A Study of Rice Industry towards Rural Development in Northwest Cambodia
-The Role of Rice Millers for Rural Development -

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Abstract

Some large-scale rice milers in Northwest Cambodia provide a loan to farmers under the agreement that the farmers will bring their paddy to them. The paper describes contract farming between commercial rice millers and paddy producers in the paddy market that facilitate the provision of credit. This contract farming, which tend to be dominant, may emerge as the best current governance structure to minimize production and transaction costs. This paper takes the case of rice milling industry in Battambang Province as an example, and analyses its efficiency and assess rice farmers' performance with and without the contract.

1. Introduction

It is widely recognized that the improvement of agricultural productivity is critical for poverty alleviation and economic growth in Cambodia, where agriculture is the primary source of livelihood for about 70 % of population. Agricultural productivity, however, does not just depend on crop yield, but also determined by the efficiency of post-harvest processing and marketing. Because of the recent new system of a market economy in the early 1990s, the efficiency of post harvest processing and marketing is becoming more and more important for local agriculture. For smallholder farmers in transition economies, market access is especially important because it means their production is not limited by their own consumption or the local market.

The access to broader markets via contract farming allows smallholder farmers to exploit their comparative advantages in natural resources, environment, and other areas. When farmers produce for international markets where consumers with higher income levels are willing to pay premiums for high quality rice becomes a comparative advantage.

Hence, the main objective of this paper is to assess the impact of contract farming on farmers' performance in the context of Cambodia.

2. Contract farming

Contract farming is an institutional arrangement widely adopted in agricultural production (Glover and Kusterer, 1990). Contract farming represents an agreement between farmers and contractors for the production and supply of agricultural products. Under contract farming, farmers usually agree to deliver specific commodities in predetermined quantities and to meet predetermined quality standards, while contractors agree to provide production support (e.g., supply of agricultural inputs and provision of agricultural technologies) and accept products at predetermined prices (Eaton and Shepherd, 2001).

Numerous case studies involving various agricultural commodities done in several developing countries have shown that smallholder farmers have variably benefited from contract farming through the access of production inputs, output markets, market development, rural development, and other intangible benefits (Key and Runsten, 1999).

It also benefits contractors by allowing them to establish close relationships with farmers and by reducing uncertainties in purchases through predetermined timing, prices and quality standards (Singh, 2002). Therefore contract farming has a positive effect on the efficiency and products quality.

While contract farming is a conceptually sound institutional arrangement, lack of flexibility is one of main its main liabilities and coordination problems are faced during its implementation. Contract farmers likely to face greater credit risks because of excessive advances, which tend to jeopardize the sustainability of their operations in the long run (Glover and Kusterer, 1990).

As mentioned above, supports from contractors can help reduce these risks. However, overdependence on a contractor not only makes farmers less adaptive and hence more vulnerable to economic shocks, but also tends to reduce their bargaining power in contract negotiations (Key and Runstern, 1999).

Rice farming and rice industry will be the engine of economic growth in rural Cambodia, and I observe a lot of different kinds of contract farming in various places in Northwest Cambodia. But there has been little study on the impact of contract farming in Cambodia. In order to fill this gap, this paper take the case of rice milling industry in Northwest Cambodia as an example, and analyzes its efficiency and assess rice farmers' performance with and without the contract.

3. Overview of paddy production and Case study of rice milling enterprises in Battambang Province

3.1 Rice farming and Rice milling in Cambodia

For most of farmers, rice is their major source of income and sustenance and thus rice plays an integral part in the economy of rural Cambodia. Rice farming is the major agricultural activities in Cambodia, accounting for nearly one third of the country's total agricultural value added. However, due to inefficient farming techniques and limited irrigation networks, the yield level of rice faming in Cambodia is well below that of its neighbors.

For the present rice cultivation, it cannot be sustained without getting cash income from paddy sales for a living and purchase of agricultural materials in addition to the production for self-consumption. The yield level is very dependent on fertilizers. Indeed, even while the land is relatively rich, the mono-cultivation of rice, added to the reduction of available land, tend to heavily impoverish the soil. In the past decade, almost all farmers have started to use chemical fertilizers. According to my interviews, their use can triple the rice yield. However the farmers cannot always use the sufficient fertilizer quantities. Indeed the input purchase represents a financial advance for farmers; therefore most part of the farmers must take loans to pay for agricultural input expenses.

The farmers are generally small scale. Their land resources are not sufficient to obtain formal credit but they can engage informal credit. It has been said that many farmers are in debt with high interest. In the absence of an insurance market, the agro-ecological risks on production are high, it is difficult to increase paddy yield without facilitated credit access to invest in agricultural materials and technology.

It is generally cultivated in an extensive system with one production cycle per year. Rice is sown in June-July and is harvested in November –January. After harvest and beating (consisting in separating the paddy grains from the straw), the farmers generally bring their rice to the rice mill. Farmers either take paddy to nearby rice millers or sale it to collectors.

In Battambang province, around 50% of farmers market a share of their production to rice millers and the average volume sold are around 2 tons per year.

With the free market policy of rice[1], many commercial rice millers were established.

[1] The government abolished the food-controlling system due directly to the financial pressure. However, upon the introduction of the market economy as the national policy, rice distribution was liberalized.

According to the Ministry of Industry, Mines and Energy, the registered medium-large[2] scale commercial rice mills counts 1,026 in year of 2008. Most of the rice millers are Chinese community. They are specialized in paddy purchase and processing and in the sale of rice. They own mils, as a result of their own investment. The quantity of paddy bought in a season depends on the miller's financial and storage capacities.

However, it can be calculated that about 600 mills are enough and about 400 mills will be forced to be overabundant to the entire rice milling business[3]. Thus, milling facilities in Cambodia are overpopulated and the selection through competition among commercial rice millers has started. The cases of closure of rice mills and conversion to paddy traders have been observed. In addition, the enlargement and centralization of rice mills have also been observed. Therefore, it is expected that the mills that have enough funds to purchase paddy and can secure the market route of milled rice, which is the end product, will surpass other mills.

In the Battambang provinces, contract farming between the rice millers and paddy producers have become common since the economical system has changed and the number of rice mills has increased.

In order to secure enough amount of paddy at harvest time, commercial millers have tried to establish producer's loyalty by contract, in the form of micro-credit mainly. At the beginning of the rice cropping cycle, the rice miller supplies a loan to the producer for an input purchase such as fertilizer, pesticide. The credit amounts vary from 50 US$ to 500 US$. In some cases, the rice millers also provide money loan for urgent expenditure. Rice millers sometimes supply other service like paddy husking for family consumption. Then rice millers can establish big producer loyalty by supplying these services.

This contract seems to facilities access to good seeds, credit, storage, and even husking for consumption by the producer's family, in return for exclusive sale of its production to the rice miller.

Therefore, this study sought to find out the effect of contract farming on rice production by comparing rice yields, determining the factors affecting rice outputs and analyzing economic profitability of rice production between farm households with and without contract farming in rural area in Cambodia.

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[2] Rice millers are those with more than the average capacity of 1 ton/hour input of paddy.

[3] Assuming the domestic consumption of milled rice is about 2 million tons and 30 % is consumed in the urban area, it will be 600,000 tons. If adding 200,000-400,000 tons of milled rice drained to neighbor countries, the milled amount handled by commercial rice mills will be 800, 000- 1,000,000 tons per year. If one rice mill operates 8 hours/day and 330 days/year, it will mean that about 5,280 tons of paddy can be milled and 3,400 tons of milled rice will be produced.

3.2 Methods and Study site

Knowing the significance of rice milling enterprises in the rice industry, these enterprises were selected to be a case study and the Battambang province was chosen to be the location for field research. Battambang province is the second largest town, and is located in the north western part of Cambodia on the border with Thailand. This province is the so called 'place for paddy production' in Cambodia. Compared with other provinces, Battambang is one of the most productive places for paddies; therefore, there are many rice milling enterprises located in this province. These mills are almost all established on the Road No.5 (connecting Phnom Penh, the capital, to Thailand).

The data used in this paper came from a field survey data, which was conducted from 2007 to 2009. I surveyed 64 rice producers, 60 commercial rice millers as well as other actors who allowed me a better understanding of the strategic determinants in the rice marketing process (input traders, paddy collectors, rice wholesalers, money lenders, local authorities and development institutions). 64 farm households consisting of 34 farm household with contract and 30 farm households without contract were selected randomly from the survey area. Rice farm households within farm household with and without contract groups in the study area were excluded because this study aimed at finding out the effect contract farming on rice production.

3.3 Result and Discussion

General information of surveyed farm households in the study area

Based on the survey results, the age of householders within contracted farmers and non-contracted farmers ranged from 26 to 58 years old, with an average of 45.2 years old and 24 to 62 years old, with an average of 43.1 years old respectively (Table 1). This can be assumed that householders within contracted farmers and non-contracted farmers have good farming experience especially in rice cultivation since rice growing is the main occupation of farmers in the study area.

Apart from the age structure, educational attainment of householders is also an important factor for individual householder to lead the family as well as to make decision in farming. The educational attainment of householders within contracted farmers was 2.81 years, followed by householders within non-contracted at 2.44 years. This indicates that educational level of both householders is low. However, they are not illiterate. Therefore, their educational level and farming experience are not significantly

different factors that might lead to differences in decision making in rice cultivation.

On average, contracted farmers have larger families and more land. The average family size for contracted farmers is 5.62 persons (4.21 adults) per household, greater than non-contracted farmers' 5.51 (3.56 adults). On average, a contract farming household controls 2.31 hectares of land (2.13 hectares of own land) greater than non-contracted farmers' 1.87 hectares (1.52 hectares of own land).

The relatively large family and land size may reflect the scale requirements for contract farming. As farmers usually need to split their land for commercial and self-consumption operations due to variety preferences in the local rice varieties, farmers with small areas of land tend to have insufficient land for sales. According to the rice millers' interviews, famers should own at least 1.5 ha of land so as to be efficient under the contract.

Table1. Characteristics of contracted and non contracted farmers

	Unit	Contracted farers (n=34)	Non Contracted farmers (n=30)
Household size	person	5.62	5.51
Number of active labor	person	4.21	3.56
Age of householder	year	45.23	43.1
Education attainment of householder	Number of years	2.81	2.44
Gender	(Male=1; Female=0)	0.89	0.76
Cultivated land	ha	2.31	1.87
Own land	ha	2.13	1.52

Source: Field survey, 2007-2009

Benefits of the contract farming to participating farmers

Table 2 shows the average economic variables for the farmers who contracted or non-contracted. These results suggest that contracted farmers harvested higher crop yields than non-contracted farmers because they used a loan from the rice millers to invest more inputs including good seed, chemical fertilizer on rice production than non-contracted farmers. Higher profits obtained by contracted than non contracted farmers could be explained by lower prices received by some non contracted farmers. The observed profit differential contracted and non contracted rice farmers could be related to the existing price differential since contracted farmers delivered paddy to

specific rice millers for a price of 843 riel/kg while non contracted farmers sold their paddy to indefinite millers at a low price. Since contracted farmers were generally outperforming their counterparts in profitability, these findings seem to disagree with the notion that contract farming is 'exploitative' to smallholder farmers (Runstern and Key, 1996).

Table 2. Economic variables by farm household type

	Contracted (n=34)	Non-contracted (n=30)
Profit (,000 riel/ha)**	1712.1	1252.7
Rice price (riel/kg)**	843	805
Yield (t/ha)***	2.65	2.21

The means are different at the level of 1 % significance (***), 5% significance, respectively.

1US$=4,000riel

Source: Field survey, 2007-2009

Table 3 shows the results of correlation analysis between contract farming, input investment and rice output. Based on the estimated coefficient of variables in table 3, the results of correlation analysis clearly indicate that there appear to be a strong correlation between contract farming, input investment and rice output. This strong correlation implying that contracted farmers use rice millers' loan to purchase inputs on rice production. Similarly, the estimated coefficient of contract farming and rice output indicating that contract farming has very strong correlation with rice output.

Table 3. Output of correlation analysis

	Contracted farmers	
Contract farming	Input investment	Rice output
	0.851***	0.819***

***indicates the significance at the 0.01 level

Costs incurred on rice production

Table 4 presents the absolute value of production cost of rice and the percentage share of each input cost to the total production cost per hectare. Contracted farmer incurred total cost around 933,000 riels (around 17 %) larger than non contracted farmers. This is due to the fact that contracted farmers paid around 1.5 times on some inputs such as seed, fertilizer and pesticide. Contracted farmers could invest larger amount of working capital in rice cultivation because they have credit access provided by rice millers.

In this study, economic profit of rice production is defined as the amount left after deducting total production cost from gross returns. Since the opportunity cost of land is not yet set throughout the country, land cost or the opportunity cost of land that this study set was based on the actual land rent that farmers paid to rent in land in the study area.

With respect to the economic profitability of rice, contracted farmers gained around 428 US$ per hectare, while non contracted farmers gain only about 313 US$ per hectare. Non contracted farmers could not make big profits from rice production, deriving from the poor performance of the crop, resulting from low input investment in crop production.

Table4. Rice production cost in riels per hectare

	Contracted (n=34)	Non-contracted (n=30)
Total Cost (,000riel)	933.2 (100)	796.3 (100)
Labor cost	559.3 (59.9)	516 (64.8)
Family labor cost	330.3	276
Exchange labor cost	23	41
Hired labor cost	206	199
Agricultural implements	68 (7.3)	56 (7.0)
Current asset	275.9 (29.6)	170.3 (21.4)
Depreciation cost	30 (3.2)	19 (2.4)
Operating cost (,000 riel) (C)	626.9 (100)	526.3 (100)
(Details)		
Labor cost	206 (32.9)	199 (37.8)
Interest on durable asset	69 (11.0)	76 (14.4)
Current asset	275.9 (44.0)	170.3 (32.3)
Depreciation cost	30 (4.8)	19 (3.6)
Land cost	26 (4.1)	54 (10.3)
Interest charge	20 (3.2)	8 (1.5)
(Details)		
Seed and seeding	54.2 (8.6)	36 (6.8)
Fertilizer	149 (23.8)	94 (17.9)
Pesticides	26 (4.1)	17 (3.2)
Plowing	41 (6.5)	53 (10.0)
Transplanting	106 (16.9)	102 (19.4)
Harvesting	94 (15.0)	79 (15.0)
Irrigation	8.2 (1.3)	9.3 (1.8)
Threshing cost	75.5 (12.0)	79 (15.0)
Transportation	39 (6.2)	34 (6.5)
Depreciation	30 (4.8)	19 (3.6)
Others	4 (0.6)	4 (0.8)
Profit (,000 riel) (=Total Revenue-Total Cost)	1712.1	1252.7

Note: ( ) indicates %.

Profit is equal to revenue minus total cost including both cash and non-cash costs. Major non-cash costs include family labor and homemade manure.

1US$=4,000riel

Source: Field survey, 2008

4. Product Quality Improvement

Through a simple observation, it is obvious that the quality of locally produced rice is lower than the imports (Thai rice) as the farmer contains a lot of broken grains and foreign materials. Hence, there is no doubt that the quality of local rice needs to be improved to compare with the imports. The question is if the rice millers' contract forester the quality improvement.

The paddy quality (good or bad) is basically determined by various conditions before harvesting such as the availability of superior seeds, growing environment and fertilizer management, but it is also affected greatly by the post harvest practices. The quality improvement at post harvest practices is to prevent, beforehand, factors that might affect the paddy quality in the various processes after harvesting; and also to remove factors that have already affected the paddy quality. The former is heated grains by high moisture content and cracked grains at drying. The latter is to remove red rice grains, dusts and weed seeds. Cambodian millers complain that the quality of milled rice, in terms of the percentage of broken rice and moisture content, is compromised by poor seed quality and mixed paddy varieties. Cambodian farmers will often use multiple varieties of seed in their paddy production, which results in higher losses for millers as the rollers used in the milling process are better suited for paddy of a relatively uniform length. Post-harvest technologies, particularly drying, are inadequate and result in high levels of moisture that leads to high levels of broken rice.

The purpose of paddy quality improvement is to raise the price of paddy, which is the raw material, and to boost the market value of milled rice, which is the end product. To be specific, it is to improve unit price and milling rate. In other words, if the market price of paddy is raised, then it means the income of farmers will be raised as well. Rice millers can also earn more profits by producing better quality of milled rice more from a certain amount of the raw material.

In order to examine the effect of contract farming of paddy quality, 36 medium-large scale commercial millers were selected from the 60 rice miller samples in Battambang province. They are all located on the Road No.5. Rural areas' rice miller samples were excluded in order to avoid location bias.

Table 5 and Table 6 are comparison between contract rice millers and non-contract rice millers' paddy quality using the data of paddy quality which conducted by my field research and JICA/PDA survey.

Table.5 Quality of paddy bought by the contract rice millers (n=10)

variety	Moisture content %	Red kernels %	Cracked/ Broken rice %	Damaged grains %	Foreign matters/ impurities %	Immature grains %	Whole grains %
Phker Mali	14.63 (4.38)	7.21 (3.09)	15.31 (9.46)	2.33 (2.81)	2.61 (1.21)	6.31 (2.64)	66.23 (7.41)
Neang Minh	15.11 (2.52)	4.95 (4.32)	20.84 (12.61)	2.14 (2.40)	1.35 (1.44)	7.45 (2.35)	63.27 (8.39)
Mixed	15.21 (3.34)	5.39 (5.82)	19.74 (10.56)	1.22 (1.73)	2.44 (1.01)	5.71 (2.40)	65.5 (7.46)

* ( ) indicates standard deviation.

Note: Paddy sample after cleaning, yellowish rice (discoloration to yellow or orange caused by the propagation of mold, which has ill effect on the human body)

Source: Field survey, 2008 (JICA Battambang project /Provincial department of agricultural Battambang)

Table.6 Quality of paddy bought by the Non-contract rice millers (n=26)

variety	Moisture content %	Red kernels %	Cracked/ Broken rice %	Damaged grains %	Foreign matters/ impurities %	Immature grains %	Whole grains %
Phker Mali	16.14 (6.11)	3.95 (6.28)	21.77 (12.38)	2.11 (1.71)	5.12 (1.31)	5.41 (2.34)	61.64 (8.16)
Neang Minh	17.40 (5.32)	5.13 (7.61)	19.63 (10.31)	2.64 (1.46)	3.56 (1.60)	6.32 (2.44)	62.72 (7.52)
Mixed	16.32 (6.36)	4.12 (6.11)	24.36 (13.32)	2.23 (2.29)	3.12 (2.02)	6.27 (3.11)	59.92 (6.46)

* ( ) indicates standard deviation.

Note: Paddy sample after cleaning, yellowish rice (discoloration to yellow or orange caused by the propagation of mold, which has ill effect on the human body)

Source: Field survey, 2008 (JICA Battambang project /Provincial department of agricultural Battambang)

The physical quality of paddy is obviously better at the contract rice millers than the non contract rice millers: the content of whole grain is higher; and the content of cracked/broken grains and impurity is lower.

In addition, as the standard deviation is greater than the mean at non contract rice millers, the quality appears to be not uniform.

Since contract rice millers often intervene in several process of rice production through contract, it is clear that contracted farmers are more determining the fully dried, well screened and uniform paddy than non contracted farmers in order to reduce the amount of broken rice and to achieve high milling rate at the milling stage.

This indicates that the contract farming, probably because of the higher concentration

of transactions, will be the basis of informal product-quality grading system, which is critical for the market development. Once price quality relationship is established in the paddy market, rice producers will pay more attention to post harvest handling and the product will be able to compete with neighbors' rice (Thai rice). Hence, contract farming play significant roles in the paddy market development, which will benefit not only the rice industry itself but also other stakeholders as well as producers.

5. Conclusion

In Cambodia, rice millers are the rural actors with the greatest ease mobilizing formal loan with banks because of their immobilized capital. They can be credit intermediaries between broad sources of financial capital and multiple small requests coming from paddy producers.

The contract farming answers the producers' main problem concerning the running of farm finances thanks to the access to credit, which he could not claim from other credit sources. The contract farming acts as a substitute to material guarantees and becomes an opportunity to borrow money. Moreover, as producers often have strong risk aversion, these contracts also serve as insurance thanks to the debt carried forward.

Overall, the results show that rice contract farming bring a number of benefits to smallholder farmers in Battambang province.

However, the emergence of this contract farming implies inefficiency of the Cambodian rice market. First, although my research suggests that relatively large mills are more technically efficient, the millers cannot fully utilize the capacity up to the optimal level. This may be caused by the shortage of working capital. In order to purchase paddy at harvest and provide micro credit at transplanting, commercial mills require large amounts of liquid working capital, in the form of cash. However, because most mills sell milled rice throughout the year on credit to wholesalers and traders, millers face difficulties in absorbing the large amount of paddy available at harvest time. This situation contributes to the flows of paddy to neighboring countries such as Viet Nam and Thailand. Second, although research results shows the benefit of the contract farming, naturally this implies that demand for credit among rice farmers is high and the credit market is not functioning well.

Medium-large scale miller's contract farming should be promoted in Cambodia, not only because of the superior efficiency but also because of their better paddy quality, both of which will enhance competitiveness of Cambodian rice. However, efficiency of the rice markets may not be so improved as expected without complementary policies to

develop efficient transportation, credit access, and information system related to the demand of paddy for milling.

Finally, the results point to the fact that contract farming is not inclusive of the poorest farmers typically with land size below 1 hectare. Public sector attention will be also required for this group of farmers.

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