

Factors Affecting the Acceptance to Use of Drone Among Cassava Farmers in Cassava Cultivation at Tha Bo District, Nong Khai Province

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Abstract

The objectives of this research were to study 1) basic personal factors, and socio-economics factors of farmers 2) acceptance to use drones in cassava cultivation 3) decision to use drones for cassava cultivation 4) problems and obstacles for farmers in cassava cultivation at Tha Bo district, Nong Khai province. Data were collected by using questionnaires and analyzed by using descriptive statistics, such as frequency, percentage, minimum value, maximum, value, mean, standard deviation and Pearson Chi-square test. A sample group was 302 farmers. Results showed that most farmers were female with an average age of 61 years old, and a bachelor's degree. The average number of family members was 4.74 people. There was an average of 1.85 agricultural laborers per household. The average experience of farmers in cassava cultivation was 2.25 years. The average income of farmers was 59,862.50 Baht per year. The average amount of land for cassava cultivation was 13.36 rai per family. A characteristic to use drones was spraying pesticides by gathering of farmers in the area. The overall acceptance for use of drones in cassava cultivation was at a high acceptance level. There was an average acceptance level of 2.15. The overall decision level to use drones for cassava cultivation was at the high decision level. The average decision level to use drones for cassava cultivation was 1.99. From the hypothesis testing, it was found that gender, age, education level, number of family's labors, experience in cassava cultivation, a characteristic to use drones was spraying pesticides by gathering of farmers in the area, and acceptance to use drones in cassava cultivation were related to the decision to use drones for cassava cultivation was statistically significant at the 0.01 level. The problem found was that farmers were lacking appropriate knowledge for using agricultural drones in cassava cultivation.

Keywords: Acceptance, decision, agricultural drone, cassava cultivation

Introduction

Cassava is the main economic crop of Thailand. It is expected that the income of farmers who grow cassava will increase to 790 billion baht or an expansion of 17.1%, with output volume and price expected to increase by 0.6% and 16.4%, respectively, even though the harvested area will decrease due to flooding during September and

October of 2021 which cause the cassava to be damaged and unable to harvest the cassava yield per Rai in 2022. The price of cassava is likely to improve due to the demand for processed cassava chips, pellets, cassava flour and ethanol, together with the increased price of crude oil, causing the price of cassava to increase. (Center for Economic Analysis TTB, 2022) Thailand is considered an

important producer of cassava in the world but little is used for consumption. Most of them are popularly processed into products for export. Thailand's cassava products are export products with high demand in international markets which has the largest export volume in the world.

In addition, the use of fertilizer herbicides, and insecticides are very necessary for growing cassava to produce high yields and weight while cassava also needs a high quality of soil, good quality of water, no weeds, and no aphids. The important factor that makes cassava have good quality lies in taking special care and attention during its lifespan as first 4 months therefore, during the care period, manpower and money must be used. Normally, spraying pesticides and sowing fertilizers, herbicides, and insecticides in plantations was applied manual labor which required many hours of work to be sprayed thoroughly. It may cause crop damage and there is a risk of danger from the diffusion of chemicals to the workers who sprayed them. Therefore, utilizing agricultural drones in farming helps keep farmers safe without having to directly touch biological products or chemicals including not having to walk into the planting area. With government support, more farmers are turning to growing cassava, but labor shortages and limited time are causing farmers to use agricultural drones on farms. The advantage of using a drone to spray chemicals reduces the time that people must use the tank to spray or spray the pesticides across the cassava fields. This will take a long time and will not allow spraying the pesticides thoroughly. Moreover,

there is a long-term plan, using drones to spray pesticides will be more cost-effective than hiring people to spray pesticides and can solve the problem of labor shortages previously, it took many people to do agriculture, which took several hours per 10 Rai but when drones are introduced, the number of workers can be reduced to just 1-2 people for supervision and reduce time to only 10 minutes. In the future, agricultural drones may be one of the important helpers for Thai farmers (Digital Economy Promotion Agency, 2019)

For these reasons, beginning to see the use of service of drones for decision on using drones for cassava cultivation in some groups, such as new generation farmers, large scale farming is increasing, causing some groups of farmers to hire people with licenses to spray various substances. Moreover, those farmers who join the group which is provided by government with One Tam Bon One Digital project (Digital Economy Promotion Agency, 2019). But in the early days of using drones for decision on using drones for cassava cultivation, it is not known exactly what factors affected the decision to use drones for decision on using drones for cassava cultivation. The researcher is therefore interested in studying the factors affecting farmers' decision on using drones for cassava cultivation in Tha Bo district, Nong Khai province. To provide a guideline for using drones in decision on using drones for cassava cultivation with efficiency and maximum benefit for farmers in the future.

Materials and Methods

Population and sample

The population and sample used in this study were 1,223 households in the year 2020 of farmers who grow cassava (Office of Agricultural Economics, 2020) in Tha Bo district, Nong Khai province. The sample size of 302 people was determined by using Taro Yamane's formula (Yamane, 1973) with the error value of 0.05 through simple random sampling method.

Research tools

The tool used in this research was a questionnaire, divided into 3 parts consisting of Part 1: Personal and socio-economic factors of farmers. Data in this section includes gender, age, educational level, family member, family members who are agricultural workers, experience in growing cassava, income from agricultural occupation, types of fertilizer used in growing cassava, Labor costs for fertilizing and spraying. Size of cassava planting area, characteristics of using the drone, channels for receiving news and the integration of farmers in the area. Part 2: acceptance to use of technology and Part 3: Decision to use drones for cassava cultivation by farmers in Tha Bo district, Nong Khai province.

Testing tools in this research checks the validity of the content by using 3 experts to check the accuracy of the content and the use of language in communication and improved until complete by testing with 30 sets of cassava farmers who were not the sample group to test. After that, the collected data will be used. Let's test the statistical reliability by finding the confidence

coefficient of the questionnaire using Cronbach's Alpha coefficient analysis method, the use of technology acceptance was 0.98, and the decision to use drones for cassava cultivation was 0.96.

Data analysis and processing

Data analysis is divided into 1) Descriptive statistics search for statistical values, including percentages, averages, maximum, minimum, and standard deviation 2) Inferential statistics test the hypothesis to find the relationship between the personal and socio-economic factors of farmers and the decision to use drones for cassava cultivation by using the Pearson Chi-square test and statistical significance was at the 0.01 and 0.05 levels.

The acceptance of the technology means acceptance to use drone, as group farmers not by buying drone directly. The criteria for interpreting the data are specified as follows:

An average score of 1.00 - 1.66 means a low level of acceptance.

An average score of 1.67 - 2.34 means a moderate level of acceptance.

An average score of 2.35 - 3.00 means a high level of acceptance.

Explaining the meaning of the average score obtained from data on the decision to use drones for cassava cultivation. The criteria for interpreting the data are specified as follows:

An average score of 1.00 - 1.66 means a low level of decision.

An average score of 1.67 - 2.34 means a moderate level of decision.

An average score of 2.35 - 3.00 means a high level of decision.

Results and Discussion

Personal and socio-economic factor of farmers

The research results found (Table 1) that the majority of farmers were female with 60.90 percent and 49.70 percent were over than at age of 51 years, average age was 61 years old, had a bachelor's degree with 50.00 percent, the number of family members was 4-6 people, 60.30 percent, an average 4.74 people and had 1 - 3 family members who were agricultural workers, 83.10 percent, an average of 1.85 people, had experience cassava cultivation for less than 4 years, with an average of 2.25 years. Farmer had an income from agricultural occupation of about 150,000 baht per year, with 49.70 percent, an average income was 59,862.50 baht per year. The type of fertilizer used in cassava cultivation was liquid with 60.30 percent. The average price for hiring fertilizer sprayers and sprayers in the area was less than 150 baht per Rai, with 46.40 percent, an average of 131.00 baht. There was an area for cassava cultivation 1-30 Rai, with 79.80 percent, an average of 13.36 Rai. Characteristics of using drones by

spraying was 56.60 percent. There were channels for receiving general news from the internet and social media such as YouTube/Facebook/Line/Website with 63.60 percent and there was a gathering of farmers in the area of 43.70 percent. Consistent with Apisithpinyo *et al.* (2022) studied the factors affecting the break-even point and safe surplus from cassava cultivation in Nakhon Ratchasima Province was found that the majority of farmers were female, 53.47 percent. The same as Wannok and Haputta (2023) studied factors related to the behavior of using pesticides among cassava farmers in Po Daeng subdistrict, Rural district, Khon Kaen province, found that 47.87% were aged 50 years and over. Similarly, Bunsongsree and Treewannakul (2023) studied farmers' compliance with measures to prevent and eliminate cassava leaf spot disease in Khon Buri district Nakhon Ratchasima province was found that the average number of workers in the household was 1 person, 53.52 percent and Nungarm *et al.* (2021) studied farmers' opinions on agricultural promotion of the Center for Agricultural Technology Promotion in Crop Protection, Suphanburi province found that there was less than 16 Rai of agricultural land, 34.62 percent.

Table 1 Personal and socio-economic factors of farmers

Personal and socio-economic factors of farmers	n (%)	Mean	Max	Min	S.D.
Gender					
Female	184 (60.9)				
Age (years old)					
21-35 years old	61 (20.2)	61	66	27	0.783
36-50 years old	91(30.1)				
> 51 years old	150 (49.7)				
Education					
Bachelor's degrees	151 (50.0)				
Number of family members (people)					
1-3 people	120 (39.7)	4.74	6	1	0.490
4-6 people	182 (60.3)				
Family's labors (people)					
1-3 people	251 (83.1)	1.85	6	1	0.375
4-6 people	51 (16.9)				
Experience in cassava cultivation (years)					
< 4 years	130 (43.0)	2.25	17	0	0.819
5-9 years	92 (30.5)				
> 10 years	80 (26.5)				
Income from agricultural occupation (Baht/year)					
< 150,000 Baht/year	150 (49.7)	59,862.50	900,000	10,000	0.861
150,000-300,000 Baht/year	112 (37.1)				
300,001-500,000 Baht/year	20 (6.6)				
> 500,001 Baht/year	20 (6.6)				
Types of fertilizer used in cassava cultivation					
Water type	182 (60.3)				
Average price for hiring fertilizer sprayers and sprayers in the area (Baht)					
<150 Baht	140 (46.4)	131	6,000	120	0.888
151-300 Baht	60 (19.9)				
> 301 Baht	102 (33.8)				

Table 1 Personal and socio-economic factors of farmers (Cont.)

Personal and socio-economic factors of farmers	n (%)	Mean	Max	Min	S.D.
Number of areas for cassava cultivation (Rai)		13.36	50	1	0.505
1-30 Rai	241 (79.8)				
31-50 Rai	50 (16.6)				
> 51 Rai	11 (3.6)				
Drone used characteristics					
Spray	171 (56.6)				
Channels for receiving general news					
Internet and social media	192 (63.6)				
YouTube/ Facebook/Line/ Website					
Gathering of farmers in the area	132 (43.7)				

Farmers' adoption on agricultural drone

The research results found that the overall level of acceptance of the use of drones for cassava cultivation was at a moderate level of acceptance. The average acceptance level was 2.15 when considering each aspect, was found that there was an acceptance level for the use of drones

for cassava cultivation. The perceived ease of use was the greatest (average score 2.24), followed by attitude toward using (average score 2.23), perceived usefulness (average score 2.21), and intention to use (average score 2.19) and perceived risk (average score 2.01), respectively (Table 2).

Table 2 Farmers' acceptance of the use of drone cassava cultivation

Acceptance of the use of drone cassava cultivation	\bar{x}	S.D.	Acceptance level
Perceived usefulness	2.21	0.648	Moderate
Perceived ease of use	2.24	0.700	Moderate
Intention to use	2.19	0.733	Moderate
Perceived risk	2.01	0.737	Moderate
Attitude toward using	2.23	0.650	Moderate
Average	2.15	0.580	Moderate

Remarks: 2.35 - 3.00 = High acceptance, 1.68 - 2.34 = Moderate acceptance, 1.00 - 1.67 = Low acceptance as the acceptance means acceptance to use of technology

Farmers’ decision on using drones for cassava cultivation

The research results found that the overall level of decision on using drones for cassava cultivation was at a moderate level of decision. There was an average level of decision on using drones of 1.99 when considering each aspect, was found that there was an average level of

decision on using drones for cassava cultivation. The convenience of drones used was the most (average score 2.11), followed by product description and clear price (average score of 2.02), cost reduction on farm management (average score 1.98), and available for trial service (average score 1.84) respectively (Table 3).

Table 3 Farmers’ decision on using drones for cassava cultivation

Decision on using drones for cassava cultivation	\bar{x}	S.D.	Decision level
Convenience of drones used	2.11	0.607	Moderate
Product description and clear price	2.02	0.676	Moderate
Available for trial service	1.84	0.613	Moderate
Cost reduction on farm management	1.98	0.635	Moderate
Average	1.99	0.555	Moderate

Remarks: 2.35 - 3.00 = High, 1.68 - 2.34 = Moderate, 1.00 - 1.67 = Low

Relationship with factors affecting the decision on using drones for cassava cultivation

Results from the study found that gender is related to the decision to use drones for cassava cultivation. at the statistical significance level of 0.01, especially understanding of new technology perceived ease of use and perception of benefits and confirmed relationship with farmers' intentions to use it as they need labor for hard work. Consistent with Shi Zheng *et al.* (2019) a study of technology adoption among farmers in Jilin province, China, found that gender was an important factor affecting farmers' technology adoption intentions.

Age has a relationship with the decision to use drones for cassava cultivation. At the statistical

significance level of 0.01, which indicates that the age of cassava farmers increases, the decision to use drones for cassava cultivation will be increased as they don't have adequate labor work. Consistent with Wannok and Haputta, (2023), conducted a study of factors related to the behavior of using pesticides among cassava farmers in Po Daeng subdistrict, Rural district, Khon Kaen province. It was found that the age of the farmers was related to the behavior of using chemicals. Farmers' chemical pesticides are statistically significant at the 0.05 level.

The level of education is related to the decision to use drones for cassava cultivation at the statistical significance level of 0.01. Different levels of education granted farmers more knowledge,

better understanding of benefits of use and easier access to information on using agricultural drones. This makes it easier to influence the decision to use agricultural drones in cassava cultivation. Consistent with Sanprasert *et al.* (2020), studied the factors affecting satisfaction in forming a group of rubber farmers in Sanam Chai Khet district, Chachoengsao province found that the education level. It has an influence on the satisfaction of joining together as a member of the rubber farmer group. Statistically significant was at the 0.05 level.

The number of family labor is related to the decision to use drones for cassava cultivation at a statistical significance level of 0.01, indicating that the number of family's labor can be main labor work and from the study found that farmer had 1-3 labors which using drones for cassava cultivation can be support limited labor work. Consistent with Kaewlaima *et al.* (2017), a study of factors affecting the acceptance of organic farming by farmers in Mae Hor Phra subdistrict, Mae Taeng district, Chiang Mai province found that the number of laborers used in the agricultural sector was a factor affecting the acceptance of organic farming by farmers in Mae Hor Phra subdistrict, Mae Taeng district, Chiang Mai province. Statistically significant was at the 0.05 level.

Experience in growing cassava is related to the decision on using drones for cassava cultivation at a statistical significance level of 0.01, indicating that farmers with average 2.25 years experiences in cassava cultivation as farmer with less experience was better at applying technology

than farmers who had more experience. Consistent with Bunsongsree and Treewannakul (2023), studied the implementation of measures to prevent and eliminate cassava leaf spot disease among farmers in Khonburi district, Nakhon Ratchasima province found that experience in cassava cultivation was related to farmers' compliance with measures to prevent and eliminate cassava leaf spot disease at a statistical significance level of 0.01.

Drone used characteristics for spraying pesticides are related to the decision on using drones for cassava cultivation at a statistical significance level of 0.01. Most farmers used for spraying such as pesticide and chemical fertilizer lead farmers who have a lot of knowledge in using pesticides had a behavior in using pesticides more correctly than farmers with less knowledge. Consistent with Wannok and Haputta (2023), studied factors related to the behavior of using pesticides among cassava farmers in Po Daeng subdistrict, Rural district, Khon Kaen province. It was found that knowledge about the use of pesticides and knowledge about the effects of using pesticides. It is significantly related to farmers' pesticide use behavior at the 0.05 level.

The gathering group of farmers in the area is related to the decision on using drones for cassava cultivation at a statistical significance level of 0.01, indicating that the grouping of farmers who grow cassava in the area had desire to use drones for reducing the inputs. Additionally, farmers are able to share and exchange their information on using agricultural drones. Consistent with Panyayuen *et al.* (2020), a study was conducted on

the need of promoting the cultivation of vegetables safe from toxins among farmers in Mueang Pan district, Lampang province. It was found that being a member of the vegetable group safe from toxins It will result in the average demand for promoting the cultivation of vegetables safe from toxic substances reduced at a statistical significance of 0.01.

Acceptance of using technology related to the decision on using drones for cassava cultivation at a statistical significance level of 0.01, as farmers who accept technology that will be able to learn, sharing, exchange knowledge and will be

affected farmer to make decision on using agricultural drone which increase the efficiency of cassava cultivation. Consistent with Soyyana *et al.* (2022), studied the acceptance of the technology of using unmanned aerial vehicles for spraying chemicals among rice farmers, San Kamphaeng district, Chiang Mai province found that farmers' acceptance of drone technology on spraying chemicals in rice fields. It is to make farmers aware of the benefits and features of the technology that will be used in drone management with statistical significance at the 0.01 level.

Table 4 Relationship between farmers' personal and socio-economic factors and factors affecting the decision on using drones for cassava cultivation

Farmers' personal and socio-economic factors	Factors affecting the decision on using drones for cassava cultivation		
	χ^2	P-value	Significance
Gender	10.618**	0.005	Sig.
Age	65.855**	0.000	Sig.
Education	30.650**	0.000	Sig.
Family's labors	18.488**	0.000	Sig.
Experience in cassava cultivation	60.742**	0.000	Sig.
Drone used characteristics	34.842**	0.000	Sig.
Gathering of farmers in the area	90.487**	0.000	Sig.
Technology acceptance	407.889**	0.000	Sig.

Remarks: **Significance level at 0.01, No cell with a frequency lower than 5 and not exceed 20%

Conclusion

Farmers had an overall acceptance level of using drones for cassava cultivation at a moderate level of acceptance. The average acceptance level was 2.15 when considering each

aspect, was found that the perceived ease of use was average score of 2.24, followed by attitude toward using at average score of 2.23, perceived usefulness at mean score of 2.21, intention to use at average score of 2.19 and perceived risk

at average score of 2.01). Farmers' overall level of decision to use drones for cassava cultivation was at the moderate level of decision. There was an average level of decision on using drones of 1.99 when considering each aspect, was found that a convenience of drones used was average score of 2.11, followed by product description and clear price average score of 2.02, cost reduction on farm management average score of 1.98, available for trial service average score of 1.84, and hypothesis testing found that personal economic and social factors such as gender, age, education, family members workers, experience in cassava cultivation, drone usage characteristics, gathering of farmers in the area, and technology acceptance of farmers in Tha Bo district, Nong Khai province. An acceptance of the use of drones related to the decision on using drones for cassava cultivation with statistical significance at the 0.01 level. The problem found that farmers were lack of knowledge and the benefits of using agricultural drones in cassava cultivation for increase efficiency in cassava cultivation.

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