

The Impact of Farmer Organisations on Rice Productivity and Livestock Production, a Follow-up Study¹

Introduction

The main rationale behind the establishment of farmer organisations (FOs) is to provide effective and collective support services to smallholders, thus reducing the major obstacles that make productivity improvement efforts ineffective and enhancing the collective power of small-scale producers within input and output markets. This implies that, in theory, FOs should be able to strengthen farmers' bargaining power and reduce transaction costs. This can potentially lead to increased food security and poverty alleviation through increasing income and driving sustainable agricultural and rural development (Barham and Chitemi 2007; Bachke 2010).

In Cambodia, over 90 percent of the poor live in rural areas and rely on agriculture for their primary sources of livelihood. The country's agricultural sector is characterised by small-scale farming: about 84 percent of rural farmers own less than one hectare of agricultural land (World Bank 2005, 2009). Some studies suggest that smallholder farmers will not be able to leverage their productivity or bargaining power vis-à-vis larger commercial farms and buyers unless institutional arrangements for smallholders to form rural producer organisations are put in place. This has been the case 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 2007).

The literature shows that since the Cambodian government cited FOs and the strategic role of the private sector as key to agricultural and rural development, there have been few studies on the effect these organisations have on rural livelihoods. The existing studies have tried to determine the status of FOs by assessing the numbers and types of organisations, FO registration processes, emerging and major issues FOs face, internal and external factors affecting the success of FOs, and the policies and legal frameworks required to promote the development of FOs in Cambodia (Couturier *et al.* 2006; Nou 2006; Ngin 2010; Chea 2010). All of these studies used qualitative approaches and produced some descriptive statistics.

A baseline survey for an impact assessment of FOs on the food security of rural people in Cambodia, conducted by CDRI in 2011, concluded that participation in an FO impacts positively on rural household food security through improved rice and livestock productivity (CDRI 2012).² However, that study was based on a cross-sectional survey; it mainly aimed at quantifying certain variables in the sample population using propensity score matching (PSM). In 2013, a follow-up survey was carried out to complement the impact assessment study.³ The objectives of that follow-up were to assess the impact of FOs on smallholder productivity in terms of rice yield, measured as kilogrammes per hectare of harvested land, and livestock (pigs and chickens) revenue.

The panel data from that follow-up survey was used in this study and enabled us to estimate the impact of FOs using difference-in-differences (DiD) estimation. Using this technique, we can determine whether FOs have a significant effect on improving the rice and livestock productivity of Cambodian farmers, especially of smallholders.

This study makes two contributions to knowledge in this area. First, using DiD estimation, we have analysed the possible relationship between FO membership and agricultural productivity. Second, using panel data, we have analysed the effect of FOs on rural livelihoods in Cambodia. The study

¹ Prepared by Chhim Chhun and Keo Socheat, research associates in the Poverty, Agricultural and Rural Development Programme, CDRI, with Rithy Longdy, monitoring and evaluation officer, Department of Planning and Public Relations, Ministry of Rural Development.

² Some of the results have been published in Theng *et al.* (2011) and Keo (2013), which can be accessed at www.cdri.org.kh.

³ The authors are grateful to USAID for its generous financial support of the Follow-up Study conducted in 2013. Thanks are also due to the trainers who delivered the "Program Evaluation Short Course for Mid-Career Agriculture, Food Security and Nutrition Professionals", especially Professor Suedi Murari from Michigan State University, USA.

Table 1: Number of Selected FOs and HHs by Province

Province	Number of FOs		Selected households		
	Total	Selected	FO member	Non-FO member	Total
Kampong Thom	328	15	94	104	198
Battambang	411	19	119	132	251
Svay Rieng	573	13	72	83	155
Kampot	143	7	45	50	95
Total	1455	54	330	369	699

Source: CDRI 2012

builds on previous research undertaken by CDRI in 2011 (CDRI 2012). The use of panel data, unlike the cross-sectional data used in the baseline study, provides a good estimation of the impact FOs are having (Khandker *et al.* 2010).

Estimation Methodology

The goal of our research was to analyse the impact participating in an FO has on farmers' agricultural productivity, specifically rice and livestock, using the two-period panel data from the baseline survey in 2011 and the follow-up in 2013. We identified two groups: the treated group, which comprised FO members, i.e. farmers who participated in an FO; and the control group, which comprised farmers who did not participate in an FO. In order to evaluate the effect of FO membership, we used DiD estimation.

DiD estimation calculates the average differences in observed outcomes over time separately for the treated and control groups. Then, after taking into account additional differences between the average changes in outcomes for these two groups, it is possible to identify the treatment effect, i.e. the estimated impact of the issue being assessed – in this case, the effect of participation in FOs.

Data

The study used household data collected for the 2011 baseline impact assessment and another set of data collected from the same households in the 2013 follow-up. Both surveys gathered information about FO members and non-FO members' households such as housing conditions, durable assets, land ownership, harvested area, rice yield, livestock, non-farm activities, credit and loans. Household heads, the spouses of household heads or other adult family members were interviewed face-to-face.

The baseline survey⁴ was carried out in four provinces: Kampong Thom, Battambang, Svay Rieng and Kampot. Three steps were taken to obtain that sample. The first involved the selection of FOs; the second step was to identify the target districts in each province (three districts in Battambang, and two in each of the other three); and the third step was the selection of households (see Table 1).

For our follow-up study, due to resource constraints, we selected only Kampot province. The 2011 baseline survey used propensity score matching (PSM) to compare the variables of interest between the treated and the control groups. This approach selects the control (comparison) group by matching participants and non-participants on the basis of similarities in observed characteristics, discarding unmatched units. The aim of using PSM is to minimise bias and other possible distortions. The variables used were based on the determinants of participation in FOs. These included household head characteristics, household resource endowments, and household location characteristics. The use of PSM at the baseline ensured that households in both groups had comparable characteristics. As Table 2 shows, data from 92 Kampot households was used in the baseline analysis, but the representatives of six households were absent during the follow-up survey, giving us panel data for 86 households (43 households per group).

Table 2: Number of HHs Interviewed in Kampot Province

HH status	Baseline (2011)	Follow up (2013)
Member	45	43
Non-member	47	43
Total	92	86

Source: Authors' calculation

Results

Table 3 shows the results of the descriptive statistics, i.e. the basic features of the baseline and follow-up

⁴ Because an updated list of FOs in the selected study locations was not available, existing lists of FOs in the four provinces were used as the sampling frame for the baseline survey.

datasets. Among the surveyed households, male-headed households were dominant in both groups, throughout. In the baseline and follow-up, the percentages of female-headed households in the treatment group (i.e. FO-members) were higher than in the control group.

There was no difference in years of schooling of the household head between the treatment and the control group, i.e. five years, which implies only a primary level education in both cases. There was a small difference in the household sizes of the treatment and control group – four and five people, respectively. However, the difference in household size between the two groups was the same during the baseline study and the follow-up study. The Khmer literacy levels (the ability to read Khmer) differed slightly between 2011 and 2013: in 2011, it was 77.8 percent for the treatment group and 66 percent for the control group; in 2013, it was 74.4

percent for the treatment and 67.4 percent for the control group. Above 76.7 percent of the household heads in both 2011 and 2013 indicated that they were married. The results also showed a high rate of widows/widowers among the respondents – 20 percent of the household heads in the treatment and 14 percent in the control group.

The role of farming as a source of household income was moderately changed for the treatment group, from 77.8 percent in 2011 to 65.1 percent in 2013, whereas for the control group it reduced by about one-third, from 91.5 percent in 2011 to 60.5 percent in 2013. This suggests that farmers have been considering business activities other than farming. Results for housing conditions show that the percentages of treatment households living in wooden houses with a tiled or tin/fibrous sheet roof slightly increased between baseline and the follow-up. In contrast, the figures for the control group

Table 3: Household Characteristics

Description	Baseline (2011)		Follow-up (2013)		
	Treatment	Control	Treatment	Control	
Sex of HH head (%):	male	75.6	78.7	70.0	84.0
	female	24.4	21.3	30.0	16.0
Age of HH head (years)	47.0	46.0	50.0	49.0	
Years of schooling of HH head (years)	5.0	5.0	5.0	5.0	
HH size (persons)	4.0	5.0	4.0	5.0	
Khmer literacy rate (%)	77.8	66.0	74.4	67.4	
Marital status (%):	married	77.8	83.0	76.7	83.7
	divorced	2.2	2.1	2.3	2.3
	widow/widower	20.0	14.9	20.9	14.0
HH source of income (%):	farming activities	77.8	91.5	65.1	60.5
	business activities	8.9	0.0	9.3	7.0
	other	13.3	8.5	25.6	32.6
Housing condition (%):	thatched house	4.4	8.5	0.0	4.7
	wooden house roofed with tiles	40.0	38.3	44.2	23.3
	wooden house roofed with tin/fibrous sheet	51.1	53.2	53.5	72.1
	concrete/brick house	4.4	0.0	2.3	0.0
Drinking water (%):	pump/bore hole	8.9	10.6	23.3	30.2
	dug well	20.0	34.0	20.9	32.6
	pond/stream	64.4	53.2	41.9	30.2
	rainwater	6.7	2.1	14.0	7.0
Cooking fuel (%):	firewood collected	91.1	93.62	83.7	95.4
	firewood bought	2.2	4.26	4.7	2.3
	gas	6.7	2.13	9.3	2.3
	other	0.0	0.0	2.3	0.0
Distance from HH to main market (km)	1.3	1.0	1.3	1.0	
HH assets ('0000 riel nominal)	842.6	645.9	978.9	757.9	

Source: Authors' calculation

Table 4: Difference-in-Differences Results (kernel-based propensity score applied)

Outcome Variables	Baseline (2011)			Follow-up (2013)			DiD	p-value
	Control	Treated	Diff	Control	Treated	Diff		
Rice								
Yield (kg per ha)	1978.4	2401.6	423.2	1891.3	1996.8	105.4	-317.8	(0.46)
Consumption per capita (kg)	1090.5	1401.2	310.7	757.5	1016.3	258.8	-51.9	(0.82)
Sales per ha (kg)	311.1	499.4	188.3	387.1	546.3	159.1	-29.1	(0.94)
Gross income ('0000 riels)	31.0	50.6	19.6	31.1	35.6	4.5	-15.1	(0.59)
Net profit per ha ('0000 riels)	117.2	200.3	83.1	119.4	129.0	9.6	-73.5	(0.13)
Chickens								
Output per capita (kg)	4.7	11.5	6.8	3.0	12.4	9.3	2.6	(0.55)
Consumption per capita (kg)	1.6	3.6	2.0	0.8	2.0	1.2	-0.8	(0.50)
Sales (kg)	1.4	4.2	2.8	0.6	2.4	1.9	-0.9	(0.56)
Sales per capita ('0000 riels)	1.7	5.5	3.8	0.9	3.6	2.7	-1.1	(0.62)
Pigs								
Output per capita (kg)	22.7	31.8	9.2	9.0	27.6	18.7	9.5	(0.58)
Consumption per capita (kg)	0.0	1.1	1.1	0.0	0.4	0.4	-0.7	(0.64)
Sales (kg)	14.4	18.4	4.0	5.8	22.7	16.9	12.9	(0.36)
Sales per capita ('0000 riels)	13.9	16.9	3.0	5.1	23.9	18.8	15.8	(0.40)

Source: Authors' calculation

indicate a shift towards lower quality housing, with a 15 percentage point decline in tile-roofed wooden houses and a 19 percentage point rise in tin-roofed wooden houses between baseline and follow-up. For drinking water, at baseline, the percentages of households using ponds/streams were high at 64.4 percent for the treatment and 53.2 percent for the control group; at the follow-up in 2013, these percentages, had markedly decreased to 41.9 percent and 30.2 percent, respectively. Meanwhile, the use of rainwater in the treatment group almost doubled to 14.0 percent while that for control group more than tripled to 7.0 percent. Further, the use of pump/bore holes considerably increased, by about two and half times (to 23.3 percent) for the treatment and almost three times (to 30.2 percent) for the control group. Firewood collected was the major source of cooking fuel throughout (in the range of 83 to 95 percent), though it was reduced by 7 percentage points for the control group at follow-up.

The distance from home to the main market varied a little between the treatment and control groups, and there was no change between the baseline and follow-up year, i.e. 1.3 km for the treatment group and 1 km for the control group. Household assets increased, from 8.426.000 riels to 9.789.000 riels for the treatment group and from 645.9 thousand riel to 7.579.000 riels for the control group. However, this

increase had no significant impact on household livelihoods since the t-test (statistical examination) results showed no significance.

The results of the difference-in-differences (DiD) estimation are presented in Table 4. This result has been guided by control variables as shown in Table 5 in the Appendix. The DiD calculations are all minus sums for all outcome variables of rice – yield, consumption, sales, gross income and net profit. However, as the t-statistics show, none of the outcome variables are statistically significant. This implies that FOs have no observed positive impact on FO members' rice productivity.

The results for households that raise chickens, 92 households at the baseline and 78 households at the follow-up survey, show negative differences for the variables of consumption per capita, sales, and sales per capita, as shown in the DiD column. This implies that the outcome at follow-up was lower than that at baseline. The results of the t-test (p-value – that is, the probability that the results of the study are caused purely by chance) indicate that the difference is not statistically significant. From the t-statistics result, we can infer that FO participation had no impact on the productivity of chicken farmers.

In respect of pig raising, there were 77 households in the baseline year and 55 households in the follow-up year. The results in the DiD column give negative

figures for consumption per capita but are positive for sales, output per capita, and sales per capita. However, there is no statistical significance for all variables. We can therefore conclude that FOs had no impact on the productivity of pig farmers in the survey groups.

Conclusion

The results of the CDRI baseline study in 2011 showed that participation in an FO had a positive impact on rural household food security through

improved rice and livestock productivity. That study was based on a cross-sectional survey. However, using panel data in this follow-up study and focussing solely on Kampot, we found that participation in FOs had no impact on productivity in terms of rice and livestock. Our conclusion is that the FOs in our study areas had no significant impact on households' agricultural productivity, i.e. rice and livestock, in the rural province of Kampot. That said, since our sample was small, these results have to be considered for further investigation.

References

- Abaru, M.B., A. Nyakuni and G. Shone (2006), *Strengthening Farmers Organisations: RELMA's Experience in Eastern and Southern Africa*, ICRAF Working Paper No. 23 (Nairobi: World Agroforestry Centre)
- Bachke, M.E. (2010), *Do Farmers' Organizations Enhance the Welfare of Small-Scale Farmers?* Working Paper (As, Norway: Norwegian University of Life Sciences)
- Barham, J. and C. Chitemi (2007), *Collective Action Initiatives to Improve Marketing Performance: Lessons from Farmer Groups in Tanzania*, CAPRI Working Paper No. 74 (Washington, DC: IFPRI)
- Bingen, J., A. Serrano and J. Howard (2003), "Linking Farmer to Market: Different Approaches to Human Capital Development", *Food Policy*, 28, pp. 405-419
- CDRI, Cambodia Development Resource Institute (2012), "Impact Assessment of Farmer Organisations on Food Security for the Rural Poor", unpublished report (Phnom Penh: CDRI)
- Couturier, J., S.O. Savun and P. Ham (2006), "Inventory of Farmer Organisations in Cambodia", draft prepared for Office of Farmer Organisation, Department of Agricultural Extension, Ministry of Agriculture, Forestry and Fisheries, Phnom Penh
- Chea S. (2010), "Final Report on Policy Analysis for Farmer Organisation Development, Department of Agricultural Extension" (Phnom Penh: MAFF, sponsored by IFAD and FAO)
- Chirwa, E., A. Dorward, R. Kachule, I. Kumwenda, J. Kydd, N. Poole, C. Poulton and M. Stockbridge (2005), "Walking Tightropes: Supporting Farmer Organisations for Market Access", *Natural Resource Perspective* (London: Overseas Development Institute)
- Keo S. (2013), "Gender Inequality in Agriculture: A Household Survey of Farmer Organisations in Four Provinces", *Cambodia Development Review*, Vol. 17 (Phnom Penh: CDRI) pp. 13-18
- Khandker, Shahidure R., Gayatri B. Koolwal and Hussain A. Samad (2010), *Handbook on Impact Evaluation: Quantitative Methods and Practices* (Washington, DC: World Bank)
- Ngin C. (2010), "Farmers' Associations in Cambodia: Internal Functions and External Relations", RCSD Research Report (Chiang Mai: Regional Center for Social Science and Sustainable Development)
- Nou Keosothea (2006), "Emerging Structures of Agricultural Cooperatives in Cambodia", *Cambodia Development Review* (Phnom Penh: CDRI) Vol. 10, Issue 1, pp. 9-12
- Peacock, C., A. Jowett, A. Dorward, C. Poulton and I. Urey (2004), "Reaching the Poor: A Call to Action – Investment in Small Agriculture in Sub-Saharan Africa", unpublished report for FARMAfrica (London: Imperial College)
- Schlotter, M., G. Schwerdt and L. Woessmann (2011), "Econometric Methods for Causal Evaluation of Education Policies and Practices: A Non-technical Guide" *Education Economics*, 19(2), pp. 109-137
- Theng V., Nou K., Keo S., Sum S. and Khiev P. (2011), "Farmer Organisations in Cambodia: Do they Improve Food Security of the Rural Poor?" *Cambodia Development Review*, Vol. 15 (Phnom Penh: CDRI) pp. 13-17
- World Bank (2005), *Cambodia Rural Sector Strategy Note: Towards a Strategy for Rural Growth and Poverty Reduction* (Washington, DC: World Bank)
- World Bank (2009a), *Poverty Profile and Trend in Cambodia: Findings from the 2007 CSES* (Phnom Penh: World Bank)

Appendix

Table 5: List of Control Variables (covariates) in the Difference-in-Differences Estimation

Variables	Description	2011			2013		
		Obs	Mean	SD	Obs	Mean	SD
q1_31	Farming activities (dummy)	92	0.85	0.36	86	0.63	0.49
q1_32	Business activities (dummy)	92	0.04	0.21	86	0.08	0.28
q2_1_22	Wooden house roofed with tiles (dummy)	92	0.39	0.49	86	0.34	0.48
q2_1_23	Wooden house roofed with tin/fibrous sheet (dummy)	92	0.52	0.50	86	0.63	0.49
q2_1_24	Concrete/brick house (dummy)	92	0.02	0.15	86	0.01	0.11
q2_1_42	Dug well (dummy)	92	0.27	0.45	86	0.27	0.45
q2_1_43	Pond/stream (dummy)	92	0.59	0.50	86	0.36	0.48
q2_1_44	Rainwater (dummy)	92	0.04	0.21	86	0.10	0.31
q2_1_51	Firewood collected (dummy)	92	0.92	0.27	86	0.90	0.31
q2_1_53	Gas (dummy)	92	0.04	0.21	86	0.06	0.24
q2_1_61	City power (dummy)	92	0.00	0.00	86	0.07	0.26
q2_1_62	Generator (dummy)	92	0.02	0.15	86	0.00	0.00
q2_1_63	Kerosene/gasoline (dummy)	92	0.33	0.47	86	0.10	0.31
q2_1_64	Candle (dummy)	92	0.01	0.10	86	0.01	0.11
q2_1_65	Battery/flash light (dummy)	92	0.62	0.49	86	0.74	0.44
q2_1_67	(Specify) (dummy)	92	0.02	0.15	86	0.01	0.11
q2_1_71	Owned toilet (dummy)	92	0.18	0.39	86	0.22	0.42
q1_2_31	Gender (male=1)	92	0.77	0.42	86	0.77	0.42
q1_2_61	Literacy (yes=1)	92	0.72	0.45	86	0.71	0.46
q1_2_71	Married (dummy)	92	0.80	0.40	86	0.80	0.40
q1_2_73	Widow/widower (dummy)	92	0.17	0.38	86	0.17	0.38
q1_2_92	Farm work (selling labour within the village) (dummy)	92	0.01	0.10	86	0.01	0.11
q1_2_93	Working outside village in Cambodia (dummy)	92	0.04	0.21	86	0.05	0.21
q1_2_94	Migration to work at border (dummy)	92	0.01	0.10	86	0.01	0.11
q1_2_95	Work in other country (dummy)	92	0.02	0.15	86	0.02	0.15
q1_2_96	Civil Servant/NGO staff/company staff (dummy)	92	0.07	0.25	86	0.07	0.26
q1_2_97	Small business/collective small business (dummy)	92	0.26	0.44	86	0.28	0.45
q1_2_98	Collecting resources from water or field (dummy)	92	0.05	0.23	86	0.05	0.21
q1_2_99	Working in construction (dummy)	92	0.16	0.37	86	0.14	0.35
q1_2_910	Money lending (dummy)	92	0.02	0.15	86	0.02	0.15
q1_2_911	Handicraft (dummy)	92	0.02	0.15	86	0.02	0.15
q1_2_912	Selling labour within village (non-farm activities) (dummy)	92	0.01	0.10	86	0.01	0.11
q1_2_4	Age of household head	92	46.64	13.13	86	47.29	13.19
q1_2_8	Education level (years of schooling) of household head	92	5.23	3.72	86	5.26	3.80

Source: Authors' calculation