

## Chapter 5

### Effectiveness Analysis of Drone Use for Rice Production in Central Thailand

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and

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#### **Abstract**

This chapter illustrates the field survey of the effectiveness analysis of drone use for rice production in Central Thailand. The results reveal that the application of drone use has a greater effectiveness compared to conventional methods. Application of a drone can reduce the loss of production by 10-15%. It can reduce water volume for chemical mixing by 10 times, and reduce the use of chemicals by 40%. According to the fine size of the droplets, it can spray chemicals effectively, which can prevent insects by up to 90%, and it can spray equally across the field. Therefore, this can enhance the quality of rice that results in increasing the selling price. The reason that affect the decision by a farmer to use a drone are that a drone is new technology and they see the effective results from neighbors. On the other hand, some farmers never use a drone because they hesitate about its efficiency. Furthermore, the cost of wages is higher compared to using farm labor. Additionally, the number of drone service providers not enough, resulting in a long queue waiting for the drone service, which is inconvenience for the farmer. Therefore, the farmer will decide to use drone when there are enough drone service providers offering effective and high-quality service.

**Key Words:** drone, rice production, smart farming, Thailand

#### **1. Introduction**

Rice is a major cash crop essential for Thai people, because it is the main food. Moreover, rice is important for Thailand's economy, since it is the major agricultural export product

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of Thailand. The cultivation area for rice in Thailand occupies 45.2% of all farm land for a total of 43 million rai.

Thailand ranks 6<sup>th</sup> in the world in terms of the total production of milled rice. The rankings of the countries producing rice are China, India, Indonesia, Bangladesh, Vietnam, and Thailand. The percentage of global production is 29.3%, 23.1%, 7.5%, 7.1%, 5.6%, and 4.2%, respectively. However, in terms of exports, Thailand is in 2<sup>nd</sup> place. The number one in exports is India, which has a 25.2% market share, Thailand has a 21.0% market share. The competitors for export markets are Vietnam, Pakistan, the United State, and Myanmar. (Krungsri Research, 2020)

Thai households. Rice farmers are paid attention by the Thai government, since rice is one of the key factors that drive the economy of the country. Therefore, the government has established policies to help rice farmers, including 1) price-based policies, for example the rice price guarantee scheme, the rice pledging scheme and 2) financial assistance with production costs and to help them with the cost of harvesting also improving rice quality. (Krungsri Research, 2020)

Thailand has adopted the governmental policy “Thailand 4.0”, which aims to restructure the economy towards a “Value-based Economy” by transforming from traditional agriculture to the new era for agriculture. (Bhandhubanyong and Sirirangsi, 2019) Drone use a technology that is interesting for rice farmers. Nowadays, rice farmers in some areas used drones for spraying pesticides and fertilizer. However, the application of using drones not broad. Therefore, this research aims to study the factors affecting the decision for using a drone, and the effectiveness analysis on drone use for rice production in central Thailand

## **2. Rice Supply Chain**

The rice supply chain of the studied area has a structure as follows, the upstream segment consists of rice farmers. Most of farmers are small-scale farmers. The output of the upstream segment is paddy rice. Most farmers lack high quality storage facilities, therefore they normally sell immediately. To sell paddy after harvesting causes the price to be low due to lower negotiating power The selling channel consists of local mills or middlemen (such as agricultural cooperatives, paddy rice center markets and paddy rice collector).

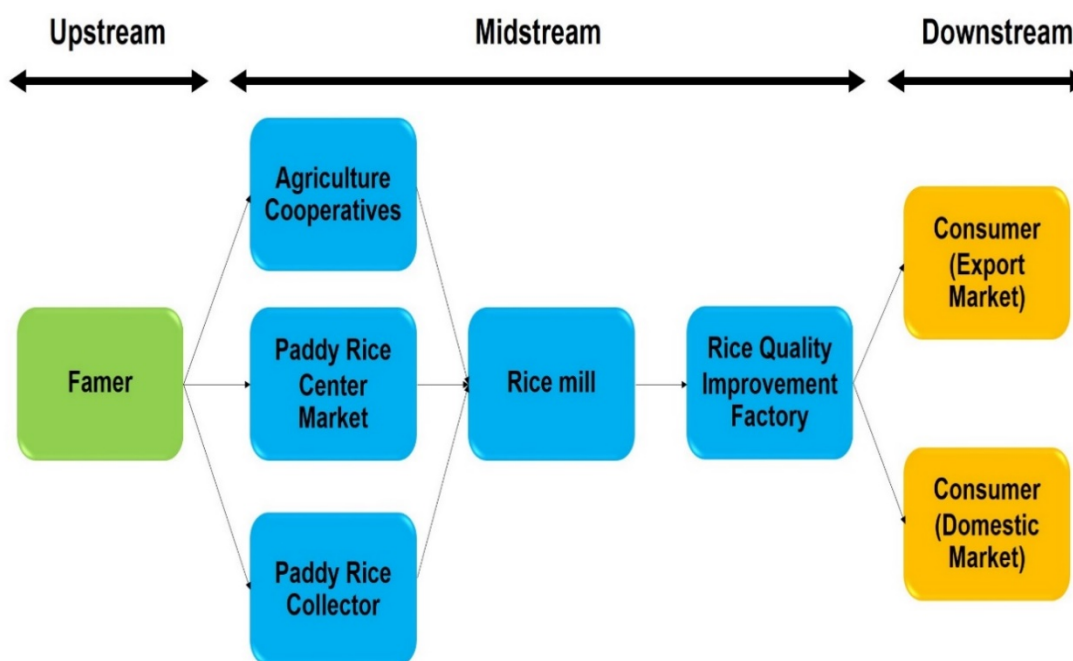
The midstream segment consists of paddy rice collector who collect the paddy

rice and transfer to rice mills. The paddy rice collector are agriculture cooperatives, paddy rice center market and paddy rice collector. Generally, 1 kilo of paddy rice produce 0.6-0.7 kilos of milled rice. After that, the milled rice is transferred to the export markets and domestic markets.

The downstream segment is composed of trading companies. They buy the rice and distribute to the export and domestic markets.

The structure of rice supply chain is shown in Figure 5-1.

Figure 5-1 Thailand's rice supply chain



Source: Farmer's interview

### 3. Research Methodology

The research was conducted by an interview survey of rice and maize farmers who used drones, farmers who have never used a drone, and drone service providers, in selected provinces of central Thailand. Data collection was done by face-to-face interviews and a questionnaire during December 2019 and January 2020. To collect the data, the researchers visited farmers and explained the objective of the research, then conducted the interview.

## **4. Information and Field Activities of Rice Farmers in Central Thailand**

### **4.1 General information of farmers**

#### **4.1.1 Farmers using a drone**

Most interviewees were male, and most had graduated from elementary school. Most own the farmland and do not need to pay rental costs. The farmers grow rice on approximately 29 rai per farm. For farmers renting farmland, the rental is approximately 2,000 baht per rai. The farmers have experience to grow rice for approximately 25 years.

#### **4.1.2 Farmers who have never used a drone**

Most of interviewees were female, and most had graduated from elementary school. Most own the farmland and do not need to pay rental. The farmers grow rice on approximately 29 rai per farm. For farmers renting farmland, the rental is approximately 1,291 baht per rai. The farmers have experience to grow the rice for approximately 24 years.

### **4.2 Problems during production**

The problems with rice production are climate change, lack of good irrigation systems, low quality of seed, and soil health.

The problems for the production cost are fertilizer price, pesticide price, cost of advanced technology equipment, and the rental price of farmland.

The problems with marketing are the low selling price with, less power to negotiate with the middlemen.

### **4.3 Factors affecting the decision to use a drone**

The factors affecting making the decision of using a drone is experience of using a drone by neighbors. Since the farmer will trust the effectiveness when they see the results. Therefore, if the area experienced ineffective results, the farmers in that area will hesitate to use a drone. This can be explained in more detail that to provide an effective and high-quality drone service, the service provider should be multi-skilled.

The first skill is drone control, there are big trees in some area, so the service provider should know the method to control the drone. Moreover, the service provider

should control the drone in windy conditions, because it is difficult to control the drone in windy conditions.

Another skill is the skill for mixing the chemicals. Each chemical should be mixed in the correct amount to prevent clogging of the spray nozzle.

The last skill is the skill to fix basic problems. This is because most drones are imported from other countries. If the drone is out of service, the service provider has to send it to the head office which takes long time for repair (1-3 months). On the other hand, if the result of using a drone is effective, other farmers will be interested in using a drone.

Another factor is the price hiring the drone service, so far the hire cost for using a drone is higher than conventional farming methods (approximately 10 baht per rai). Thus, some farmers are concerned about this and still hire traditional labor. Additionally, a factor can be the size of the farmland, if the farmland has a small area (less than 10 rai), the farmers prefer to do the work by themselves.

Moreover, the other factor that affects the decision is the long queue for service. These days, the number of service providers is not enough for the demand. Thus, farmers cannot wait for the service. However, if there are enough service providers, there would be many farmers who prefer to use a drone.

Another interesting factor affecting the decision to use a drone is the labor that they hire is mostly family relatives, which difficult to change. Because the farmers prefer to continue to hire family labor to keep the relationship. Additionally, the information about drone is one of the factor affecting the decision to use a drone. Some farmers have not enough information about drone and its advantage. Therefore, they do not want to used drone.

## **5. Information of drone's providers**

Drone service providers are mostly males of approximately 56 years old. They have income of approximately 402,717 baht per year. Most are farmers in the area who bought a drone to use on their farmland and also provide service to neighbors. Most graduated from elementary school. They normally provide the service in a range of 0-100 km from their house, and they do not provide the chemicals. This is because it might be a problem with the chemicals that can affect the effectiveness of using a drone.

The service providers offer several type of services those are fertilizer spraying, pesticide spraying, herbicide spraying, plant hormones spraying and drone training course.

Drone capacity is shown in Table 5-1.

Table 5-1 Drone capacity

Topic	Capacity
Spraying capacity	2 Minute/rai
Maximum service area	137 Rai/day
Spraying radius	3.5Meters
Carrying capacity	10 Liters
Battery capacity (14,400 mAh)	1 Rai

Source: Service provider's interview

The drone has spraying capacity around 2 minute per rai, maximum service area is 137 rai per day, spraying radius of 3.5 meters, carrying capacity is 10 liters and battery capacity is 1 rai per battery.

Cost of service provider is 280,694 baht include drone and its equipment as shown in Table 5-2. The price of drone start from around 200,000 to 600,000 baht deepens on the capacity and technology of each drone. The main cost of service provider are drone and the others equipment. Each service provider should has set of these equipment to provide the service.

Table 5-2 Cost of Service provider

Items	Life time (Years)	Price/Unit (Baht)
Drone (Series MG1P)	5	229,111
Electric generator	4	13,900
Battery (14,400 mAh)	2	13,432
Charger	3	19,417
Propeller (size 21 inch)	2	849
Mixing tank	5	820
Stirrer	1	500
Diesel oil	-	472
Wage fee	-	675
Electricity fee	-	818
Maintenance fee	-	700
<b>Total</b>		<b>280,694</b>

Source: Service provider's interview

## 6. Effectiveness of drone use for rice production in central Thailand

The results of the effectiveness of using a drone can be explained in terms of production. Firstly, using a drone can reduce the loss of production by 10-15%. Because spraying the chemicals using labor, the labor will walk in the field and destroy the crop. On the other hand, using a drone does not destroy the crop.

Secondly, using a drone can reduce the water used for chemical mixing by 10 times. To spray by labor, the water used is 20L per 2 L of chemical. However, using drone, the water use is 2L per 2 L of chemical. Also, using a drone can reduce the amount of chemicals used. Spraying by labor, the water uses 100ml of the chemical. However, by using a drone, the water uses 60ml of the chemical.

Additionally, using a drone avoids spraying the chemical on the same area, since the drone flies by a GPS system that is very precise.

Moreover, using a drone can save time, and be more comfortable and safer

because the labor does not need to contact the chemicals. The other effectiveness factor is the quality of the rice increases because a drone can spray the chemicals equally across the field.

## 7. Conclusion

This research paper reveals the results of the study of the effectiveness of drone use for rice production in central Thailand. Data was collected from selected farmers who use a drone, farmers who do not use a drone, and drone providers in central Thailand. The main results are the effectiveness of drone use for rice production compared with conventional methods.

The results reveal that using a drone can reduce the loss of production by 10-15%. It can reduce water for chemical mixing by 10 times and reduce the use of chemicals by 40%. According to the fine size of droplets, it can spray the chemicals effectively, which can prevent insects by up to 90%. Therefore, this increases the rice quality.

Farmers decided to use a drone because they would like to try new technology and they saw the effective result from neighbors. However, some farmers who have never used a drone still hesitate about its efficiency. Moreover, the hire cost is quite high compared to using traditional labor. Additionally, farmers have to wait in a long queue which is inconvenient for the farmers.

Therefore, if there are enough drone service providers to provide effective and high-quality service, application of drones for rice production will absolutely increase.

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