Evolution of Rice Farming in Ubon Ratchathani Province

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INTRODUCTION

Rice production systems in Thailand have changed from traditional to modern practices since the 1980s. The change began in the Central Region where improved irrigation systems were developed, providing a basis for innovations in technology such as the use of high-yielding varieties (HYVs), fertilisers, pesticides, and machinery (Srisompun and Isvilanonda 2012). Previously, growth in rice production was mainly due to increases in the cultivated area (Thepent and Chamsing 2009). However, the widespread adoption of modern technologies has entailed an intensification and commercialisation of rice production, increasing the productivity of both land and labour and the size of the marketable surplus (Chamsing 2007). Apart from the seed-fertiliser technology associated with the green revolution, the major innovation has been the widespread mechanisation of rice farming. Farm machinery was initially imported from East Asia but rapidly came to be manufactured in Thailand and adapted for local conditions. Notable developments were the adoption of

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two-wheeled tractors, medium-sized four-wheeled tractors, and combine harvesters (Thepent and Chamsing 2009).

Thai rice farming systems have changed again since the country's economic crisis in 1997. In the wake of the crisis, agricultural input prices increased while product prices were low. Alternative rice farming systems following King Bhumibol's philosophy of the "sufficiency economy" were widely promoted (Chap. 2). In particular, since 2007 the Community Development Department in the Ministry of the Interior initiated a project promoting the model of a "self-sufficiency village". The project aims to strengthen villages' competencies in self-management and develop the economic base on self-sufficiency principles (Prathanchawano 2013). Some commercial farmers are reported to have reverted to being self-sufficient farmers, relying less on external resources, drawing more on local resources, and diversifying into other crops. In addition, to address the affordability of farm inputs, the government has prioritised the provision of more suitable forms of credit. Provision of agricultural credit has always been an important policy for the Thai Government and has been a crucial driver of the commercialisation of agriculture. However, in recent years a number of government projects have been implemented using micro-finance principles. Villages have been designated as grassroots units and targeted in credit projects.

In the Northeast, as described in Chap. 2, rice is an important crop and the major source of income for farmers. The area cultivated with rice was about 6.37 million ha in 2010 out of a total crop area of 10.3 million ha (OAE 2012)—the largest rice area of any of the four regions in Thailand. Rice in the Northeast is also recognised as a high-quality export product because of the fragrant rice variety widely grown in the region called *Khow Hom Mali*. However, farmers' incomes in the Northeast are still low, partly due to low yields, averaging around 2.2 ton/ha. The yield is 0.6 t/ha below the national average and about 1.2 t/ha lower than in Northern and Central Thailand (OAE 2012). Low income from agricultural production has forced some farm household members to migrate seasonally to the big cities.

Hence, in the context of a book about the commercialisation of rice farming in the Mekong, it is of special interest to study how farmers in the Northeast have made use of modern technologies and credit to increase net returns or have adopted the principles of the "sufficiency economy". Three contrasting villages in Ubon Ratchathani Province were selected for this study to investigate the use of rice farming technologies, especially

fertiliser and machinery, to estimate the returns to the farm household from rice production, and to identify the problems and potential of different approaches to the development of rice farming in the region. The case studies drew on village statistics, discussions with key informants, and household interviews.

THE CASE STUDY VILLAGES

Ubon Ratchathani Province is located in the southeastern corner of Northeast Thailand, in the lower part of the Mun River catchment (Fig. 2.1). The province borders Laos to the east (in particular the provinces of Saravan and Champasak), Cambodia to the south, Si Sa Ket Province to the west, and Amnat Charoen and Yasothon Provinces to the north. In terms of pursuing the sufficiency economy programme, there were about 332 farmers' groups in the province but only 180 groups were still active in 2012. According to the Cooperative Promotion Department, about 114 groups had withdrawn registration, 12 had stopped working as a group, four were just forming, and the status of 22 groups could not be ascertained.

The study was conducted in 2014 in Ban Donmoo in Trakan Phueta Phon District, Ban Bua Teang in Sawang Weerarong District, and Ban Nong Bua Hi in Phiboon Mangsahan District. The three villages were selected because most farmers engaged in rice-based farming systems and, unlike most villages in Thailand, they were attempting to follow "sufficiency economy" principles, though in different ways. Ban Donmoo and Ban Bua Teang were officially designated as "model self-sufficiency villages"; in particular, Ban Donmoo won a prize for the best model village in the Province in 2012. However, Ban Nong Bua Hi was quite different from the first two villages. The villages also differed in their distance from Ubon Ratchathani City and in the degree of farm diversification that had occurred. The contrasts between the three villages highlight the varying degrees of change in rice-based farming systems in the Northeast generally.

Ban Donmoo

Ban Donmoo was located far from the main road about 14 km from the district capital and 50 km from Ubon Ratchathani. The village had a population of 776 in 156 households in 2013. The average household size was 5.0, ranging from 1 to 15. Almost half (49%) of the workforce was engaged in the agricultural sector as rice farmers and 18% were wage

labourers. Very few were salary-earners or engaged in trade or business. The villagers had a close-knit community and tried to follow the sufficiency economy philosophy. They had formed the Donmoo Group and operated various sub-groups such as the rice mill group, the rice farmer group, the community bank, and a community training group. As mentioned, the village had been given a provincial-level award as a model “sufficiency economy” village. The village’s land was rainfed, so farmers usually only cropped in the wet season. Organic rice was the major crop, while a few farmers grew vegetables such as long bean, Chinese cabbage, and cucumber after rice using part of their paddy land and on-farm sources of irrigation such as ponds. The rice yield was around 3.1–3.4 t/ha. In 2013, the average household income was THB 223,343 (USD 6741), of which THB 80,922 (USD 2443), or 36%, was farm income.

Ban Bua Teang

Ban Bua Teang was located near the main road about 16 km from the district town of Sawang Weerawong in one direction and 16 km from the provincial capital, Ubon Ratchathani, in the other. There were 189 households in this village in 2013 with a total population of 808. The average household size was 4.3, ranging from 1 to 10. About a fifth (22%) of the workforce was self-employed in farming, mainly planting rice, while 40% were employed as labourers. Farmers in this village had formed farmers’ groups to provide services related to agro-tourism, homestays, and training. The village farming area included irrigated lowlands as well as uplands; hence, farmers could diversify their farms with sugarcane, cassava, rubber, fruit trees, flowers, and vegetables. Nevertheless, rice was the most important crop, with paddy fields accounting for about 70% of the farming area. Thirty per cent of rice farmers grew rice twice a year. Rice yields ranged from 1.6 to 2.2 t/ha. In 2013, the average household income was THB 298,124 (USD 9001), of which THB 174,272 (USD 5262), or 59%, was farm income.

Ban Nong Bua Hi

Ban Nong Bua Hi was located near the main road about 16 km from the district town of Phibun Mangsahan and 62 km in the other direction to Ubon Ratchathani. There were 187 households in 2013 with total population of 643. The average household size was 3.4, ranging from 1 to 9.

About 60% of the workforce was engaged in farming, mainly rice. Labouring, business, trading, and professional activities each accounted for less than 7%. Farmers in this village had been encouraged to form farmers' groups but there was no strong group at the time of the survey. However, there were several agrochemical shops because the village was at the centre of the sub-district. As the village croplands were irrigated, about 80% of farmers practised double cropping of rice. The rice yield averaged about 2.5 t/ha. In 2013, the average household income was THB 233,430 (USD 7048), of which THB 146,092 (USD 4411), or 63%, was farm income.

FERTILISER USE

Overall, farmers in the case study villages used mainly synthetic fertilisers together with some organic fertilisers. However, the use of fertiliser was dependent on farming practices. In Ban Donmoo, 90% of rice farms were organic, so there was no use of synthetic fertilisers or other agrochemicals on these farms. Alternative methods of nutrient management and crop protection were used, such as organic fertiliser, compost, animal manure, green manure, and animal or plant extracts. Most farmers in Ban Bua Teang and Ban Nong Bua Hi applied both synthetic and organic fertilisers; a minority of farmers applied only organic fertilisers while some applied mainly organic fertilisers with a small quantity of synthetic fertilisers.

In Ban Nong Bua Hi there was intensive use of synthetic fertilisers and pesticides. The three agrochemical shops in the village supplied credit to farmers for input purchase. Farmers had used organic fertilisers together with synthetic fertilisers since 2008 when a project promoting organic fertiliser to improve soil conditions was launched in the village through the village fund. Farmers produced organic fertilisers as a group and received a share to use on their farms. The amount of each farmer's share was enough for only 3 rai (0.5 ha) per crop, so the farmers used only synthetic fertilisers on their remaining rice area. Farmers interviewed could not yet see any difference from using organic fertilisers on their farms, apart from the lower cost compared to synthetic fertilisers.

Most farmers in Ban Donmoo and Ban Bua Teang obtained inputs on credit from the local sub-district cooperative, while farmers in Ban Nong Bua Hi obtained credit from both the cooperative and the agricultural chemical stores in the village and district town. The sub-district cooperatives ordered in fertilisers and agricultural chemicals such as pesticides,

Table 3.1 Fertiliser use and paddy yield under different fertiliser regimes

<i>Input/output</i>	<i>Conventional practice</i>	<i>Conventional with organic</i>	<i>Organic practice</i>
NPK Complex rate (kg/ha)	468	125	–
NPK Complex expense (THB/ha)	1500	400	–
Ammonium sulphate rate (kg/ha)	468	106	–
Ammonium sulphate expense (THB/ha)	1500	340	–
Green manure imputed cost (THB/ha)	–	–	250
Organic fertiliser rate (kg/ha)	–	1250	187
Organic fertiliser imputed cost (THB/ha)	–	400	120
Total fertiliser cost (THB/ha)	3000	1140	370
Paddy yield range (t/ha)	1.6–2.5	1.9–2.8	2.5–3.4

Source: Farmer survey and group interviews in each village

Note: NPK Complex comprises NPK in the ratio 15:15:15; ammonium sulphate comprises NPK in the ratio 21:0:0

herbicides, and fungicides from the district- or provincial-level cooperatives, which in turn had direct links to agencies or companies.

Farmers in Ban Donmoo had been cultivating organic rice since 2003 when they experienced failure from commercialised rice production. The farmers interviewed claimed that they had increased their rice yield from 1.25 t/ha in 2003 to 2.5 t/ha in 2012. For the first crop after going organic, they applied about 1250 kg/ha of organic fertilisers and obtained yields of only 1.25–1.6 t/ha. However, in recent years farmers used only 187 kg/ha of organic fertilisers and obtained 2.5 t/ha.

The use of fertilisers and associated rice yields under different farming practices are summarised in Table 3.1. The survey data suggest that integrating organic fertiliser into the soil fertility regime resulted in higher yields and lower cost. The organic practice reportedly gave 50% higher average yield for 12% of the cost. However, other factors would need to be quantified to confirm this result.

LABOUR AND MACHINERY USE

With increasing scarcity and ageing of farm labour, mechanisation of low-land rice farming has occurred throughout Thailand, first in the Central Region, where increased cropping intensity due to the expansion of irrigation was a key driver, but now including both irrigated and rainfed systems in the Northeast. The study villages varied in the extent of irrigation, but

Table 3.2 Use of machinery in the study villages

<i>Machine</i>	<i>Capacity^a</i>	<i>Year of initial use in village</i>		
		<i>Ban Donmoo</i>	<i>Ban Bua Teang</i>	<i>Ban Nong Bua Hi</i>
Two-wheeled tractor	4–5 rai/day	1993	1993	1993
Small four-wheeled tractor	10–15 rai/day	2010	2010	2010
Medium four-wheeled tractor	20 rai/day	2009	2010	2010
Large four-wheeled tractor	30–40 rai/day	2009	2007	2002
Threshing machine	4–6 tons/hr	1983	1983	1983
Combine harvester	50–70 rai/day	2011	2010	2005

Source: Group and individual interviews

^a1 day = 8 hours; 6.25 rai = 1 ha

most farmers depended on a single wet-season crop of rainfed lowland rice. Some farmers had invested in small ponds or tubewells and pumps to tap underground water and were able to grow small areas of crops such as vegetables, beans, and chillies following rice. Nevertheless, rice production had become highly mechanised in all villages, though not in all operations (Table 3.2).

Labour shortage in the main rice season was prevalent in the villages as many household members migrated to Bangkok or other urban centres. Typically, migrants came back to the village during peak periods to work on their own farms or as hired labour. However, due to increasing transportation costs and higher urban wages, many farmers preferred to invest in owning or hiring machinery instead of asking family members to incur the financial and opportunity costs of returning for rice production. At the same time, small- and medium-sized machinery suitable for small farms has become widely available in the past two decades, enabling mechanisation of the once-labour-intensive operations of land preparation, planting, and harvesting, including threshing (Table 3.2). In addition, the availability of long-term credit from the Bank for Agriculture and Agricultural Co-operatives (BAAC) has enabled many farmers to purchase farm machinery. The Bank also offers to refinance farmers' loans from finance companies and machinery dealers.

Land Preparation

The use of tractors for land preparation had become the norm in all three villages (Table 3.3). Most farmers owned two-wheeled tractors, which

Table 3.3 Tractors used for land preparation in the study villages

<i>Type of tractor</i>	<i>Advantages</i>	<i>No. of units in village</i>		
		<i>Ban Donmoo</i>	<i>Ban Bua Teang</i>	<i>Ban Nong Bua Hi</i>
Large 4W tractor	Suitable for large areas and heavy work, for example, newly opened land	2	1	1
Medium 4W tractor	Suitable for small areas of paddy land	3	3	20
2W tractor	Suitable for very small areas of paddy land; used as power sprayer	Every farm	Every farm	Every farm

Source: Group and individual interviews

began to be purchased in the early 1990s. However, after improvements in four-wheeled tractor technology, farmers began using them from 2009, particularly in Ban Nong Bua Hi. These medium-sized tractors were light enough to work satisfactorily in paddy fields and could cross the bunds surrounding individual paddy plots without causing damage. The small numbers of large Ford tractors were normally used only for heavy-duty work, particularly in newly opened land.

Farmers ploughed their paddy land twice. For the first ploughing they generally hired a four-wheeled tractor to break up the soil and for the second ploughing they had previously used their own two-wheeled tractor to get an even planting surface. At the time of the study, however, most farmers were hiring medium-sized four-wheeled tractors for all land preparation; only a few still used two-wheeled tractors for this purpose. The capacity of the four-wheeled tractors was two to nine times that of the two-wheeled tractors, depending on the type of work.

The costs of purchasing and renting the different types of tractor are shown in Table 3.4. The cost of a four-wheeled tractor was more than ten times that of a two-wheeled tractor. However, for farmers with no non-farm work and hence less time-pressure, owning a two-wheeled tractor was still the most attractive alternative, with running costs lower than hiring either a two-wheeled or a four-wheeled tractor. Thus two-wheeled tractors were still used for preparing very small paddy fields (and could be modified to be used as mobile power sprayers, as well as having other functions). Farmers' ability to purchase medium-sized four-wheeled tractors usually depended on access to credit from machinery dealers or banks. Farmers who owned a four-wheeled tractor normally had to do contract

Table 3.4 Cost of purchasing and renting machinery for land preparation

<i>Type of tractor</i>	<i>Purchase cost (baht)</i>	<i>Contractor charge (baht/rai)^c</i>	
		<i>First cultivation</i>	<i>Second cultivation</i>
Large 4W tractor	>1,000,000	200–250	300–400
Medium 4W tractor ^a	550,000–900,000	200–250	300–400
2W tractor	50,000–130,000	250	350
Use of own 2W tractor ^b		163	163

Source: Group and individual interviews

^aWhen contracting both first and second cultivation the charge was 600 baht/rai

^bImputed labour cost plus fuel cost, excluding depreciation

^c6.25 rai = 1 ha; USD 1 = THB 33

land preparation for other farmers to earn the money to repay their loans. These farmers mentioned that the payback period was only two years.

Sowing/Planting

Farmers in the three villages did not use any equipment for crop establishment. Some farmers, particularly in Ban Nong Bua Hi, practised broadcasting directly onto the paddy field, while some, especially in Ban Donmoo and Ban Bua Teang, still established nurseries and transplanted seedlings. Rice transplanters are now widely used in Central Thailand and in some parts of the Northern Region. However, few of the farmers in the study villages who practised transplanting had tried using a transplanter. The machine was found not to work well on their gravelly soils and no farmers had adopted them.

Harvesting and Threshing

Mechanical harvesting has been extended to the study villages. However, farmers in Ban Donmoo were producing organic rice and required a high-quality product to get maximum returns, so they harvested manually, though they hired mechanical threshers. Many farmers in Ban Bua Teang also harvested manually because their paddy fields were quite small and located in wetter lowland sites where the combine harvesters could not be used. While farms in Ban Donmoo and Ban Bua Teang were mostly harvested manually, farms in Ban Nong Bua Hi were mostly harvested by combine harvesters.

Table 3.5 Harvesting/threshing cost by method of harvesting

<i>Method</i>	<i>Unit cost (baht/rai)</i>
Daily hired labour	1000
Piece rate	1000
Exchange labour (imputed cost) ^a	1000
Thresher (@ 250 baht/t)	60
Combine harvester	600

Source: Group and individual interviews. 6.25 baht = 1 ha; USD 1 = THB 33

^aComputed as opportunity cost of labour

Harvesting costs using combine harvesters were much lower than for manual harvesting (Table 3.5). The combine harvesters achieved both harvesting and threshing for only 600 baht/rai. Farmers who hired labour for harvesting incurred about 1000 baht/rai, whether the labour was paid daily wages or a piece rate, and they still had to pay for contract threshing, which cost about 60 baht/rai (assuming a yield of 1.5 t/ha). Hence the demand for combine harvesting had increased in areas where manual harvesting was not necessary.

Nevertheless, there were still no local combine services in the study villages or in the surrounding districts. Combine harvester services were mostly supplied from provinces in Central Thailand such as Suphanburi, Nonthaburi, and Bangkok. There were also contractors from other provinces in the Northeast such as Sisaket and Roi Et. Farmers contacted an agent to obtain harvesting services. The agent checked the paddy fields to determine if they were suitable for their machines. Large, dry paddy fields with no lodging were the preferred conditions. The appropriate time to bring the harvester into the field was also estimated. There was a high demand for harvesting services in the wet season; hence, farmers in Ban Bua Teang could obtain harvesting services only in the dry season.

Summary

Machinery use in rice production varied across the three villages. Farmers in Ban Donmoo and Ban Bua Teang were found to use fewer machines than in Ban Nong Bua Hi. Differences in farming systems played an important role in this variation. Organic farming systems required less machine use, mostly in land preparation. Farmers who grew rice mainly for household consumption tended to keep their cash expenses low and

rely on household labour. Two-wheeled tractors were still used by these subsistence-oriented farmers as they were affordable and provided multiple benefits. Commercial farms were found to make greater use of contract machinery services, including medium-sized four-wheeled tractors for land preparation and combine harvesters for harvesting and threshing, because the financial cost was significantly lower than when hiring manual labour.

COMPARATIVE RETURNS TO RICE PRODUCTION

Given the different uses of fertilisers and agrochemicals in the three villages, the rice cropping systems can be termed “organic” in Ban Donmoo, “mixed” in Ban Bua Teang, and “conventional” in Ban Nong Bua Hi. The organic and mixed systems used transplanting for crop establishment, while the conventional system used broadcasting, thus saving on labour. More generally, the conventional system relied more on contracted machinery services (including four-wheeled tractors and combine harvesters) and purchased inputs than the organic system, with the mixed system somewhere in between. These three systems showed different levels of yield, cost, and gross margins (Table 3.6).

The organic rice system had higher average yield (3.2 t/ha) and enjoyed a 33% price premium over the mixed and conventional systems; hence, gross revenue was about 50% higher than the other two at THB 64,000 (USD 1900) per ha. Total paid-out costs were very similar across the three systems at about THB 16,000 (USD 490) per ha. However, there were differences in the importance of individual cost items. The organic system had lower costs for land preparation (because it was mainly done by family labour), higher costs for wage labour (used for transplanting, hand weeding, applying organic fertiliser, and hand harvesting), zero costs for inorganic fertiliser, and higher costs for manure and organic fertiliser.

The conventional system, on the other hand, had higher costs for seed (because of broadcasting) and inorganic fertilisers. The imputed value of family labour used in rice production (valued at the local wage rate of THB 300/day) was around THB 3000 (USD 90) per ha for the organic and mixed system, but much lower for the conventional system, which relied extensively on contractors for land preparation, spraying herbicides, and harvesting. The overall unit cost of production was slightly lower for the organic system at THB 5900 (USD 180) per ton of paddy produced.

Given the organic system’s higher gross revenue and similar paid-out costs, the gross margin for organic rice, at THB 48,000 (USD 1500) per

Table 3.6 Costs and returns for wet-season rice production in the study villages

<i>Variable</i>	<i>Village (cropping system)</i>		
	<i>Donmoo (organic)</i>	<i>Bua Teang (mixed)</i>	<i>Nong Bua Hi (conventional)</i>
Paddy production (kg/ha)	3200	2813	2719
Paddy price (baht/kg)	20	15	15
Gross revenue (baht/ha)	64,000	42,188	40,781
Input costs (baht/ha)			
Land preparation	2188	4375	3250
Seed	547	625	3125
Hired labour	4375	2813	846
Inorganic fertiliser	0	2763	4950
Manure/organic fertiliser	3375	200	0
Pesticide	0	0	398
Harvesting and threshing	3750	3750	2500
Other costs	1623	1561	1168
Total paid-out costs	15,857	16,086	16,237
Family labour (@ 300 baht/day)	3008	3109	329
Total costs	18,865	19,195	16,566
Hired labour use (days/ha)	14.6	9.4	2.8
Family labour use (days/ha)	10.0	10.4	1.1
Total labour use (days/ha)	24.6	19.7	3.9
Gross margin 1 (baht/ha)	48,143	26,102	24,545
Gross margin 2 (baht/ha)	45,135	22,992	24,215
Cost per kg of paddy (baht)	5.90	6.82	6.09
Gross margin per kg of paddy (baht)	14.10	8.18	8.91
Return to labour (baht/day)	2135	1468	6511

Source: Household Survey, 2013

Notes: 1 hectare = 6.25 rai; USD 1 = THB 33; Gross margin 1 is excluding the cost of family labour; Gross margin 2 is including the cost of family labour; Return to labour is gross revenue less all non-labour costs divided by the number of days of family and hired labour

ha, was about double that of the mixed and conventional systems. The ranking was similar when the imputed cost of family labour was deducted, with organic rice averaging a gross margin of THB 45,000 (USD 1360) per ha. However, the higher labour input for the organic system meant that the return to labour (family and hired) was THB 2135 (USD 65) per day compared with THB 6511 (USD 197) for the conventional system. The labour requirement was the main reason conventional farmers did not want to follow organic practices.

CONCLUSION

Rice farming in Northeast Thailand has changed significantly in the past few decades, becoming more commercialised and mechanised. This has involved increased use of high-yielding seed, inorganic fertilisers, and machinery, especially for land preparation and harvesting, and lower use of family labour as household workers find more profitable non-farm employment, often outside the district and province. However, the study of three villages in Ubon Ratchathani found different patterns of change depending on both choice and circumstances.

Ban Donmoo was a more remote, close-knit community with somewhat larger households (a mean of 5.0 members) and active farmer groups that followed the “sufficiency economy” approach. With no irrigation, farmers planted a single crop of organic rice in the wet season. They used little or no synthetic fertiliser and made less use of farm machinery. Nevertheless they obtained higher yields and a price premium, while incurring comparable costs to the other two villages, giving them a high return to land and a moderate return to labour. Household income averaged USD 6800, of which only USD 2400 (36%) was farm income, implying a high dependency on non-farm activities.

Ban Bua Teang was near the main road and close to Ubon Ratchathani. Household size was somewhat less (4.3) and farmers’ groups had been set up for different activities. Some farmers had irrigated lowlands and 30% grew rice twice a year; they also had upland crops such as sugarcane. Nevertheless, 40% of the population was employed in labouring. With their intermediate approach to rice farming, which was mainly for subsistence, farmers obtained lower gross income than those in Ban Donmoo but incurred similar costs. The return to land was half that in Ban Donmoo and the return to labour about three quarters. Nevertheless, given their greater cropping activity, household income averaged USD 9000 (32% more than Ban Donmoo), of which USD 5300 was farm income (59%), more than twice the farm income of Ban Donmoo.

Ban Nong Bua Hi was also near main road and had several agrochemical shops in the village. Household size was even smaller (3.4) and group formation had not been successful. Most households cultivated rice and, given that most land was irrigated, about 80% of farmers practised double cropping. Rice farming was commercially oriented, relying on synthetic fertilisers and contracted use of machinery such as large and medium four-wheeled tractors and combine harvesters. Farmers in this village needed

more capital for inputs and incurred higher debts than in the first two villages. The returns to land were half that of Ban Donmoo but the return to labour was more than three times as high. Household income averaged USD 7100, of which USD 4400 was farm income (63%), almost twice that of Ban Donmoo.

Comparing the three villages shows that, even after several decades of commercialisation in the Northeast, rice farming is following different trajectories and making different contributions to household livelihoods, depending on the goals and circumstances of individual households and communities. Alternative agriculture based on organic production methods can be a viable pathway alongside conventional commercial agriculture. However, in all cases, non-rice and non-farm sources of income are needed to augment income from rice production.

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