicate a positive relationship between a household head's age and propensity to participate in FOs; however, when household heads become older (over the age of 54) they are less likely to join an FO.[17] Taking the subsamples (i.e., FG, FA, AC) into account, findings reveal that age of household head has a significant effect similar to the

[17] The U-shape marginal effect of age is 54 years old, i.e. household heads older than 54 are unlikely to participate in FOs.

pooled sample, except for the FG member subsample in which age of household head has no significant effect on participation (see Table 4.10).

Table 4.9: Logit Estimates of Propensity Scores for Participation in FOs in the Pooled Sample

| Explanatory Variables | Pooled 1 | Pooled 2 (no credit) |
|---|---|---|
| Age of household head | 0.134*** | 0.133*** |
| Age of household head squared | -0.0012** | -0.00127** |
| Number of years of household head's schooling | 0.0347 | 0.033 |
| HHH can read and write (dummy) | 0.381 | 0.369 |
| HHH is male (dummy) | -1.025*** | -1.033** |
| HHH is married (dummy) | 0.574 | 0.6023 |
| HHH is unemployed (dummy) | -0.606*** | -0.592*** |
| Household size | -0.440** | -0.370** |
| Square of Household size | 0.0358** | 0.0323** |
| Dependents ratio (adults aged 15-65 years) | 0.244 | 0.2176 |
| Agriculture is primary source of HH income (dummy) | 0.0526 | 0.0615 |
| Household access to loan in last 12 months | 0.688*** | |
| Index of household agricultural assets | 0.182* | 0.2049** |
| Total value of assets (0000 riels) | 0.00087*** | 0.00074** |
| Square of asset value | $-3.26x10^{-7}$*** | $-3.23x10^{-7}$** |
| Constant | -3.107** | -2.684** |
| **Pseudo-$R^2$** | **0.0734** | **0.0575** |
| **Number of observations** | **695** | **695** |

Note: Coefficient is reported as statistically significant at *10%, ** 5% and *** 1%. When the credit variable is excluded, there is no sign of any changes in the coefficients of other variables in the logit estimate, and the model is more stable; therefore, discussion of the credit variable is included in our paper.

Male household heads have a lower propensity to participate in FOs than their female counterparts. This finding implies that FOs in Cambodia may have primarily targeted female household heads so that they can enhance their capacity in community activities. Female household heads are frequently concerned with household matters and are thus likely to get involved with FOs in their villages, where they believe doing so would provide them with various kinds of support. Male household heads tend to pay more attention to farm production and seek other off-farm activities. When considering the subsample, this significant effect is only observed for the FA.

Unemployment of household head is negatively associated with a household's participation at a significance level of at least 5 percent in the pooled sample and FG and FA subsamples. However, it has no significant impact on the participation in AC, and it is in line with the findings of Bachke (2010) (Tables 4.9 and 4.10). A possible explanation for the negative relationship between unemployed household head and probability of participating in an FO is that unemployed household heads may be older (average age is around 56) and less active in seeking jobs outside primary farming or in engaging in community-based work. This determinant is consistent with the result for age of household head; older household heads are less likely to join an FO.

Table 4.10: Logit Estimates of Propensity Scores for Participation in FOs in the Subsamples

| Explanatory Variables | AC 1 | AC 2 (no credit) | FA 1 | FA 2 (no credit) | FG1 | FG2 (no credit) |
|---|---|---|---|---|---|---|
| Age of household head | 0.294*** | 0.281*** | 0.1874** | 0.188** | 0.052 | 0.052 |
| Age of household head squared | -0.0026*** | -0.00255** | -0.00178** | -0.0018** | 0.0005 | 0.0004 |
| Number of years of household head's schooling | 0.1095* | 0.1051* | 0.0661 | 0.0584 | -0.027 | -0.020 |
| HHH can read and write (dummy) | 0.636 | 0.614 | 0.260 | 0.241 | 0.528* | 0.467 |
| HHH is male (dummy) | -0.644 | -0.709 | -1.693*** | -1.669*** | -0.653 | -0.664 |
| HHH is married (dummy) | -0.294 | -0.235 | 1.455*** | 1.479*** | 0.357 | 0.360 |
| HHH is unemployed (dummy) | -0.132 | -0.151 | -0.598** | -0.591** | -0.842*** | -0.815*** |
| Household size | -0.571* | -0.510* | -0.531** | -0.426* | -0.309 | -0.239 |
| Square of household size | 0.034 | 0.0310 | 0.049** | 0.0424** | 0.026 | 0.023 |
| Dependents ratio (adults aged 15-65 years) | 0.334 | 0.318 | 0.128 | 0.117 | 0.217 | 0.208 |
| Agriculture is primary source of HH income (dummy) | -0.119 | -0.0783 | 0.2621 | 0.295 | -0.066 | -0.048 |
| Household access to loan in last 12 months | 0.531* | | 0.742*** | | 0.782*** | |
| Index of household agricultural assets | 0.182 | 0.215 | 0.172 | 0.186 | 0.162 | 0.210 |
| Total value of assets (0000 riel) | 0.00265*** | 0.00256*** | 0.000289 | 0.000199 | 0.001 | 0.000 |
| Square of asset value | $-8.48x10^{-7}$*** | $-8.41x10^{-7}$*** | $-1.15x10^{-7}$ | $-1.28x10^{-7}$ | 0.000 | 0.000 |
| Constant | -8.965*** | -8.449*** | -5.602*** | -5.354*** | -2.071 | -1.594 |
| **Pseudo-$R^2$** | **0.1653** | **0.1572** | **0.1001** | **0.0844** | **0.0608** | **0.0419** |
| **Number of observations** | **445** | **445** | **470** | **470** | **510** | **510** |

Note: Coefficient is reported as statistically significant at *10%, ** 5% and *** 1%.

Household size is negatively related to a household's participation in an FO for the subsamples and pooled sample. This result is backed by Davis et al. (2010), but contradicts Bachke (2010). One possible reason is that a household could deploy some of its members to earn income through various means such as migration, thus preventing the household from participating in an FO. However, when household size increases to its maximum (6 persons),[18] its link with propensity to participate in FOs turns positive, except for AC which has no positive significant impact. A possible explanation is that when household size becomes larger, it is likely to divert its members to FO participation, i.e. FG or FA. This suggests that an FO (FG or FA) member's household is likely to have greater labour power (to deal with the collective work of FOs) while an AC member's household is likely to be smaller in comparison.

Household access to loans shows a positive significant relationship with propensity to participate in FOs (pooled and subsamples), implying that a household participating in an FO has more access to credit. Survey data after matching shows that more than half of FO members get loans from their FOs although there are no significant differences in interest rate and amount of loans between members and non-members. This observation is similar to that of Couturier et al. (2006) and Chea (2010), where savings and credit is reported as a key activity of many FO types in Cambodia. The same is true for this study, with approximately 67 percent of FO members stating savings and credit to be their main activity. However, FGD participants and

[18] U-shaped marginal effect of household size is 6 persons.

key informants expressed that the size of loan provided does not meet their needs, although they acknowledged that FO loans do not impose complex requirements and offer more flexible repayment terms; the average loan size received from an FO at the time of study was 340,000 riels (USD84). However, credit access is an endogenous variable, determined by an instrumental variable that this study is not able to address, though it does enable us to imply a causal relationship between access to credit and participation in FOs.

The index[19] of household agricultural assets has a positive relationship with a household's decision to participate in an FO and is statistically significant at 10 percent level, implying that a household with productive agricultural assets is likely to participate in an FO. However, when the subsamples are taken into account, this variable has a positive impact on participation, though not significant. One possible explanation is that agricultural assets may be a complementary factor, allowing a household to make use of agricultural techniques from its FO (Bernard and Spielman 2009). In contrast, a household with limited productive assets may find it difficult to apply the techniques acquired from an FO and thus have low propensity for participation.

To answer the first hypothesis on the level of human and productive capital of households, we examine the logit estimation of the two most important determinants: education of household head and total value of household assets. Generally, household head's education shows positive probability to join FOs, but is not statistically significant (Tables 4.9 and 4.10). This implies that there is no relationship between the education of the household head (i.e. human capital) and participation in FOs. This empirical result is consistent with the qualitative findings that those with both lower and higher human capital can participate in FOs. As for household welfare, the associated probability between this variable and participation in FOs is U-shaped, even though there is a positive and statistically significant probability between total value of assets and participation in FOs. The marginal effect shows that when the total value of assets is higher than 13.6 million riels (USD3350), households are less likely to participate in an FO. These results indicate that the probability of participating in FOs is likely to decrease as farmers reach higher levels of productive capital; however, farmers with both lower and higher levels of human capital participate in FOs. This is probably because members or leaders who have some knowledge are needed to lead and manage the complex FO functions and operations and/or to respond to legal framework issues in order to sustain the operation of FOs.

In sum, there are indications that hypothesis 1a – "farmers with higher levels of human capital are less likely to participate in FOs, while poor farmers with lower levels of human and productive capital are more likely to do so" – does not hold. As shown above, the number of years spent at school has no significant relationship with propensity to participate in FOs. On the other hand, there are indications showing that hypothesis 1b can be accepted, that "farmers with higher levels of productive capital are less likely to participate in FOs, while poor farmers with lower levels of productive capital are more likely to participate in FOs".

### *4.2.3. Impact of Farmer Organisations on Participation on Livelihoods*

This section presents the results of the average treatment effect of participation in FOs on rice and livestock productivity using both nearest neighbour (NN) matching and kernel matching approaches. Caliendo and Kopeinig (2008) point out that there is no best algorithm for matching because the selection of algorithm for matching completely depends on the data at hand. In

[19] Estimated by applying principal component analysis to data on agricultural tools and equipment. The index is not interpreted, but can show causal relationships with participation in dependent variable (FO) when we incorporate it in model specification.

addition, the reason for using PSM is to reduce characteristic gaps between members and non-members rather than to obtain precise estimates from different algorithm matching estimators. In this regard, our interpretation is based on Kernel matching, though we present two different algorithm results – NN matching and kernel matching estimators. Moreover, to get a deeper understanding of the effect of FO participation on rice and livestock productivity, the pooled sample and subsamples (i.e. FG, FA and AC) were examined to determine which FO types significantly impact on members' livelihoods. We have reinforced the results from PSM by using those from ordinary least squares (OLS) approach.

Table 4.11 shows the matching results of the effect of participation in FOs on rice productivity and profit. In the pooled sample, although FO members have higher revenues and profits than non-members, FO participation (i.e. for FO members) does not exert any significant effect on the value (revenue) and profit of rice production. However, at subsample level, the effect of participation in an AC (i.e. for AC members) has a positive and significant impact on rice productivity and profit. AC members' average rice revenue is about 376,400 riels (USD92.70) higher per ha and rice profit is approximately 629,700 riels (USD155) higher per ha than non-members', implying that AC member households have better technology and are more cost-efficient than non-member households. This finding coincides with the studies of Bratton (1986), Bachke (2010) and Davis et al. (2010).

Table 4.11: Average Treatment Effects of Participation in FOs on Rice Production Using PSM

| Variable | Nearest neighbour matching | | | Kernel matching | | |
|---|---|---|---|---|---|---|
| | Difference (ATT) | T-stat | Treatment/Control (Number) | Difference (ATT) | T-stat | Treatment/Control (Number) |
| **Rice revenue/ha (0000 riels)** | | | | | | |
| Pooled sample | 13.82 | 1.37 | 292/313 | 10.40 | 1.13 | 301/313 |
| - Farmer group | 0.24 | 0.02 | 129/313 | 2.03 | 0.17 | 134/313 |
| - Farmer association | 19.49 | 1.28 | 87/313 | -2.68 | -0.2 | 92/313 |
| - Agri. cooperative | 19.05 | 0.95 | 74/313 | 37.64 | 2.46** | 73/313 |
| **Rice profit/ha (0000 riels)** | | | | | | |
| Pooled sample | 21.65 | 1.13 | 292/313 | 14.06 | 0.82 | 301/313 |
| - Farmer group | -7.50 | -0.58 | 129/313 | -4.29 | -0.22 | 134/313 |
| - Farmer association | 7.08 | 0.3 | 87/313 | 1.13 | 0.05 | 92/313 |
| - Agri. cooperative | 32.41 | 1.73* | 74/313 | 62.97 | 3.17*** | 73/313 |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively; ATT refers to the average treatment effect on the treated (Appendix 3 describes technical explanation). These results are confirmed by the results of ordinary least squares (OLS) regression shown in Tables A3-2 and A3-3. In addition, we find that households with irrigated farmland have higher per ha revenue than those without irrigated land.

The effect of AC membership on rice productivity and profit finds support in the observation that FO members have statistically significant greater access to technical services than non-members. About 55-70 percent of FO members had accessed training services such as improved seed selection, disease and pest control, chemical fertiliser application, composting and planting techniques for rice, compared to only 30 percent of non-members (Table 4.12). Another possible reason for the significant effects of AC membership is that among the three types of FO, AC members have significantly larger loans (2.51 million riels) than non-members (1.37 million riels) at comparable interest rates (3.24 percent vs. 3.55 percent) (Table 4.13).

Also, FO members' (all FO types) and non-members' main motive for taking out a loan is to invest in agriculture (rice and vegetable production) (Table A2-4 in Appendix 2). At the same time, AC members use lower amounts of inputs such as chemical fertilisers and pesticides than non-members, though there is no significant difference, indicating AC members' better management and know-how (e.g. applying the right amount of inputs at the right time) significantly contribute to improved rice productivity and reduced input costs (Table 4.14). Our PSM results are consistent with OLS regression results (Tables A3-2 and A3-3), which show that only AC has positive and significant impact on rice productivity and profit. OLS results provide an appealing finding that irrigation has a positive impact on rice productivity because the irrigation coefficient is positive and statistically significant at 10 percent for the pooled sample and 5 percent for every subsample (Table A3-2). The index for agricultural assets also demonstrates a positive and significant effect on rice productivity, which coincides with an empirical study in rural Cambodia (Tong 2011).

Table 4.12: Pre- and Post-production Services Accessed by Members and Non-members (percentage of HHs reporting)

| Services /advice | Members | | Non-members | | Chi$^2$-Test | P-Value |
|---|---|---|---|---|---|---|
| | n | % | n | % | | |
| ***Rice/vegetables*** | | | | | | |
| - Disease and pest control for crops | 221 | 66.97 | 120 | 32.88 | 80.61 | 0.000 |
| - Planting techniques | 243 | 73.64 | 145 | 39.73 | 80.81 | 0.000 |
| - Improved crop varieties and seed selection | 236 | 71.52 | 143 | 39.18 | 73.09 | 0.000 |
| - Chemical fertiliser application | 186 | 56.36 | 98 | 26.85 | 62.47 | 0.000 |
| - Composting and organic residue management | 234 | 70.91 | 109 | 29.86 | 116.81 | 0.000 |
| - Irrigation and water management for crops | 176 | 53.33 | 94 | 25.75 | 55.49 | 0.000 |
| ***Livestock raising techniques*** | | | | | | |
| - Breed improvement | 212 | 64.24 | 112 | 30.68 | 78.42 | 0.000 |
| - Housing | 232 | 70.3 | 124 | 33.97 | 91.56 | 0.000 |
| - Disease control | 215 | 65.15 | 101 | 27.67 | 98.19 | 0.000 |
| - Feeding and nutrition | 207 | 62.73 | 95 | 26.03 | 95.00 | 0.000 |
| ***Market Information*** | | | | | | |
| - Output prices | 195 | 59.09 | 137 | 37.53 | 32.28 | 0.000 |
| - Input prices | 156 | 47.27 | 103 | 28.22 | 26.91 | 0.000 |
| - Collective marketing | 111 | 33.64 | 34 | 9.32 | 62.09 | 0.000 |
| - Where to sell products | 167 | 50.61 | 99 | 27.12 | 40.45 | 0.000 |

Table 4.13: Credit Accessed by Members and Non-members in the 12 Months before Survey

| | Members | n | Non-members | n | t-statistics |
|---|---|---|---|---|---|
| **Pooled sample** | | | | | |
| Number of HHs with loan | - | 238 | - | 215 | - |
| Number of HHs without loan | - | 92 | - | 150 | - |
| Average number of loans per HH | 1.59 | 238 | 1.27 | 215 | 4.55*** |
| Average size of loan (0000 riels) | 201.04 | 238 | 137.19 | 215 | 2.49** |
| Average monthly interest rate (%) | 3.31 | 222 | 3.55 | 172 | -1.32 |
| Age of loan to total number of loans (months) | 9.53 | 238 | 8.77 | 215 | 0.71 |
| **Subsample** | | | | | |
| Average loan size: FG vs. non-member (0000) riels) | 182.24 | 109 | 137.19 | 215 | 1.44 |
| Average interest rate: FG vs. non-member | 3.25 | 99 | 3.55 | 172 | -1.37 |
| Average loan size: FA vs. non-member (0000 riels) | 194.94 | 78 | 137.19 | 215 | 1.98** |
| Average interest rate: FA vs. non-member | 3.44 | 74 | 3.55 | 172 | -0.44 |
| Average loan size: AC vs. non-member (0000 riels) | 250.56 | 51 | 137.19 | 215 | 2.99*** |
| Average interest rate: AC vs. non-member | 3.24 | 49 | 3.55 | 172 | 1.13 |
| **Among FO members** | | | | | |
| Average loan size: FG vs. FA (0000 riels) | 182.24 | 109 | 194.94 | 78 | -0.28 |
| Average loan size: FG vs. AC (0000 riels) | 182.24 | 109 | 250.56 | 51 | -1.15 |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively.

Table 4.14: Technologies Used and Output Prices between AC Members and Non-members

| AC | Treatment | Control | Difference | t-Stat |
|---|---|---|---|---|
| **Inputs used** | | | | |
| Fertiliser used for rice (kg per ha) | 116.01 | 188.19 | -72.18 | -0.58 |
| Pesticides used for rice (kg per ha) | 1.28 | 1.66 | -0.38 | -0.97 |
| Average price of fertiliser (riels per kg) | 1378.69 | 1668.99 | -290.30 | -0.73 |
| Average price of pesticide (riels per kg) | 29553.03 | 18974.26 | 10578.77** | 2.41 |
| Average price of rice (riels per kg) | 968.62 | 948.31 | 20.31 | 1.00 |
| **Total input cost** | | | | |
| Total rice input cost (0000 riels per ha) | 43.13 | 68.52 | -25.38 | -1.03 |
| Total livestock input cost (0000 riels per HH) | 99.17 | 40.45 | 58.72** | 2.42 |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively.

Table 4.15 illustrates the effects of FO participation on livestock revenue and profit per household. The estimate from kernel matching indicates that participation in FOs exerts a positive and statistically significant effect on revenue, but not on profit, for livestock in the pooled sample. On average, FO members' revenue from livestock production is about 905,500 riels (USD223) per year higher than non-members', and this is statistically significant at 10 percent level. As far as the subsamples are concerned, there is a positive statistically significant impact on FA and AC members', but not on FG members', revenues and profits from livestock production. The difference in livestock revenues between FA and AC members and non-members is 2,074,100 riels (USD510.86) and 1,456,500 riels (USD358.74), respectively, and is significant at 10 percent level only. In addition, OLS regression results also show positive relationship between

participation in FOs and livestock production, though this is not statistically significant (Tables A3-4 and A3-5). These effects have two possible explanations.

First, FO members tend to have broader access to livestock raising techniques. The household survey findings reveal that around 65 percent of households had access to livestock raising techniques compared with approximately 30 percent of non-members (Table 4.12). The survey also found that FO members received technical support from agencies such as the PDA and NGOs. Non-members' major sources of knowledge about livestock raising techniques are neighbours, NGOs and self-study, suggesting that most of them have lower access to livestock husbandry techniques than members (TableA2-5). This implies that non-members have fewer incentives in terms of improving their livestock raising practices.

Table 4.15: Average Treatment Effects on Livestock Production Using PSM

| Variable | Nearest neighbour matching | | | Kernel matching | | |
|---|---|---|---|---|---|---|
| | Difference (ATT) | T-stat | Treatment/Control (n) | Difference (ATT) | T-stat | Treatment/Control (n) |
| **Livestock revenue** | | | | | | |
| Pooled sample | 47.18 | 0.89 | 278/297 | 90.55 | 1.80* | 290/297 |
| - Farmer group | -68.22 | -1.53 | 122/297 | -20.81 | -0.54 | 128/297 |
| - Farmer association | 232.67 | 1.91** | 87/297 | 207.41 | 1.84* | 90/297 |
| - Agri. cooperative | -8.12 | -0.08 | 69/297 | 145.65 | 1.69* | 69/297 |
| **Livestock profit** | | | | | | |
| Pooled sample | 11.40 | 0.28 | 278/297 | 55.58 | 1.47 | 290/297 |
| - Farmer group | -52.89 | -1.25 | 121/297 | -9.04 | -0.25 | 128/297 |
| - Farmer association | 134.99 | 1.69* | 87/297 | 121.10 | 1.73* | 90/297 |
| - Agri. cooperative | -95.79 | -1.15 | 69/297 | 101.31 | 1.68* | 69/297 |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively; ATT refers to average treatment effect on the treated.

Second, the costs of livestock production for FO members are partly covered by support agencies. For instance, key informants and FGD participants observed that some FO members had received "in-kind" assistance (i.e., chicks or ducklings) from their support agencies, thus having more incentives to raise livestock than non-members.

Table 4.16: Input and Output Prices (pooled sample mean)

| Input and output prices | Members | Non-members | Difference | t-Stat |
|---|---|---|---|---|
| **Inputs used** | | | | |
| Fertilisers used for rice (kg per ha) | 135.45 | 188.19 | -52.74 | -0.88 |
| Pesticides used for rice (kg per ha) | 1.70 | 1.66 | 0.04 | 0.16 |
| Average price of fertiliser (riels per kg) | 1478.89 | 1668.99 | -190.10 | -0.95 |
| Average price of pesticide (riels per kg) | 26141.23 | 18974.26 | 7166.97** | 2.51 |
| Average price of rice (riels per kg) | 941.62 | 948.31 | -6.70 | -0.53 |
| **Total Input Cost** | | | | |
| Total rice input cost (0000 riels per ha) | 62.01 | 68.52 | -6.51 | -0.46 |
| Total livestock input cost (0000 riels per HH) | 75.23 | 40.45 | 34.78 | 1.40 |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively.

As can be seen from the discussion above, participation in FOs has limited impact on both rice and livestock productivity. Bratton (1986), Bingen et al. (2003) and Chirwa et al. (2005) point out that for participation in rural producer organisations to have a significant impact on rural smallholder producers, FOs must provide a combination of three fundamental services to their members, i.e. advice, input access and market access. In Cambodia, however, FOs fail to offer a complete package of these basic services and the majority of FO members receive only advice or training from their support agencies (NGOs and DAE or MAFF). In terms of access to inputs, 76 percent of FO members reported this to be occurring at the individual level (Table 4.17, Table A2-6 in Appendix 2). Absence of market support for their agricultural produce was reported by around 81 percent of members (Table 4.17, Table A2-7 in Appendix 2). Individual access to inputs increases transaction costs, while individual marketing of agricultural products risks lower bargaining power and lower prices or leads to exploitation by external buyers (Nou 2006; Couturier et al. 2006; Sivramkrishna and Jyotishi 2008). This indicates that FOs in Cambodia have yet to mature and explains the limited impact on their members.

These results suggest that the significant impacts of FO participation on rice and livestock revenues and profits, i.e. rice and livestock production for AC member households and livestock production for pooled sample and subsamples of FA and AC, largely stem from better technology use. In effect, members have so far not benefited from low input costs or better market prices for produce through participation in FOs. Thus, if agricultural productivity and food security is to be attained, greater effort and increased attention from the government, NGOs and support agencies should strengthen FOs by prioritising other principal aims, i.e. building the capacity of farmers for inputs and market accessibility (Chirwa et al. 2005). The private sector could play an important role in helping FOs gain access to inputs supply and markets through contract farming schemes. For the latter, the government has a very important role in providing an enabling environment such as enforcement of contract farming schemes, enabling the agribusiness environment, and protection of property rights and legal rights of producer groups and contractors/private sector. The impact of rural producer organisations on market access and their potential to significantly improve agricultural productivity and food security in developing countries is comprehensively discussed in the literature (Bingen et al. 2003; Chirwa et al. 2005; Barham et al. 2008; Miyata et al. 2009; Bernard et al. 2009; Markelova et al. 2009; Barham and Chitemi 2009; Kruijessen et al. 2009).

Table 4.17: Sources and Access to Inputs and Produce Markets (percentage of HHs reporting)

| Sources of supporters | Access to inputs | | | | Access to produce markets | | | |
|---|---|---|---|---|---|---|---|---|
| | Members | | Non-members | | Members | | Non-members | |
| | n | % | n | % | n | % | n | % |
| Neighbours | 65 | 20.90 | 104 | 31.42 | 31 | 9.54 | 35 | 10.17 |
| Local authorities | 28 | 9.00 | 18 | 5.44 | 0 | 0.00 | 3 | 0.87 |
| Supporting agencies | 46 | 14.79 | 2 | 0.60 | 9 | 2.77 | 1 | 0.29 |
| Relatives and friends | 15 | 4.82 | 15 | 4.53 | 3 | 0.92 | 5 | 1.45 |
| Group members of FO | 22 | 7.07 | 1 | 0.30 | 8 | 2.46 | 1 | 0.29 |
| Traders | 72 | 23.15 | 75 | 22.66 | 164 | 50.46 | 143 | 41.57 |
| PDA | 34 | 10.93 | 21 | 6.34 | 0 | 0.00 | 1 | 0.29 |
| Self-buying/access | 238 | **76.53** | 273 | 82.48 | 264 | **81.23** | 265 | 77.03 |
| Other NGOs | 31 | 9.97 | 21 | 6.34 | 11 | 3.38 | 2 | 0.58 |
| Total(n) | 553 | 177.81 | 531 | 160.42 | 490 | 150.77 | 456 | 132.85 |

From the above discussion, it can be said that the effect of participation in FOs (except FGs) on agricultural productivity is positive and statistically significant for livestock production revenue only. The impact of FOs on rice productivity is not significant in the overall sample. In the subsample analysis, the effect exerted by AC participation is positive and statistically significant for both rice and livestock revenues and profits. Therefore, membership in FOs has a positive and statistically significant impact on both rice productivity and livestock production, but this only holds for ACs. These results suggest that hypotheses 2a, 2b and 2c can be rejected, and only hypothesis 2d can be accepted.

To ensure that the effect of participation in FOs on agricultural productivity is not influenced by other factors, the matching quality must be checked. The ability of PSM to balance the estimates is ascertained by first considering the reduction in the mean absolute standardised biases between the matched and unmatched models. The median absolute standardised biases for rice and livestock productivity matching are in Tables 4.18 and 4.19, respectively. As shown, the standardised differences before matching range from 6.8 to 13.9 percent for rice and 4.6 to 16.3 percent for livestock, while the standardised differences after matching range from 3.1 to 8.7 percent for rice and 3.6 to 13.1 for livestock. This indicates that matching and balancing the covariates of members and non-members identified and reduced bias.

Table 4.18: Indicators of Covariate Balancing Before and After Matching for Rice

| Matching algorithm | Outcome variables | Median absolute bias (before matching) | Median absolute bias (after matching) | Pseudo-$R^2$ (unmatched) | Pseudo-$R^2$ (matched) | P-value of LR (unmatched) | P-value of LR (matched) |
|---|---|---|---|---|---|---|---|
| Nearest neighbour matching | **Rice value (ha)** | | | | | | |
| | Pooled sample | 6.80 | 3.12 | 0.089 | 0.014 | 0.000 | 0.993 |
| | FG | 10.52 | 3.83 | 0.111 | 0.029 | 0.000 | 0.997 |
| | FA | 12.43 | 8.66 | 0.142 | 0.048 | 0.000 | 0.995 |
| | AC | 13.93 | 7.42 | 0.236 | 0.092 | 0.000 | 0.835 |
| | **Rice profit (ha)** | | | | | | |
| | Pooled sample | 6.80 | 3.12 | 0.089 | 0.014 | 0.000 | 0.993 |
| | FG | 10.52 | 3.83 | 0.111 | 0.029 | 0.000 | 0.997 |
| | FA | 12.43 | 8.66 | 0.142 | 0.048 | 0.000 | 0.995 |
| | AC | 13.93 | 7.48 | 0.236 | *0.090* | 0.000 | 0.855 |
| Kernel matching | **Rice revenue (ha)** | | | | | | |
| | Pooled sample | 6.80 | 3.82 | 0.089 | 0.023 | 0.000 | 0.840 |
| | FG | 10.52 | 1.83 | 0.111 | 0.019 | 0.000 | 1.000 |
| | FA | 12.43 | 7.16 | 0.142 | 0.037 | 0.000 | 0.999 |
| | AC | 13.93 | 4.63 | 0.236 | 0.062 | 0.000 | 0.986 |
| | **Rice profit (ha)** | | | | | | |
| | Pooled sample | 6.80 | 3.34 | 0.089 | 0.016 | 0.000 | 0.981 |
| | FG | 10.52 | 1.83 | 0.111 | 0.019 | 0.000 | 1.000 |
| | FA | 12.43 | 7.16 | 0.142 | 0.037 | 0.000 | 0.999 |
| | AC | 13.93 | 4.63 | 0.236 | 0.062 | 0.000 | 0.986 |

The kernel distribution of propensity scores before and after matching in Figure A2-1 depicts a good match between members and non-members after matching. The pseudo-$R^2$ of the propensity score estimation before and after matching, and the livelihood-ratio test of the joint significance of covariates (i.e. all regressors) in the probit model of propensity score estimation before and after matching, are the second and third indicators for checking quality matching. The P-value of the livelihood ratio test of the regressors on treatment status could always be rejected after matching (i.e. no significant differences); it is, however, never rejected before matching (i.e. significant difference) (Caliendo and Kopeinig 2008). The relatively low pseudo-$R^2$ and the non-significant difference in P-value of livelihood ratio test of the covariates after matching imply that there is no systematic difference in the distribution of covariates between members and non-members after matching. This suggests that the positive relationship between participation in FOs and rice and livestock productivity discussed earlier is not confounded by the impacts of other factors (see Tables A2-8 and A2-9 in Appendix 2 for outcome variables before and after matching).

Table 4.19: Indicators of Covariate Balancing Before and After Matching for Livestock

| Matching algorithm | Outcome variables | Median absolute bias (before matching) | Median absolute bias (after matching) | Pseudo-$R^2$ (unmatched) | Pseudo-$R^2$ (matched) | P-value of LR (unmatched) | P-value of LR (matched) |
|---|---|---|---|---|---|---|---|
| Nearest neighbour matching | **Livestock revenue** | | | | | | |
| | Pooled sample | 4.59 | 4.93 | 0.084 | 0.017 | 0.000 | 0.985 |
| | FG | 6.78 | 3.59 | 0.107 | 0.027 | 0.001 | 0.999 |
| | FA | 10.34 | 4.81 | 0.130 | 0.048 | 0.001 | 0.996 |
| | AC | 16.28 | 6.78 | 0.232 | 0.056 | 0.000 | 0.997 |
| | **Livestock profit** | | | | | | |
| | Pooled sample | 4.59 | 4.93 | 0.084 | 0.017 | 0.000 | 0.985 |
| | FG | 6.78 | 3.59 | 0.107 | 0.027 | 0.001 | 0.999 |
| | FA | 10.34 | 4.81 | 0.130 | 0.048 | 0.001 | 0.996 |
| | AC | 16.28 | 6.78 | 0.232 | 0.056 | 0.000 | 0.997 |
| Kernel matching | **Livestock revenue** | | | | | | |
| | Pooled sample | 4.59 | 3.70 | 0.084 | 0.042 | 0.000 | 0.144 |
| | FG | 6.78 | 3.50 | 0.107 | 0.054 | 0.001 | 0.850 |
| | FA | 10.34 | 7.48 | 0.130 | 0.083 | 0.001 | 0.772 |
| | AC | 16.28 | 12.72 | 0.232 | 0.170 | 0.000 | 0.164 |
| | **Livestock profit** | | | | | | |
| | Pooled sample | 4.59 | 3.87 | 0.084 | 0.038 | 0.000 | 0.260 |
| | FG | 6.78 | 3.50 | 0.107 | 0.054 | 0.001 | 0.850 |
| | FA | 10.34 | 8.63 | 0.130 | 0.105 | 0.001 | 0.473 |
| | AC | 16.28 | 13.18 | 0.232 | 0.183 | 0.000 | 0.101 |

To see whether AC and FA members have higher agricultural productivity compared to their FG counterparts, t-test was applied to examine the revenue and profit of rice per ha and livestock per household between AC and FG members and between FA and FG members (Table 4.20). The sample means of rice and livestock productivity were tested using weighted samples after balancing the covariates of members and non-members using PSM; hence the mean significant difference is not influenced by other characteristics.

Results reveal that FA and FG members have comparable rice productivity because there are no statistical differences in revenue and productivity of rice per ha between both groups. However, AC members had higher rice productivity and profit than FG members, and this is statistically significant at 5 and 1 percent level, respectively (Table 4.20). The household survey observations also show that the proportion of AC members with access to rice growing techniques is higher than for FG members at 5 percent statistical significance level (data not shown). In addition, although not statistically significant, AC members have access to bigger loans for investment in production inputs such as fertilisers, which help to increase their rice productivity (see Table 4.13).

Table 4.20: Comparison of Revenues and Profits from Rice and Livestock

| Outcomes | Difference | t-Statistics |
|---|---|---|
| Rice revenue (0000 riels per ha) | | |
| FG vs. FA | 4.98 | 0.32 |
| FG vs. AC | -41.97 | -2.50** |
| Rice profit (0000 riels per ha) | | |
| FG vs. FA | -1.22 | -0.05 |
| FG vs. AC | -69.95 | -3.41*** |
| Livestock revenue (0000 riels per year) | | |
| FG vs. FA | -255.08 | -2.64** |
| FG vs. AC | -234.10 | -3.29*** |
| Livestock profit (0000 riels per year) | | |
| FG vs. FA | -145.06 | -2.33** |
| FG vs. AC | -164.52 | -2.95*** |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively.

Results on livestock production show that FA and AC members perform better than their FG counterparts. The revenues and profits of FA and AC members are higher than FG members' at 5 percent and 1 percent statistical significance levels, respectively (see Table 4.20). The household survey findings reveal that FG, FA and AC members have equal access to livestock raising techniques; however, the proportions of AC and FA members who reported having easy access to quality livestock vaccinations are higher than for FG members at 1 percent and 5 percent significance levels, respectively. Thus, this tends to be a contributor to AC and FA members' relatively high revenues and profits from livestock compared to FG members'. Findings from rice and livestock productivity are consistent with the qualitative findings and the principles of FG formation. Most FG members are very poorly resourced since NGOs target poor households to form FGs to enhance self-help in the community; they have limited access to credit as their FGs have limited deposits/savings, and they use low-level agricultural technology due to their limited ability and knowledge to use advanced techniques.[20] The challenges facing poor-self-help groups in Cambodia are similar to those identified in other developing countries (Thorp et al. 2005; Bingen et al. 2003).

[20] About 69 percent of FO members reported that the techniques and knowledge provided by supporting agencies are far from practical, and 83 percent reported a shortage of capital to run credit services due to their members' low savings.

The results indicate that AC members' rice productivity (revenue and profit) is significantly higher than FG members', while that of FA and FG members is comparable. Additionally, AC and FA members' revenues and profits from livestock are significantly larger than FG members'. This finding allows us to reject hypothesis 3a, that "FA members' revenue and profits from rice and livestock production are likely to be higher than that of FG members". However, we can accept hypothesis 3b, that "AC members' revenue and profits from rice and livestock production are likely to be higher than that of FG members".

In terms of ACs' institutional set-up, we cannot imply that AC is the most successful type of FO. As shown in the qualitative findings, key informant interviews with support agency representatives (NGOs and PDA) reveal that some ACs have evolved from former well functioning FGs or FAs.

# 5

# CONCLUSION AND POLICY IMPLICATIONS

This study offers crucial insights into and important evidence on the impact of participation in farmer organisations on food security among rural poor households in Cambodia. Using a mixed-methods approach, the study assessed the impact of different types of FOs, i.e. farmer group (FG), farmer association (FA) and agricultural cooperative (AC), on members' livelihoods in the four provinces of Battambang, Kampong Thom, Kampot and Svay Rieng, which have a high density of operating FOs. Qualitative data captured the roles, operations and the challenges of FOs, while quantitative information, through propensity score matching (PSM), assessed a naïve (unconfounded) impact of FO participation on food security, with agricultural productivity (value of production and profit) of rice and livestock as proxies. The overall objective of the study is to provide pragmatic evidence that could assist policymakers, donors and practitioners on whether and, if so, how to better support FOs' operations for livelihood improvement and poverty reduction in Cambodia.

The main findings from both qualitative and quantitative survey data reveal that the main activity of FOs (all types of FOs in the study areas) is building and mobilising savings by lending to members for investment in agricultural production. Improved agricultural techniques were provided to members from support agencies via their respective FO; in some areas, in-kind input support for crops and livestock had been extended by support agencies. Market access for agricultural produce was also facilitated by FOs, but only to a limited extent. Collective action to support access to inputs and markets was generally non-existent given that the majority of FO members purchase inputs and sell produce on an individual basis.

Different support agencies establish FOs in different ways, but share the common principles of volunteerism and respect for FOs' rules and regulations. Most of the study FOs were formed by external support agencies, and their operations have been significantly assisted by the same organisations, either public sector (mainly Office of Agriculture Extension [OAE]) or local and international non-governmental organisations, indicating that none of the FOs in the study areas could operate independently. FGs and FAs have similar structures, managed and coordinated by a management committee (leader, deputy leader, treasurer, secretary) elected by the members. Given the requirements for formal registration, an AC has a more coherent management structure and is managed by a board of directors, board of auditors and a manager. The sample FAs and ACs basically evolved from FGs. Sample FO member households were highly dependent on support agencies' agenda and strategies; thus, if the groups had been formed from only poor and disadvantaged households, the FOs' operations were unlikely to be successful. All the sample FO members were from households with differing levels of socioeconomic welfare.

The major organisational challenges impeding the operation of FOs are lack of sufficient credit resources, members' illiteracy, low adoption of agricultural techniques, and low participation. For instance, deposits accumulated by poor and medium resourced FOs through their members' small savings could not provide sufficient funds for lending to FO members for investment in agricultural production. Members' illiteracy negatively affects FOs' ability to plan and implement activities in general, and can engender mistrust between FO management and members

with regard to financial management, resulting in members' low participation in collective group action. FOs' limited ability to extend credit services has hindered many FO members from adopting improved agricultural practices from FOs' support agencies to improve their productivity; improved techniques require more and better inputs use (for instance, fertilisers and pesticides) for crop management. Therefore, poorly resourced members (FGs and some FAs) have generally had a low impact on participation. Other main organisational challenges facing FOs in Cambodia are poor group structure, lack of adequate farmland, limited planning skills, problems with leadership (lack of partisanship and low accountability), lack of good leadership (ineffective coordination and planning) and poor enforcement of internal rules and regulations. The greater challenges facing FOs reflect the greater outside support needed if FOs are to have a positive and effective impact on rural household food security.

With regard to challenges to legal framework, qualitative findings show that many FAs were not legally registered due to the complexity of the registration process, red tape and low benefits from being officially registered. However, OAE, a key agency within MAFF, has been proactive in helping and promoting informal groups (FGs) to become legal entities by strengthening their structure and management skills through providing training services (both technical and management capacity) in the study areas. Many well structured and mature FGs and/or non-registered FAs expressed willingness to become an AC. Through the Provincial Department of Agriculture (PDA), MAFF has provided initial start-up financial capital to some ACs, which has made a significant contribution to improving AC members' livelihoods through improved agricultural productivity. However, inputs and market access assistance for existing registered ACs were largely insufficient. Some ACs expressed a critical concern that if their main activity remains focussed on just savings and lending, the cooperatives' business activities will not improve, impeding potential livelihood improvement as well as the cooperatives' sustainability.

Among the eight hypotheses statistically tested, only three can be accepted. These hypotheses are (i) productive capital of household is negatively associated with participation in FOs (hypothesis 1b); (ii) AC has positive relationship with the revenues and profits of rice and livestock productivity (hypothesis 2d); and (iii) AC members' revenues and profits from rice and livestock production are higher than FG members' (hypothesis 3b). The other five hypotheses cannot be accepted given their lack of statistical significance. Empirical analysis of the survey data also reveals that the factors affecting FO participation differ between the pooled sample (all FOs) and subsamples (FGs, FAs, ACs). The age of household head had a positive and significant relationship with the probability of participation in FOs, but household heads older than 54 in the pooled and subsamples were less likely to become an FO member, with the exception of FGs where household head age was not a significant determinant of participation. The significant negative relationship between male-headed households and participation in FOs suggests that a higher proportion of female-headed households in the pooled sample and subsample of FAs were likely to join FOs, but this was not so for FGs and ACs. Unemployment of household head and size of household had a significant negative impact on participation, whereas access to credit was a key positive determinant of the propensity to participate in an FO, i.e. in pooled and subsamples of FGs, FAs and ACs.

Households with productive agricultural assets for agricultural purposes were likely to participate in FOs for the pooled sample. Household wealth has a positive relationship with participation in FOs, but this relationship turns to a negative impact on participation when households became rich with total assets worth 13.6 million riels or more. Thus, farmers

with higher levels of productive capital are less likely to become FO members in the pooled sample and AC subsample. Education of household head was not a significant determinant of participation in all FO types, suggesting that rural producers with both lower and higher levels of human capital join FOs in Cambodia, rejecting the main argument that farmers with a higher level of human capital are less likely to participate in FOs.

In conclusion, our empirical evidence suggests that FOs' contribution to achieving food security is still limited. Improvement in agricultural productivity is largely attained with improved agricultural techniques, mostly from support agencies. The collective action by FO members in accessing inputs and selling outputs is almost absent based on the survey– members continue to access markets individually. In addition, organisational challenges such as weak planning and management skills of FO leaders, members' illiteracy, low participation by members, lack of financial capital for credit to members and low adoption of advanced production techniques, to mention a few, are the main obstacles to FOs' functions and operations, thereby limiting their impact on members. These findings suggest that the FO sector in Cambodia is still in the early stages of development. Increased efforts need to be made to enhance the impact of participation in FOs on livelihoods. Many non-governmental and public sector (OAE/PDA of MAFF) organisations are actively supporting FOs' operation. Private sector engagement, however, is not visible, indicating that FOs are unlikely to be able to operate sustainably. The study suggests that a combination of an FO development strategy and contract farming scheme could help sustain FO operations and increase their impact on memberships. It is in this context that the private sector could play a crucial role in providing services, inputs supply, and secure produce markets.

**Policy Implications**

Given the positive relationship between AC rice productivity and livestock production, and existing government policy on promoting rice export through FO development, established FOs should be further supported and promoted even though they are not yet fully functional. The following policy implications can be drawn from the study findings:

1. Challenges facing FOs are organisational difficulties (lack of good leadership, low participation by members, illiteracy of members) and weak organisational capacity (poor management/leadership ability, low financial management skills, low planning capacity, lack of financial resources). These pose major obstacles to FOs' operations, which in turn lead to FOs' low impact on members. Policies that respond to these organisational challenges would increase and significantly help the FO sector in Cambodia and augment FOs' sustainable and positive effect on livelihoods. Priorities are in capacity building to develop leadership and management skills, strategic business planning, financial management, and/or human resource management.

2. Technical services provided by support agencies (public sector and NGOs) are positive and significantly contribute to improving FO members' agricultural productivity. However, some FO members (especially poorly resourced ones) do not adopt the taught production techniques as they are too complex to follow and demand technical, managerial and/or financial resources. To be more effective and practical, agricultural technical services offered to FO members should be simple, specific and respond to their needs.

3. A major constraint on all FO types is the lack of financial capital for lending to members. The average loan is less than USD80 taken out for a three to six month term at an average

monthly interest rate of 3 percent. Loans are mainly used to invest in production inputs, which distinctly contribute to improved crop and livestock productivity. However, increasing FO savings capacity is not a feasible option because most members are poorly resourced. Therefore, policies that help FOs access rural credit from banks and microfinance institutions should be improved and promoted to better help FO members increase and make informed investment in agricultural production and initiate other business activities, which in turn could increase food security and improve livelihoods.

4. Many FOs operating in Cambodia are highly dependent on and largely assisted by external players. Such external support (see items 1 and 2 above on leadership and managerial skills and technical extension services) provided to FOs should be committed over an extended time to allow FOs to learn to be effective and efficient so they can eventually operate independently. Furthermore, support should be targeted to specific groups so they can get off to a strong start and flourish, rather than spreading support and subsidies too thinly across a wide range of FOs.

5. Our empirical evidence shows that AC members are better off compared to FG and FA members and non-members, thus ACs are positively associated with rural household food security through improved rice and livestock productivity. However, policy that supports and promotes FOs could be enhanced by stakeholders, not only ACs but also other types of FOs because well-functioning FGs eventually develop into ACs. Given the limited resources of both NGOs and public institutions, policy that offers incentives for private sector investment may help sustain FO operations and also assist FO members in accessing services, inputs supply and secure market prices through contract farming schemes, thereby increasing the impact of FO participation on food security and improved livelihoods.

6. Many FOs are willing to stay outside the protected legal framework (FGs and FAs) owing to the complexity and demands of the registration process, yet legal recognition would provide benefits to members in the long run (AC), for instance legal protection when initiating business activity. The registration process would be largely eased simply by reducing the demand for required documents, and expediting and simplifying registration procedures. Doing so would motivate FOs to register legally with the relevant authority, i.e. Ministry of Interior, Ministry of Agriculture, Forestry and Fisheries or Ministry of Commerce.

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# APPENDICES

## Appendix 1: Technical Details of the Survey Methodology

In principle, the studies of impact assessment basically encounter three interrelated challenges: establishing the predicted outcome in the absence of the intervention (a viable counterfactual or recalled information), i.e. what would happened to the participant had they not participated in the intervention project; attributing the impact to the treatment or intervention; and dealing with unprecedented lag times (if the number of observed years is quite large) (Alston and Pardey 2001; Salter and Martin 2001 cited in Davis et al. 2010). To address these challenges, some major methods have been generally employed as follows:

- **Randomisation/experimental approach:** a well-defined set of people is randomly selected and divided into treatment and control groups.
- **Reflexive comparisons:** no control group is needed, but baseline survey of participants is conducted before the intervention.
- **Instrumental variables:** used to predict participation in the programme under a restrictive assumption that the variables have no impact on the outcomes given participation. However, finding instrument variables is a difficult task in empirical analysis (Ali and Abdulai 2010). Because we were not able to find some variables to address endogenous variables (participation in FOs or access to credit), we use the results from ordinary least squares (OLS).
- **Quasi-experimental and non-experimental approaches:** the comparison or control group is constructed by matching. The methods include propensity score matching (PSM) and the double-difference estimator (if baseline data is in place) (Ravallion 2001).

Due to the lack of baseline information in this study and to the absence of experimental study, investigating the changes in outcomes in the treatment and control groups is impossible; the experimental and reflexive comparison approaches are not applicable to this study. Hence, we construct the control group through PSM with the results reinforced by OLS.

Following are the specifics of the methods employed in this study, including the application of PSM.

### 1. Model Specification for the Participation in FOS

According to Baum (2006), one can use either a logit or a probit model to investigate participation behaviour in a programme, which is expressed in the following form:

$$I_i^* = z_i\beta_i + u_i, \;\; I_i = 1 \;\; if \;\; I_i^* > 0; \;\; I_i = 0 \;\; if \;\; I_i^* \leq 0 \quad (1)$$

where $I_i = 1$ indicates participation of a household $i$ in FO, which is denoted by $I_i^* > 0$ if the perceived benefits from participation are positive, and $I_i = 0$ if otherwise; $z_i$ is a vector of the household $i$ characteristics;[21] $\beta_i$ is a vector parameter or estimator; and $u_i$ is the random error

[21] For further details about households likely to join the intervention projects, please see Davis et al. (2010); Miyata et al. (2009); Ali and Abdulai (2010); Bachke (2010).

term. The independent variables for the logit model of participation in FO are specified and defined in Table 4.5 in Section 4.2.

The dependent and explanatory variables of our empirical framework and the definitions of equation (1) can be found in Tables 4.5, 4.6 and 4.7 in Section 4.

The analytical framework for the benefits of the participating FOs is defined by the following equation:

$$\pi = PmQ(X;z,m) - X'rm - C(m) \quad (2)$$

where *z* is a vector of household characteristics; member status $m \in \{0, 1\}$; production *Q* depends on inputs used *(X)*, household characteristics *(z)*, and membership status *(m)*. The production prices *P* and inputs prices *r* may depend on membership status; *C(1)* is cost of membership fee, but no membership fee is charged in Cambodia, thus *C(1)=C(0)=0*.

We assume that membership (m=1) in FOs may improve household income through agricultural productivity due to:

1) Lower price of inputs as FOs buy large quantities, lower transport costs, or access to low-cost in-kind credit for inputs provided by FOs. i.e. (r(1)<r(0));

2) Technical assistance (fertiliser, pesticide, better production techniques) from FOs' support agencies, so the production Q(X;z,0)<Q(X;z,1) for all X and z;

3) Output prices negotiated by FOs may be better than what individual household can get *(p1>p0)* because FOs have more bargaining power due to bulk sales and lower transaction costs for buyers.

Therefore, it could be expected that the productivity of FO member households may be higher than that of non-FO members.

**Propensity Score Matching**

Testing hypotheses 3a and 3b using PSM entailed three stages:

**First,** we used a logit model to analyse the characteristics of households that are likely to participate in FOs, all of which can be expressed in equation (1). The results obtained from the logit regression show the characteristics of households who are likely to participate in FOs. It particularly tests the hypothesis that households with higher levels of human and productive capital are less likely to participate in FOs.

**Second,** we used an impact estimator model to find out whether FOs have any significant impact on household revenues and profits for rice and livestock. According to Caliendo and Kopeinig (2008), the seminal assessment parameter is the average treatment effect on the treated (ATT) which is defined as the difference between *participants' expected outcome with the project* $(E[y(1)|D=1])$ *and their expected outcome if they had not engaged in the project* $(E[y(0)|D=1])$. The ATT can be summarised as follows:

$$ATT = E[y(1)|D=1] - E[y(0)|D=1]$$

where $D=1$ represents participation in the project, and $D=0$ otherwise. Likewise, $y(1)$indicates the outcome for participants when taking part in the project, while $y(0)$ is the counterfactual outcome for the same participants without taking part.

However, the estimate for the counterfactual outcome of the participants without the project ($E[y(0)|D=1]$) is far from feasible in reality because it is also unobservable (Ravallion 2001). To deal with the bias challenges, Dehejia and Wahba (2002), Blundell and Dias (2000) and Caliendo and Kopeinig (2008) suggest using PSM, in which participants and non-participants with comparable propensity scores – the estimated conditional probability of participation given observed characteristics – are matched. The observations on whose propensity scores are not comparable (not in common support) are dropped from the analysis. The estimated average impact of treatment (i.e. participation in FOs) on the treated (i.e. FO members) is the difference in outcomes between the two matched groups (Smith and Todd 2005). Given the framework of this study, this approach was applied to detect the significant impacts of farmers' participation in FOs on household livelihood.[22] Using PSM adapted from Guo and Fraser (2010) and Ravallion (2001), the analytical process is as follows:

- **Step1:** In our sample selection, we construct a control group of FO non-members to facilitate matching; the treatment group is represented by FO members.
- **Step 2:** We estimate the probability of a household participating in an FO by using logit regression as described above. This was already done in the first empirical analysis in equation (1)
- **Step 3:** After running regression of the logit model (equation (1)), we can predict propensity scores for every sample FO member and their non-member counterpart.
- **Step 4:** After propensity score is estimated, the analysis proceeds with matching the members and non-members based on propensity scores using the two matching algorithms – nearest neighbour (NN) and kernel estimators. Our interpretations were based on the algorithms that produced statistically significant results.
- **Step 5:** We check the region of common support to avoid comparing incomparable observations, which could result in evaluation bias. The observations with scores smaller than the minimum or larger than the maximum in the counterpart group should be dropped. Alternatively, we can also check it through visual analysis of the density distribution of the propensity score in both groups.
- **Step 6:** The mean value (ATT) of the outcome indicators is calculated using weighted propensity score distribution in the following equation:

  $$\tau_{\text{ATT}}^{\text{PSM}} = E_{P(X)|D=1}\{E[y(1)|D=1,P(X)] - E[y(0)|D=0,P(X)]\}$$

  where $P(X)$ is the predicted propensity score obtained in step 3. Table 3.1 presents the list of outcome variables (impact variables) for the comparison of food security impacts between FO members and non-members.
- **Step 7:** To check the quality of matching, we compare the matching indicators before and after matching. Mean and median of absolute bias and pseudo-$R^2$ are expected to decrease markedly after matching. In addition, the standardised bias (pstest) of each control variable

[22] This approach could be applied to the pooled sample and the subsample groups, i.e. FG, FA and AC.

in the logistic regression before and after matching is also used to examine whether there are systematic differences in the means of the control variables for both groups (Rosenbaun and Rubin 1983). After matching, no significant differences in control variables between both groups should be found.

To compare food security impacts between FO members and non-members, the pooled sample and subsample data were used since the sample FO member group comprises FGs, FAs and ACs. This enabled analysis of which types of FO significantly impact on members' food security at the household level when compared with that of non-members.

**In the third stage of the empirical analysis,** t-test was used, as modelled by the t distribution to test the null hypothesis that there is no statistical difference in the average agricultural productivity between FG and FA and FG and AC. In other words, we aim to compare benefits of participation among FG and FA and AC members without taking non-members into account. Using STATA, we can reject the null hypothesis when the *p-value* is less than 0.01, 0.05 and 0.1 at 1 percent, 5 and 10 percent significance levels, respectively (i.e. our suggested hypothesis is accepted). However, if the *p-value* is greater than 0.1, we fail to reject the null hypothesis.

**2. Econometric Specification for Ordinary Least Squares Approach**

$$y_i = \beta_o + \sum_k a_k X_{ik} + yFO_i + \varepsilon_i$$

$$i = 1,2,3, ..., n; k = 1,2,3, ..., m$$

where is $y_i$ a set of outcome variables of firms $i$, and $X_i$ is a set of observed household characteristics including access to credit. *FO* represents dummy membership of firms in FOs (AC, FA and FG), where 1 denotes membership and 0 otherwise; $\varepsilon_i$ is the randomly distributed error term indicating the unobservable factors affecting the outcome variable with zero conditional mean $E(\varepsilon_i|X_i,M_i)=0;$ and $\pi_k$ and $y$ are parameters to be estimated. In empirical studies, both the decision to participate in a programme and access to credit are influenced by external forces (endogenous variables) if used as explanatory variables. Thus, the OLS model is subjected to two endogenous variables, which we are not able to address because we have to find a variable affecting endogenous variable, but not affecting dependent variable $y_i$.

## Appendix 2: Additional Empirical Results

Table A2-1: Household Characteristics for FO Members and Non-members

| Characteristics | Members | Non-members |
|---|---|---|
| **Gender of household head (n=330/365 )** | | |
| Male (%) | 74.85 | 79.73 |
| Female (%) | 25.15 | 20.27 |
| **Mean age of household head** | | |
| Male (n=247/291) | 47.19 | 46.88 |
| Female (n=83/74 ) | 52.29 | 54.43 |
| **Educational attainment of household head (n=330 363)** | | |
| None (%) | 20.91 | 28.37 |
| Primary school (%) | 52.42 | 50.69 |
| Secondary school (%) | 20.91 | 16.53 |
| High school (%) | 5.45 | 4.13 |
| **Mean years of schooling of household head** | | |
| Male (n=247/290 ) | 4.84 | 4.03 |
| Female (n=83 /73 ) | 2.88 | 2.16 |
| **Household size (n=330/365)** | | |
| Single person households (%) | 1.21 | 1.64 |
| 2 - 4 members (%) | 39.09 | 37.26 |
| 5 - 7 members (%) | 45.76 | 53.42 |
| 8 or more members (%) | 13.94 | 7.67 |
| Mean household size (male-headed/n=247/291 ) | 5.38 | 5.14 |
| Mean household size (female-headed/n= 83/74) | 4.70 | 4.53 |
| Mean household size (all households/n=330/365) | 5.21 | 5.02 |
| Average number of adults per household (n=330/365) | 3.63 | 3.37 |
| Average dependency ratio per household (n=330/365) | 0.57 | 0.60 |
| **Household labour power** [a/] | | |
| Mean household labour power (male-headed/n=247/291 ) | 4.28 | 3.94 |
| Mean household labour power (female-headed/n=83 /74 ) | 3.71 | 3.68 |
| Mean household labour power (all households/n= 330/365 ) | 4.14 | 3.88 |

[a/] Household labour power is an index of available household labour calculated as: LP=0.5P6-14 + 0.75P15-17 + 1P18-59 + 0.75P60 and older, where P=number of persons, and subscripts are age categories of household members

Table A2-2: Employment of HH Heads and Individual HH Members

| Categories | Employment of household head | | | Employment of individual members | | |
|---|---|---|---|---|---|---|
| | Members | Non-members | Overall | Members | Non-members | Overall |
| | (%) | (%) | (%) | (%) | (%) | (%) |
| Unemployed | 28.79 | 38.90 | 34.10 | 51.22 | 52.96 | 52.11 |
| Selling labour in village (farm) | 10.00 | 9.86 | 9.93 | 7.69 | 6.38 | 7.02 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Selling labour outside village (farm) | 5.15 | 7.40 | 6.33 | 7.50 | 9.98 | 8.77 |
| Migration to work at border | 1.21 | 2.19 | 1.73 | 1.17 | 2.40 | 1.80 |
| Migration to work in other country | 0.61 | 1.10 | 0.86 | 2.63 | 3.05 | 2.84 |
| Civil servant/NGOs/company | 7.88 | 5.21 | 6.47 | 4.38 | 3.14 | 3.75 |
| Small business/street vendor | 25.76 | 18.08 | 21.73 | 10.52 | 10.17 | 10.34 |
| Collecting CPR from water or field | 11.52 | 12.05 | 11.80 | 2.34 | 1.94 | 2.13 |
| Equipment and animal rental | 0.61 | 0.00 | 0.29 | 0.00 | 0.09 | 0.05 |
| Construction worker | 14.55 | 9.86 | 12.09 | 4.58 | 3.23 | 3.89 |
| Money lending | 1.21 | 0.27 | 0.72 | 1.36 | 0.37 | 0.85 |
| Handicrafts/artisan | 3.33 | 2.74 | 3.02 | 1.07 | 2.13 | 1.61 |
| Selling labour within village (non-farm activities) | 3.03 | 4.38 | 3.74 | 3.12 | 2.03 | 2.56 |
| Working in manufacturing enterprise | 0.00 | 0.00 | 0.00 | 6.33 | 4.62 | 5.45 |
| Other | 0.91 | 1.92 | 1.44 | 0.10 | 0.09 | 0.09 |
| **Total households/individuals** | **114.56** | **113.96** | **114.25** | **104.01** | **102.58** | **103.26** |

Table A2-3: Distribution of Sample Households by Size of Landholding

| Category | Land Owned ($m^2$) | Members | | Non-members | | Overall | |
|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % |
| Landless | 0 | 17 | 5.15 | 35 | 9.59 | 52 | 7.48 |
| Small | <10000 | 124 | 37.58 | 137 | 37.53 | 261 | 37.55 |
| Intermediate | 10000 - 19999 | 89 | 26.97 | 92 | 25.21 | 181 | 26.04 |
| Medium | 20000 - 29999 | 38 | 11.52 | 40 | 10.96 | 78 | 11.22 |
| Large | >30000 | 62 | 18.79 | 61 | 16.71 | 123 | 17.70 |
| **Total** | | **330** | **100** | **365** | **100** | **695** | **100** |

Table A2-4: Main Reason for Accessing Credit/Loan by Members and Non-members (percentage of HHs reporting)

| Reason to access loans | Members | | Non-members | |
|---|---|---|---|---|
| | n | % | n | % |
| Farming (rice and vegetables) | 96 | 40.34 | 66 | 30.70 |
| Livestock raising | 29 | 12.18 | 16 | 7.44 |
| Buying inputs for business/trade | 47 | 19.75 | 37 | 17.21 |
| Household consumption (food and non-food) | 48 | 20.17 | 42 | 19.53 |
| Health | 38 | 15.97 | 33 | 15.35 |
| Education | 8 | 3.36 | 4 | 1.86 |
| Repay another loan | 8 | 3.36 | 11 | 5.12 |
| Social ceremonies (marriage, funeral) | 9 | 3.78 | 7 | 3.26 |
| Other emergency (fire, food, theft, conflict) | 1 | 0.42 | 0 | |
| Building/renovating house | 21 | 8.82 | 18 | 8.37 |
| Expenditure on migration to work at border | 3 | 1.26 | 2 | 0.93 |
| Connecting to electricity supply | 0 | | 1 | 0.47 |
| Other | 6 | 2.52 | 4 | 1.86 |
| **Total (n)** | **314** | | **241** | |

Table A2-5: Sources of Training and Know How (percentage of HHs reporting)

| Source of training | Members (%) | | | Non-members (%) | | |
|---|---|---|---|---|---|---|
| | Crops | Livestock | Market access | Crops | Livestock | Market access |
| Neighbours | 13.29 | 11.24 | 30.74 | 30.81 | 32.00 | 46.01 |
| Local authority | 3.50 | 2.01 | 1.64 | 4.74 | 4.00 | 2.45 |
| Supporting agencies | 29.02 | 29.72 | 20.90 | 1.90 | 2.67 | 0.00 |
| Relatives/friends | 2.10 | 1.20 | 2.87 | 6.64 | 2.00 | 3.68 |
| Group members of FO | 2.10 | 4.82 | 5.33 | 0.95 | 0.00 | 1.23 |
| Traders | 1.75 | 3.21 | 26.23 | 5.21 | 6.67 | 40.49 |
| PDA | 29.72 | 26.10 | 10.25 | 21.80 | 14.00 | 2.45 |
| Self-study | 5.59 | 7.63 | 12.30 | 19.91 | 24.67 | 20.86 |
| Other NGOs | 41.61 | 36.14 | 17.62 | 37.91 | 30.67 | 9.82 |
| Media system | 3.50 | 3.61 | 5.74 | 5.69 | 4.67 | 7.36 |
| Other | 1.75 | 0.80 | 1.64 | 0.47 | 0.00 | 0.61 |
| **Total (n)** | **383** | **315** | **330** | **287** | **182** | **220** |

Table A2-6: Access to Quality Farm and Livestock Inputs (percentage of HHs reporting)

| Farm inputs | Members | | Non-members | | $Chi^2$-Test | P-Value |
|---|---|---|---|---|---|---|
| | n | % | n | % | | |
| ***Access quality inputs*** | | | | | | |
| Seeds/seedlings | 150 | 45.45 | 142 | 38.90 | 5.53 | 0.06 |
| Fertilisers | 180 | 54.55 | 198 | 54.25 | 0.25 | 0.88 |
| Pesticides | 152 | 46.06 | 129 | 35.34 | 10.09 | 0.01 |
| Animal feed | 114 | 34.55 | 81 | 22.19 | 13.11 | 0.00 |
| Animal births | 117 | 35.45 | 114 | 31.23 | 3.10 | 0.21 |
| Animal vaccination | 124 | 37.58 | 91 | 24.93 | 13.54 | 0.00 |
| ***Individual buying*** | | | | | | |
| Seeds/seedlings | 199 | 88.05 | 216 | 98.63 | -19.79 | 0.00 |
| Fertilisers | 223 | 90.28 | 264 | 98.51 | -16.90 | 0.00 |
| Pesticides | 189 | 96.92 | 170 | 98.27 | 0.69 | 0.41 |
| Animal feed | 137 | 97.86 | 116 | 100.00 | 2.52 | 0.11 |
| Animal births | 167 | 96.53 | 164 | 98.20 | 0.92 | 0.34 |
| Animal vaccination | 126 | 88.11 | 102 | 91.89 | 0.97 | 0.32 |
| ***Group buying*** | | | | | | |
| Seeds/seedlings | 27 | 11.95 | 3 | 1.37 | 19.79 | 0.00 |
| Fertilisers | 24 | 9.72 | 4 | 1.49 | 16.91 | 0.00 |
| Pesticides | 6 | 3.08 | 3 | 1.73 | 0.69 | 0.41 |
| Animal feed | 3 | 2.14 | 0 | 0.00 | 2.52 | 0.11 |
| Animal births | 6 | 3.47 | 3 | 1.80 | 0.92 | 0.34 |
| Animal vaccination | 17 | 11.89 | 9 | 8.11 | 0.97 | 0.32 |

Table A2-7: Access to Output Markets (percentage of HHs reporting)

| Products | Members | | Non-members | | Chi2-Test | *P*-Value |
|---|---|---|---|---|---|---|
| | N | % | n | % | | |
| ***Sale surplus products*** | | | | | | |
| Rice | 200 | 60.61 | 193 | 52.88 | 7.4487 | 0.024 |
| Vegetables | 135 | 40.91 | 101 | 27.67 | 19.1363 | 0.000 |
| Chickens | 257 | 77.88 | 243 | 66.58 | 12.3697 | 0.002 |
| Ducks | 82 | 24.85 | 84 | 23.01 | 0.4629 | 0.793 |
| Pigs | 160 | 48.48 | 153 | 41.92 | 3.2171 | 0.200 |
| Cattle | 157 | 47.58 | 154 | 42.19 | 7.8230 | 0.020 |
| Buffalo | 14 | 4.24 | 16 | 4.38 | 2.2240 | 0.329 |
| ***Individual sale*** | | | | | | |
| Rice | 247 | 93.21 | 252 | 96.55 | 3.0199 | 0.082 |
| Vegetables | 178 | 98.89 | 139 | 100.00 | 1.5542 | 0.213 |
| Chickens | 286 | 100.00 | 281 | 100.00 | - | - |
| Ducks | 91 | 100.00 | 95 | 98.96 | 0.9530 | 0.329 |
| Pigs | 186 | 100.00 | 182 | 100.00 | - | - |
| Cattle | 189 | 100.00 | 175 | 100.00 | - | - |
| Buffalo | 16 | 100.00 | 16 | 100.00 | - | - |
| ***Group sale*** | | | | | | |
| Rice | 18 | 6.79 | 9 | 3.45 | 3.0199 | 0.082 |
| Vegetables | 2 | 1.11 | 0 | 0.00 | 1.5542 | 0.213 |
| Chickens | 0 | 0.00 | 0 | 0.00 | - | - |
| Ducks | 0 | 0.00 | 1 | 1.04 | 0.9530 | 0.329 |
| Pigs | 0 | 0.00 | 0 | 0.00 | - | - |
| Cattle | 0 | 0.00 | 0 | 0.00 | - | - |
| Buffalo | 0 | 0.00 | 0 | 0.00 | - | - |

Table A2-8: Average Treatment Effects on Revenues and Profits from Rice Before and After PSM

| Outcome variable | Nearest neighbour matching | | | | Kernel matching | | | |
|---|---|---|---|---|---|---|---|---|
| | Difference (ATT) | | T-stat | | Difference (ATT) | | T-stat | |
| | Unmatched | Matched | Unmatched | Matched | Unmatched | Matched | Unmatched | Matched |
| **Rice revenue** | | | | | | | | |
| Pooled sample | 12.88 | 8.74 | 1.46 | 0.85 | 12.88 | 8.59 | 1.46 | 0.93 |
| FG | 4.01 | -4.00 | 0.37 | -0.29 | 4.01 | -1.22 | 0.37 | -0.10 |
| FA | -1.27 | 23.34 | -0.10 | 1.36 | -1.27 | -0.95 | -0.10 | -0.07 |
| AC | 45.76 | 35.44 | 3.38*** | 1.91** | 45.76 | 32.61 | 3.38*** | 2.07** |
| **Rice profit** | | | | | | | | |
| Pooled sample | 19.39 | 8.23 | 1.23 | 0.41 | 19.39 | 12.94 | 1.23 | 0.75 |
| /FG | 1.64 | -13.10 | 0.08 | -0.79 | 1.64 | -1.44 | 0.08 | -0.07 |
| FA | 2.67 | 6.07 | 0.10 | 0.23 | 2.67 | 0.37 | 0.10 | 0.01 |
| AC | 71.15 | 50.19 | 2.67** | 2.43** | 71.15 | 52.87 | 2.67** | 2.41** |

Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively.

Table A2-9: Average Treatment Effects on Revenues and Profits from Livestock Before and After PSM

| Outcome variable | Nearest neighbour matching | | | | Kernel matching | | | |
|---|---|---|---|---|---|---|---|---|
| | Difference (ATT) | | T-stat | | Difference (ATT) | | T-stat | |
| | Unmatched | Matched | Unmatched | Matched | Unmatched | Matched | Unmatched | Matched |
| **Livestock revenue** | | | | | | | | |
| Pooled sample | 102.20 | 84.30 | 2.06 | 1.48 | 102.20 | 90.33 | 2.06 | 1.79* |
| FG | -36.57 | -27.86 | -0.81 | -0.54 | -36.57 | -30.50 | -0.81 | -0.77 |
| FA | 209.08 | 190.14 | 2.69** | 1.44 | 209.08 | 200.92 | 2.69** | 1.76* |
| AC | 215.76 | -17.68 | 3.13*** | -0.17 | 215.76 | 150.99 | 3.13*** | 1.72** |
| **Livestock profit** | | | | | | | | |
| Pooled sample | 65.23 | 41.79 | 1.75* | 0.95 | 65.23 | 55.59 | 1.75* | 1.46 |
| FG | -24.21 | -12.15 | -0.58 | -0.25 | -24.21 | -18.56 | -0.58 | -0.51 |
| FA | 119.95 | 36.80 | 2.08** | 0.44 | 119.95 | 116.56 | 2.08** | 1.65* |
| AC | 156.31 | -72.51 | 2.66** | -0.84 | 156.31 | 109.16 | 2.66** | 1.67* |

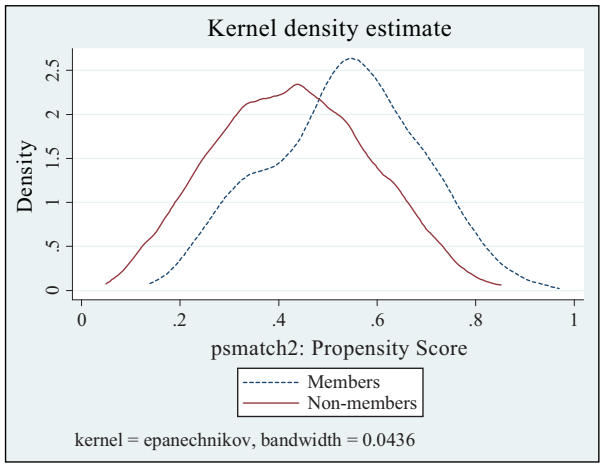
Note: *, **, *** indicate statistically significant difference at 10%, 5% and 1% level, respectively.

Table A2-10: Sources of Loans (percentage of HHs reporting)

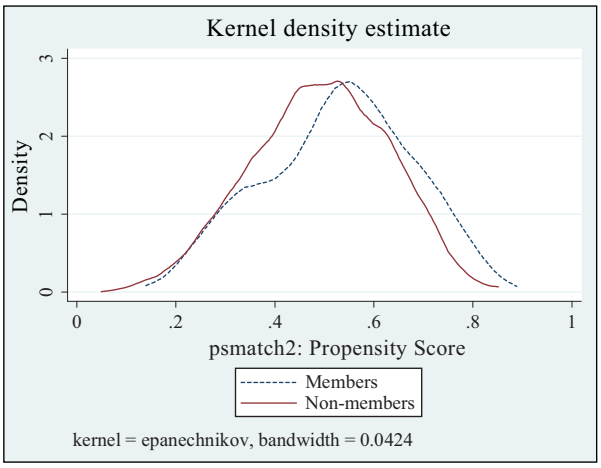
| Sources of credit | Members | | Non-members | |
|---|---|---|---|---|
| | N | % | n | % |
| Relative/friend | 43 | 18.07 | 65 | 30.23 |
| Moneylender | 55 | 23.11 | 47 | 21.86 |
| Supporting agency | 17 | 7.14 | 7 | 3.26 |
| FO (savings group, other association | 125 | 52.52 | 11 | 5.12 |
| Microfinance Institution | 77 | 32.35 | 103 | 47.91 |
| Other | 4 | 1.68 | 1 | 0.47 |
| **Total (n)** | **321** | | **234** | |

Figure A2-1: Kernel Distribution of Propensity Scores Before and After Matching

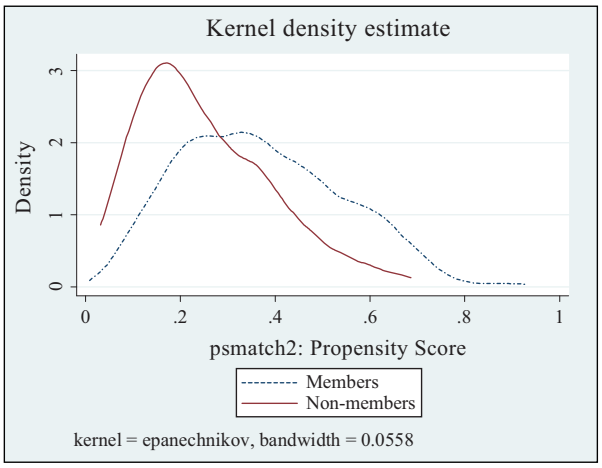
A1: Pooled Sample Before Matching



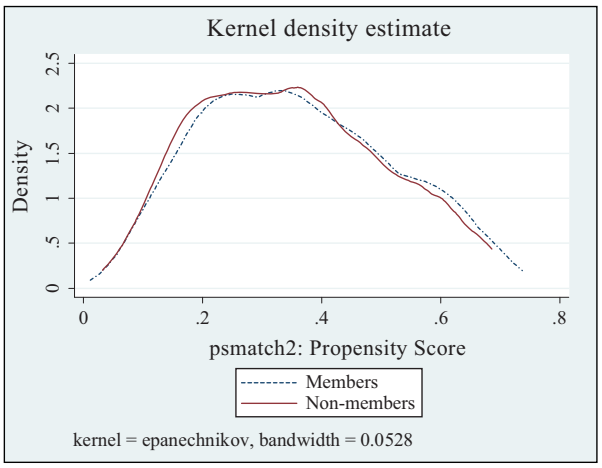

A2: Pooled Sample After Matching



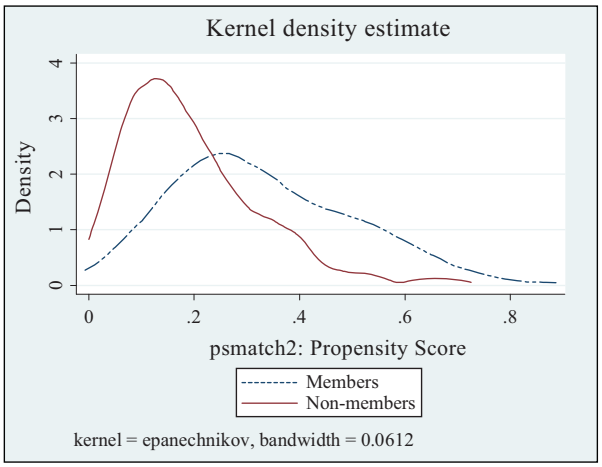
B1: FG Before Matching



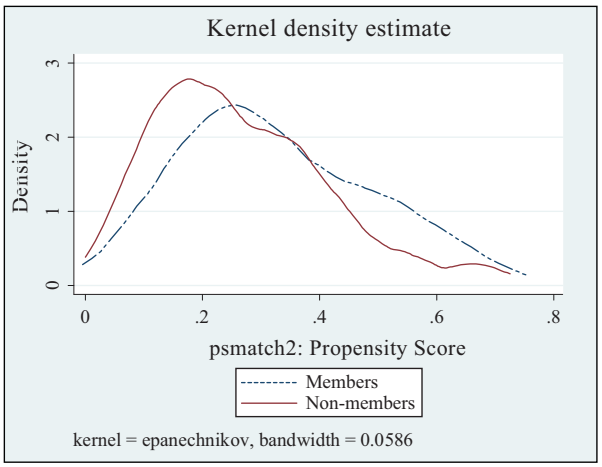

B2: FG After Matching



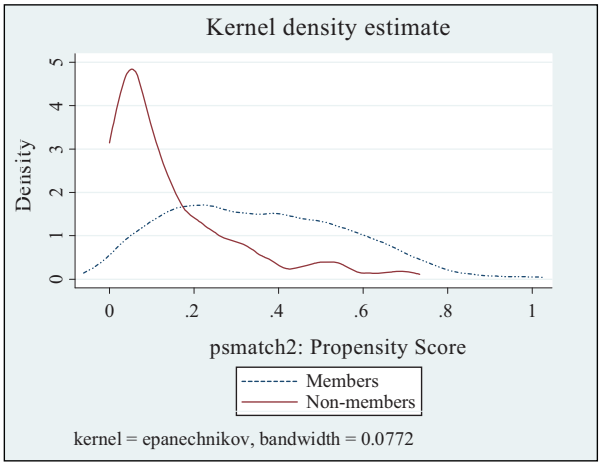

C1: FA Before Matching



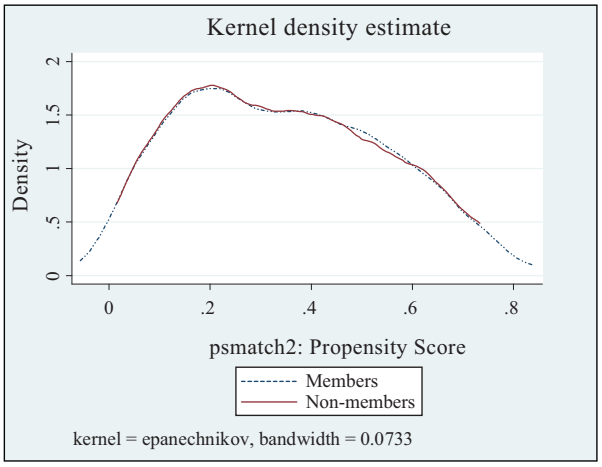

C2: FA After Matching




D1: AC Before Matching (kernel)




D2: AC After Matching (kernel)



## Appendix 3: Additional Regression Results

Table A3-1: Definition of Variables and Descriptive Statistics

| Variables | Description |
|---|---|
| head_age | Age of household head |
| head_age_sq | Age of household head squared |
| head_educa~n | Number of years of household head's schooling |
| head_liter~y | HHH can read and write (dummy) |
| head_male | HHH is male (dummy) |
| head_married | HHH is married (dummy) |
| head_unemp~d | HHH is unemployed (dummy) |
| hhsize | Household size |
| hhsize_sq | Square of Household size |
| pro_dep_ra~o | Dependents ratio (adults aged 15-65 years) |
| agri_incom~e | Agriculture is primary source of HH income (dummy) |
| Credit | Household access to loan in last 12 months (dummy) |
| FO | HH member participate FO (dummy) |
| AC | HH member participate AC (dummy) |
| FA | HH member participate FA (dummy) |
| FG | HH member participate FG (dummy) |
| agri_index | Index of household agricultural assets |
| assets_value | Total value of assets (0000 riels) |
| assets_val~q | Square of asset value |
| Irrigated land | 1 if any household's cultivated parcels of land is irrigated; 0 otherwise. |

Table A3-2: OLS Regression Results 1 (robust standard error)

| Dependent Variable=Rice Revenue per Ha (in logarithm) | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| **FO** | **.03934634** | - | - | - |
| head_age | .001373 | .00530801 | .0008108 | -.00993195 |
| head_age_sq | -.00003974 | -.00005923 | -4.673e-06 | .0000584 |
| head_educa~n | .01268264 | .00748578 | .01012441 | .00969604 |
| head_liter~y | .05209366 | .05841616 | .097331 | .07484665 |
| head_male | .22367687** | .14743123 | .30010427** | .19619249 |
| head_married | -.15715516 | -.00488076 | -.21419765 | -.1314412 |
| head_unemp~d | .06499812 | .06107216 | .01535112 | .11036873 |
| hhsize | -.24486879*** | -.19314888** | -.22149887*** | -.20993823*** |
| hhsize_sq | .01666703*** | .01129426* | .01497472** | .01506369** |
| pro_dep_ra~o | .03891524 | -.00206749 | -.0248106 | -.00583905 |
| agri_incom~e | .06048894 | .00300583 | .04124781 | .06992995 |
| credit | .09534512 | .16590658** | .10440209 | .12666936* |
| agri_index | .12023593*** | .11309349*** | .12558302*** | .13994914*** |
| assets_value | .00010017 | .00008321 | .00003828 | -7.697e-06 |
| assets_val~q | -5.566e-09 | -1.054e-08 | -8.618e-09 | 2.859e-09 |
| irrigatedl~d | .10378042* | .16152592** | .18244944** | .1663477** |
| **AC** | - | **.20966359**** | - | - |
| **FA** | - | - | **-.01609808** | - |
| **FG** | - | - | - | **-.02088258** |
| _cons | 5.4825547*** | 5.2015429*** | 5.3874452*** | 5.6556076*** |
| N | 616 | 389 | 405 | 448 |
| R-squared | 0.1155 | 0.1260 | 0.1245 | 0.1018 |

Legend: * p<.1; ** p<.05; *** p<.01

Table A3-3: OLS Regression Results 2 (robust standard error)

| Dependent Variable=Rice Profit per Ha (in logarithm) | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| **FO** | **.0509235** | - | - | - |
| head_age | .00243784 | .00382739 | -1.148e-06 | -.00618806 |
| head_age_sq | -.00004907 | -.00004229 | 1.970e-06 | .00002455 |
| head_educa~n | .03008715 | .01053871 | .01672134 | .0255468 |
| head_liter~y | -.06910237 | .03899352 | .05203837 | -.03104934 |
| head_male | .26618988* | .18451534 | .32399214** | .3211698 |
| head_married | -.17691539 | -.01209663 | -.20556839 | -.21799166 |
| head_unemp~d | .08073763 | .03502064 | -.0064986 | .06886651 |
| hhsize | -.21873507*** | -.16359749 | -.14021349 | -.20978272** |
| hhsize_sq | .01261697* | .00834244 | .00546522 | .01415876* |
| pro_dep_ra~o | .07895419 | .01527412 | .00326305 | .04094132 |
| agri_incom~e | -.09521995 | -.24572581** | -.17213333 | -.09680928 |
| credit | .1062539 | .15312579* | .14875057 | .11852203 |
| agri_index | .09499613** | .10155447** | .10346845** | .12477972*** |
| assets_value | .0002103 | .0003663** | .00018794 | .0000777 |
| assets_val~q | -1.068e-08 | -1.068e-08 | -3.198e-08 | 1.160e-09 |
| irrigatedl~d | .02795725 | .06916085 | .1379275 | .069315 |
| **AC** | - | **.26355779**** | - | - |
| **FA** | - | - | **.03641266** | - |
| **FG** | - | - | - | **-.09648085** |
| _cons | 5.1484528*** | 4.935565*** | 4.9922794*** | 5.343061*** |
| N | 589 | 373 | 386 | 426 |
| R-squared | 0.0825 | 0.1064 | 0.0827 | 0.0652 |

Legend: * p<.1; ** p<.05; *** p<.01

Table A3-4: OLS Regression Results 3 (robust standard error)

| Dependent Variable=Livestock Revenue per year (in logarithm) | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| **FO** | **.07715171** | - | - | - |
| head_age | -.02354677 | -.04439375 | -.01586926 | -.02900717 |
| head_age_sq | .00012166 | .00032164 | .0000287 | .0001491 |
| head_educa~n | .01430434 | .02859985 | .00614655 | -.00187435 |
| head_liter~y | -.10923447 | -.19163347 | -.18181235 | -.07300208 |
| head_male | -.28424757* | -.28300245 | -.24405176 | -.09084633 |
| head_married | .07480172 | -.12344215 | .00196837 | -.09666181 |
| head_unemp~d | .12040505 | -.0045258 | .090794 | -.00669481 |
| hhsize | .15612546 | .04785633 | .17348251 | .39331836*** |
| hhsize_sq | -.01174435 | -.00300326 | -.01494557 | -.02963973*** |
| pro_dep_ra~o | .0610455 | .18947832 | .17572433 | -.01333937 |
| agri_incom~e | .19320868 | .43416347** | .44012964** | .24578886* |
| credit | -.1743016 | -.19051038 | -.18924612 | -.21430538 |
| agri_index | .00474294 | .03686053 | -.02354918 | .03638063 |
| assets_value | .00300521*** | .00281039*** | .0031286*** | .00316746*** |
| assets_val~q | -7.059e-07*** | -6.549e-07*** | -7.087e-07*** | -7.811e-07*** |
| **AC** | - | **.02420217** | - | - |
| **FA** | - | - | **.19251776** | - |
| **FG** | - | - | - | **.06592972** |
| _cons | 4.3498652*** | 5.1819715*** | 4.0089036*** | 3.9233712*** |
| N | 634 | 396 | 423 | 463 |
| R-squared | 0.3768 | 0.3594 | 0.4186 | 0.4065 |

Legend: * p<.1; ** p<.05; *** p<.01

Table A3-5: OLS Regression Results 4 (robust standard error)

| Dependent Variable=Livestock Profit per year (in logarithm) | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| **FO** | **.050515** | **-** | **-** | **-** |
| head_age | -.03073536 | -.05977521 | -.035777 | -.02616175 |
| head_age_sq | .00020298 | .0004795 | .00023333 | .00012096 |
| head_educa~n | .0150162 | .02998469 | .00402635 | -.00924871 |
| head_liter~y | -.04514394 | -.15146652 | -.06748475 | -.03954098 |
| head_male | -.21827161 | -.30582633 | -.18863992 | -.07374384 |
| head_married | .04258369 | -.03666275 | -.0923879 | -.02740435 |
| head_unemp~d | .12907326 | .00328331 | .0948527 | .02516585 |
| hhsize | .10807929 | .02702627 | .10167469 | .35184545** |
| hhsize_sq | -.0080796 | -.00223159 | -.00900953 | -.02744395** |
| pro_dep_ra~o | .04402926 | .15891144 | .13311572 | -.03268791 |
| agri_incom~e | .27960789** | .46027905** | .48683141*** | .31978781** |
| credit | -.2128487* | -.24581031 | -.24882195* | -.24537486* |
| agri_index | -.00813252 | .03329413 | -.01870257 | .0194271 |
| assets_value | .00293713*** | .00272682*** | .00306055*** | .00302993*** |
| assets_val~q | -6.938e-07*** | -6.479e-07*** | -6.990e-07*** | -7.480e-07*** |
| **AC** | **-** | **.0272479** | **-** | **-** |
| **FA** | **-** | **-** | **.05930611** | **-** |
| **FG** | **-** | **-** | **-** | **.11420546** |
| _cons | 4.4593021*** | 5.5034851*** | 4.5809566*** | 3.8557812*** |
| N | 621 | 389 | 414 | 454 |
| R-squared | 0.3705 | 0.3515 | 0.4106 | 0.3917 |

Legend: * p<.1; ** p<.05; *** p<.01

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