

Status and Challenges of Agricultural Machinery Services Development in Vietnam Central Coast Area

Du Anh Tho¹* and Katsutoshi Onaka²

The purpose of this case study is to assess the status and challenges of agricultural machinery services of 60 households of two communes in the Central Coastal Area of Vietnam. Decision No.48/NQ-CP aiming to reduce governmental post-harvest losses promoted the development of machinery services and contributed to the owner's income structure by 36.2%. Due to low local demand for machinery services, Phong Binh owners had to expand their services to nine other provinces in hope to increase the income. The lack of information about customer demand made it challenging for the farmers to achieve the goals.

Key words: Agricultural machinery service, combine-harvester and four-wheel tractor, Central Coastal Area.

1. Introduction

Agriculture mechanization has played an economically significant role in increasing agriculture production and reducing cultivation costs (Kamboj *et al.*, 2012). However, small farm sizes and seasonality have presented some difficulties to the use and ownership of large agricultural machines (Pingali, 2007) (Weiner *et al.*, 1988) (Sims and Kenzle, 2006) (Ji *et al.*, 2012). Hence, the hiring machine service in Vietnam had been developed as the solution for the demand of using agricultural machines. Markets of farm machinery services have developed in smallholder farming systems all over Asia such as India, Thailand, and Malaysia (Houssou *et al.*, 2015). The result was impressive, small-scale farmers in India cultivating as little as 0.1 ha and producing only 100 kg of grain have mechanized their operations (Houssou *et al.*, 2015). However, high tractor prices and capital constraints were unfavorable factors for the development of these services (Houssou *et al.*, 2015).

Although there has been little information on the actual extent of mechanization prior to 1975, in the past 10 years, Vietnam has reportedly experienced rapid growth in agricultural mechanization (Takeshima *et al.*, 2018). The liberalization of the agriculture sector in the early 1990s (Pingali, 2007) had led to a rapid increase in the adoption of tractors and combine-harvesters (Reardon *et al.*, 2014). The proportion of mechanization land preparation in Vietnam was recorded as 27% in the 1970-1980 period, increased to 40% in 1990 and reached 70% in 2010

(Takeshima *et al.*, 2018). In 2006, only 15% of rice was harvested by combine-harvester nationwide. This number increased to 35% in 2013 (Takeshima *et al.*, 2018). In 2009, to reduce post-harvest losses, the Vietnam Government launched a policy supporting investment for agricultural machinery (Vietnam Government, 2009). The following years witnessed a rapid growth of the number of agricultural machines. During 2014, the number of tractors increased by 1.6 times compared to that of 2006, while the number of harvesters increased by 25.6 times (Tran, 2016).

Agricultural mechanization developed in three mains deltas in Vietnam including Red River Delta in the North, Central Coastal Delta in the Center, and Mekong River Delta in the South. The research of Takeshima *et al.* in 2018 on "Evolution of agricultural mechanization in Vietnam" shows that the number of combine-harvesters in the Mekong River Delta accounted for around 75 percent of the total machine number in Vietnam in 2014. Many Kubota combine-harvester owners are wealthy farmers, cultivating 20-100 ha annually. Research of Takeshima *et al.* also present the historical development of agricultural machinery in Vietnam, however, the analysis on the status of farm machinery services in the Central Coastal Area has been unexplored. In the framework of this study, the preliminary surveys were conducted in 3 large areas of rice production in Thua Thien Hue Province, the Central Coast Area, including Huong Tra District in 2016, Phong Dien District and Huong Thuy Town in 2017 to understand the status and challenges of the agricultural

¹ University of Economics, Hue University

² Okayama University

Corresponding author*: anhthohce@gmail.com

machinery services development. The result of the preliminary surveys has shown dramatic growth of mechanization and machinery services in the local area. Base on the results of preliminary surveys, two commune Phong Binh and Thuy Phu in Thua Thien Hue Province were chosen as the research area due to the excessive growth in agricultural machinery supply in Phong Binh Commune (8/8 surveyed households expand their services to other provinces due to the excess of supply in the research sites) and the huge effect of industrialization in Thuy Phu Commune. Hence, the research aims to 1) Examine Vietnam's historical policy environment that directly facilitates the investment of agricultural machinery; 2) Explore the local farmers' ownership and capacity in providing agricultural machinery services; 3) Evaluate income structure of rice farm households who are farm-machinery service providers.

2. Research Overview

Thua Thien Hue is one of the key rice production provinces in the Central Coastal Area of Vietnam. In 2015, the paddy field area was 32,452 ha, accounted for 46.4% of the total agricultural land area (Thua Thien Hue Statistics Office, 2015). Rice production has long been the traditional livelihood of the Thua Thien Hue rural farmers who produce twice per year, especially on the summer-autumn season (May-August) and the winter-spring season (December-May) (Thua Thien Hue Department of Agriculture and Rural Development, 2019). Phong Binh Commune in Phong Dien District and Thuy Phu Commune in Huong Thuy Town were selected for the research study based on a large number of combine-

harvester and four-wheel tractor (4WT) owners, providing harvesting and land preparing services for rice production in nine of the 63 provinces in Vietnam. Importantly, farm machinery services have been strongly developed in the last five years in Phong Binh, where one of the largest paddy fields is located. The 16 companies and factories located in Phu Bai Industrial zone¹⁾ in the South part of Thua Thien Hue attracted 2,112 local workers from Thuy Phu Commune. On the other hand, most farmers in Phong Binh Commune rent out their paddy fields and work as a freelance builder after harvesting, resulting in a decrease of 144 (from 1656 to 1511) farming households in the period of 2013-2017, while that of Thuy Phu Commune was 30 in the same period (see Table 1).

The survey was conducted in two communes by a group of trained enumerators of the Hue University of Economics. All the rice farmer households from Phong Binh (47 households) and Thuy Phu Commune (13 households) who possess combine-harvesters and 4WTs participated in a 45-minute semi-structured interview from August to September in 2018. The questionnaire included information of the household members, labor allocation, farmland ownership and utilization, income from rice production, investment and operation cost, revenue, and agricultural machinery ownership. Regarding the agricultural machinery services, this research focused on 4WTs and combine-harvesters with a capacity greater than 20 horsepower. Besides, data on non-farming job income were collected to evaluate the income structure of households. Additionally, six staff from six agricultural cooperatives, two officers from the two communes were in-depth interviewed about the social

Table 1. General information of Thuy Phu Commune and Phong Binh Commune

			2013	2014	2015	2016	2017
Phong Binh	Number of farmer household	Household	1,656	1,641	1,623	1,597	1,511
	Total of paddy area	Ha	629.8	653.0	671.7	671.7	671.0
	Average paddy area	Ha/household	0.38	0.40	0.41	0.42	0.44
	Average rice yield	Ton/ha/season	51.7	60.6	61.7	62.4	61.2
Thuy Phu	Number of farmer household	Household	1,916	1,916	1,886	1,886	1,886
	Total of paddy area	Ha	638.5	638.3	638.5	638.5	638.5
	Average paddy area	Ha/household	0.33	0.33	0.34	0.34	0.34
	Average rice yield	Ton/ha/season	57.4	63.2	62.3	63.9	66.4

Source: Thua Thien Hue General Statistics Office, 2016 and Author's own survey.

1) Phu Bai Industrial Zone is the first industrial zones in Thua Thien Hue Province established by the Government in 1998 following by the Decision No.1144/QD-TTg. This is the biggest industrial zone in Thua Thien Hue Province. The total

area is about 800 ha. Investment and production major: yarn, garment, handicraft, building materials, ceramics, beverages (sources: thuathienhue.gov.vn).

Table 2. Annual invested-machine number in Phong Binh and Thuy Phu Commune during the period 2010 – 2017

	Year	2010	2011	2012	2013	2014	2015	2016	2017
Phong Binh	Four-wheel tractor	0	0	1	2	3	6	10	5
	Combine-harvester	0	0	1	5	3	10	4	5
Thuy phu	Four-wheel tractor	1	1	0	1	2	3	1	3
	Combine-harvester	0	1	0	0	0	0	1	0

Source: Author's own survey.

-economic status of the research areas. The list of combine-harvester and 4WT owners was obtained from the agricultural cooperative office. Collected data were then analyzed by qualitative and quantitative methods.

3. Results and Discussion

1) Indirect impacts of post-harvest loss reduction policy on agricultural mechanization

In 2009, the Vietnam Government announced Decision No.48/NQ-CP aiming to reduce the post-harvest losses of rice production from 11-13% in 2009 to 5-6% by 2020 (Vietnam Government Portal, n.d.). According to the Decision, organizations, households, and individuals shall be entitled to take a capital loan equal to 100% goods value from credit institutions with 0% interest in the first two years and 50% of the current rate in the third year when buying domestic (determined by 60% of equipment being locally made) agricultural machineries. In 2013, the Decision No.48/NQ-CP was replaced by Decision No.68/2013 QD-TTg in which the households were not restricted to purchases of 60% local-made machinery. Instead, they are obliged to operate a machinery service contract, conducted by the Vietnam Bank for Agriculture and Rural Development with a 36-month liquidity loan period and authorized by the local government. Farmers got support-policy information from the annual congress by the local agricultural cooperative. Although the policy did not focus on agricultural mechanization, its implementation has directly and significantly affected the farmers' decision on agricultural machinery investment. The low-interest rate policy allowed farmers with low to moderate household income (approximately \$1,248/year) to buy high capacity farming machines (approximately \$27,000 for a new combine harvester and \$16,000 for a

4WT). As a result, this Decision has strongly promoted the expansion of agricultural machine investment nationwide. Specifically, the number of tractors increased by 221,600 and 9,100 for combine-harvesters by 2011-2016 period (VGSO, 2016). The effects of the policy were significant in the Central Coastal Area, especially in Thuy Phu and Phong Binh Commune (see table 2) with a dramatic increase in the number of invested machines from a few in 2010-2012 to 19 machines/year in 2015 and the remaining balance in 2017.

2) Characteristics of households in Phong Binh and Thuy Phu Commune, Thua Thien Hue Province

Family size and its compositions are important parameters that determine the capability and availability of households' farm and off-farm activities (see table 3). The average age of the household-head in Phong Binh and Thuy Phu were respectively 42.1 and 52.9 years old. Phong Binh Commune had a strong agricultural production focus with 2 out of 2.87 household labors doing farming for a living while that was 2.38 out of 4.38 for Thuy Phu Commune and the rest worked at Phu Bai Industrial Zone.

Farm size is a crucial component that affects the efficiency of resource allocation and productivity of agricultural production. On average, a household in Phong Binh used 0.45 ha of farmland they owned and rented 1.04 ha from either retired farmer's land or the commune's 5% land fund²⁾ for rice production. In Thuy Phu, the numbers were 0.31 and 1.06 respectively. While there were not any remarkable differences between the average paddy area between Phong Binh Commune (1.49 ha/household) and Thuy Phu Commune (1.36 ha/household). The Thuy Phu Commune's standard deviation (2.2) was higher than that of Phong Binh Commune (1.3). The main reason is that

2) Commune's 5% land fund: Article 132, Vietnam land laws - No. 45/2013/QH13. The land fund is not excess 5% of the total area of local land for planting the annual crop, perennial crops, and aquaculture. The People's Committee of the commune can allow individual or farmer households to rent

for the agricultural production purpose. Lease form: auction. Rental period: maximum 5 years. The proceeds from the lease of land must be remitted into the state budget which is managed by the commune-level People's Committees.

Table 3. Characteristics of households in Phong Binh and Thuy Phu Commune

	Commune						All (n=60)		
	Phong Binh (n=47)			Thuy Phu (n=13)					
	Avg	%	SDs.	Avg	%	SDs.	Avg	%	SDs.
Age of household head (year)	42,1	-	8,9	52,9	-	5,2	44,4	-	9,4
Educational level of household head (year)	9/12	-	2,6	7/12	-	2,9	8/12	-	2,8
Number of household family member (person)	4,98	-	1,4	5,38	-	0,9	5,07	-	1,3
Number of household family labour (person)	2,87	-	0,7	4,38	-	1,3	3,20	-	1,5
Number of household family farmer (person)	2,00	-	0,5	2,38	-	0,8	2,08	-	0,7
Average paddy area (hectare/household)	Total	1,49	100,0	1,3	1,36	100,0	2,2	1,5	100,0
	Owned	0,45	30,2	0,5	0,31	22,8	0,2	0,4	28,8
	Rent	1,04	69,8	1,2	1,06	77,9	2,3	1,1	71,9
Average household income (USD/ household/year)	Total income	7.240,5	100,0	8.601,7	6.943,8	100,0	3.623,0	7.176,2	100,0
	Machinery services	2.493,5	34,4	7.756,6	2.962,9	42,7	1.666,3	2.595,2	36,2
	Rice production	2.807,3	38,8	2.532,6	1.772,2	25,5	2.255,5	2.583,1	36,0
	Non-farming jobs	1.925,1	26,6	2.037,0	2.202,1	31,7	1.987,7	1.985,1	27,7
	Other crops	14,6	0,2	37,7	6,6	0,1	22,1	12,8	0,2
Number of farm machines	Number		%	Number		%	Number		%
	Combine-harvester	28		2		100,0	30		100,0
	Applying support policy	25		2		100,0	27		90,0
	Four-wheel tractor	27		13		100,0	40		100,0
	Applying support policy	8		7		53,8	15		37,5

Source: Author's own survey.

Note:

- 1) Exchange rate in 2018, October 30th: 1 USD = 23,300 VND (Table 3,4).
- 2) SDs refers to standard deviations.
- 3) Income from farm machinery services was calculated by Revenue minus Total cost (the cost of hiring labor, fuel, repair, machine transport and interest expenses). Income from rice production was calculated by Revenue minus Total cost (the cost of hiring labor, harvesting, land-preparing, pesticide, fertilizer, irrigation and seed) (Table 3,4).
- 4) The general education system in Vietnam was designed by 12 school years. The educational level of the household head indicates the years of schooling of the household head in the total 12 school years.
- 5) The household income was determined by the income from the jobs of all members who live at home at the interview time in the last 12 months.

there was a large-scale rice farmer in Thuy Phu commune who own 0.15 ha and rent 9 ha of paddy field for rice production. The main source for the rent land area was the commune's 5% land fund. The total number of machines in two communes were 70, including 30 combine-harvesters (28 in Phong Binh and 2 in Thuy Phu) and 40 4WTs (27 in Phong Binh and 13 in Thuy Phu). In Thuy Phu Commune, machinery services were provided by both the farmers and the agricultural cooperatives. In fact, two agriculture cooperatives own 4 combine-harvesters and 4 4WTs, providing services for the farmers in their area. Ninety percent of combine-harvester and 37.5% of 4WT were bought applying the support policy in both communes.

There were three main sources of income for a farming household in which farm machinery services and rice production contributed the highest proportions, 36.2%, and 36.0%, respectively, followed by a non-farming job, 27.7% which came from other family members. Rice production accounted for about one-third (i.e. 36.0%) of the household income despite the low percentage of paddy

area allocated to each household (1.49 ha/household in Phong Binh and 1.36 ha/household in Thuy Phu). On average, each household earned \$2,807 and \$1,772 from the two crops each year. The other major source of income came from the machinery services (i.e. 36.2%), contributing \$2,494 and \$2,963 to the total household income in Phong Binh and Thuy Phu respectively (see table 3). Notably, there was a significant difference in standard deviations (SDs) between two communes when we estimated the average income from agricultural machinery services. The standard deviations of Phong Binh Commune were considerably high due to the differential income from machine services between one household in Phong Binh Commune and the others. The highest income from machines services was \$52,532/household. The high income was gained due to 4 machines owned by the individual and the large area of services provision, (100 ha in the local commune and 500 ha in other provinces). To gain high effective of services provision, this machine owner rents about 5 labors per day and they work in around 2 months of the harvesting time

Table 4. Agricultural machinery services management of household in Phong Binh and Thuy Phu Commune

		Land preparing services		Harvesting services	
		Local area	Other areas	Local area	Other areas
Phong Binh (n=47)	Number of households owning machine	23	23	24	24
	Number of households providing machine services	23	14	24	19
	% household providing machine services	100,0	60,9	100,0	79,2
	Area (ha)	548	402	1,550	2,930
	Average profit (USD/ha)	51.8	46.9	47.2	73.9
	Number of machines		27		28
Thuy Phu (n=13)	Average profit (USD/machine)		1,748.9		10,348.4
	Number of households owning machine	11	11	2	2
	Number of households providing machine services	11	2	2	1
	% household providing machine services	100,0	18,2	100,0	50,0
	Area (ha)	616	57	110	40
	Average profit (USD/ha)	69,4	18,9	66	87,3
	Number of machines		13		2
	Average profit (USD/machine)		3,369.9		5,377.7

Source: Author's own survey.

Note: Local area: Phong Binh Commune or Thuy Phu Commune; Other areas: Other communes in Thua Thien Hue and 9 provinces in the north of Thua Thien Hue.

at other provinces in the north of Thua Thien Hue province.

3) Agricultural machinery services management of household in Phong Binh and Thuy Phu Commune

There are three kinds of ownerships for the two types of machines (i.e. 4WTs and combine-harvesters): individual, farmer group, and agricultural cooperative ownership. The individual ownership was most commonly found for the 4WTs (75 out of 100 machines were used by an individual household). Simple operational system and competitive cost made it possible for a single family to handle and own this type of machine. Meanwhile, 67 out of 100 combine-harvesters was owned by farmer groups due to its high cost and sophisticated built-in that required more labors for operation.

Land preparing services were operated in a small scale in both communes. On average, 4WT owners in Phong Binh commune provided 548 ha in the local area and 402 ha to other communes while the figures were respectively 616 and 57 ha in Thuy Phu (see Table 4). Meanwhile, there was a significant difference in the harvesting service coverage/status between the two communes due to the machine supply capacities. Specifically, in Thuy Phu, the total local area of service coverage was 110 ha for there was a shortage of combine-harvester machine supply. However, the figure was 1,550 ha in Phong Binh as there

were more machine supplies. Additionally, to cover the initial investment cost, 79.2 percent of machine owners in Phong Binh commune had to expand their service market a great deal (2,930 ha) to nine other rice-producing provinces³⁾. Even though outside services attracted a higher income than that within a community (\$73.9 versus \$47.2 per ha), there are still a lot of challenges for the expansion process including 1) the lack of information on the market demand, and 2) the annual rapid increase of the machine supply, especially at the outside communities that led to a decreased demand for services. In addition, the average profit/machines in Phong Binh was 10,348.4 USD/machine/year, that figure was two times higher than in Thuy Phu. The average price of a new combine harvester was approximately 27,000 USD and 1 old item was approximately 16,000 USD. This means that farmers in Phong Binh can get fully profit from harvesting services to pay the loan in three years while farmers in Thuy Phu Commune need 6 years to pay for the total loan amount. However, farmers in both communes tried to pay the loan in the time of the supporting policy. Other income resources mainly aimed were to pay for the bank. Finally, the strong growth of mechanization in other provinces will threaten the sustainable development of agricultural machinery service in Thua Thien Hue Province in the future.

3) Name and the distance between nine provinces and Thua Thien Hue provinces: Quang Binh (168 km), Ha Tinh (317 km), Nghe An (367 km), Thanh Hoa (452 km), Nam Dinh

(609.3 km), Thai Binh (631.82 km), Ha Noi (669 km) and Vinh Phuc (715.8 km).

4. Conclusion

Agricultural machinery services in the Central Coastal Area of Vietnam significantly developed in the last five years. The rapid increase of 4WTs and combine-harvesters after the resolution No.48/NQ-CP and the high demand for machinery harvesting and land preparing services have given the farmers opportunities to invest in the machinery leasing business. The interview results of the rice farm households who invested in 4WT and combine-harvester in Phong Binh Commune and Thuy Phu Commune, Thua Thien Hue Province revealed that farm machinery services, rice production, and non-farming jobs were three main sources of income for the household. Investing in large-scale agricultural machinery has not only solved the demand for local farmers to use machines for rice production but also created a significant income for machine owners. High initial investment costs for high horsepower machines led to the popularity of the group ownership model.

The appearance of high capacity farm machinery created the agricultural machinery service market in both communes Phong Binh and Thuy Phu. However, there was a significant difference in machinery services management by machinery owners' in two communes. Labor, especially young labor in Thuy Phu commune tends to work in companies and factories of the Industrial Zone instead of focus on developing machinery services for rice production. That causes low competition in services provision due to the limits number of agricultural machines. Meanwhile, Phong Binh does not have any industrial zone, therefore, except for rice production as a major livelihood, the farmer decided to invest in machinery and become a service provider. The large machine number led to the high market competition of providing services in the local area. Service providers in Thuy Phu focused on the local market due to the high demand for the machinery services while those in Phong Binh tended to expand the services to other provinces in the North of Thua Thien Hue to cover the investment cost due to high competition in the local area. Expanding machinery services to the neighbor provinces helps machine owners shorten the repayment period and earn a higher income. It appears that the difference in non-agricultural and industry development caused the difference in agricultural management of the two communes.

However, this trend cannot be a sustainable future direction for machine owners because the trend of investment in agricultural machines both locally and outside the province continues leading to competition in service provision in and out of the province. Moreover, this trend can cause difficulties for future machine owners to find customers outside Thua Thien Hue province. These findings suggested that if the increasing trend of mechanization continues, the important challenges for local government are seeking and providing customer information in other provinces to the machinery service providers. Furthermore, farmers in the central coast areas need to be enhanced awareness that the unbalance of supply and demand will negatively affect the agricultural machinery services market. Furthermore, the changes in policy implementations on reducing post-harvest losses should be considered for the market equilibrium of agricultural machinery in the Central Coast of Vietnam.

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