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Extension Case Study: Why Paddy Farmers Are Not Inclined to Use a Drone as Part of Mechanisation for Paddy Cultivation

MUHAMMAD NURFAIZ ABD KHARIM AND WAN NURUL ATIQAH ROSDI
Faculty of Agro Based Industry, Universiti Malaysia Kelantan, 16300 Bachok, Kelantan Darul Naim, Malaysia

Drone technology is emerging as a pivotal component in the agricultural sector, particularly in the context of Agricultural Industrial Revolution 4.0 (IR4.0). Its application, especially in activities such as fertiliser and crop protection chemical spraying in the Kemubu Agricultural Development Authority (KADA) granary areas, can significantly enhance the farmers' yields. Despite the positive reception of drone technology, there is a growing phenomenon of technology rejection that requires further exploration. This research aims to investigate farmers' acceptance of drones as a mechanisation tool for paddy cultivation in the Jajahan Bachok, Kelantan granary areas within KADA authority. A structured questionnaire, based on the knowledge, attitude, practice (KAP) model, was administered to 82 farmers surrounding Jajahan Bachok through purposive sampling. Data analysis using SPSS version 26.0 involved Descriptive statistics, Spearman's Correlation, and Reliability tests. The study reveals that paddy farmers exhibit acceptance of drone technology, albeit with a slow adoption rate. The correlations between knowledge, attitude, and practice with drone mechanisation acceptance are significant but negligible at levels of 0.253, 0.866, and 0.69, respectively. This research is vital for both agency and drone vendors to comprehend the factors influencing drone technology acceptance among paddy farmers. Understanding these factors can contribute to enhance the application and adoption rate of drone as next important mechanisation for paddy farming activities among farmers especially in the KADA granary areas.

Keywords: *Drone, paddy, acceptance, KAP model, KADA.*

By 2050, agriculture and food production and distribution are anticipated to be pivotal sectors, especially in light of global food shortages resulting from population growth (Rosnani *et al.*, 2016). Recognising the significance of the paddy and rice industries for food security and economic sustainability, the Malaysian government has strategically invested in modern agricultural technologies. This commitment is exemplified by the integration of innovative technologies, such as drone technology, in the paddy and rice sectors under the government's economic transformation programme aimed at achieving high-income status by 2030 (Bernama, 2021).

Farmers constitute the backbone of the paddy chain, and to secure a sustainable rice supply, it is imperative that each link in the paddy sector contributes effectively. The adoption of modern technologies, such as drone technology, plays a crucial role in enhancing efficiency and profitability along the paddy production value chain (Norasma *et al*., 2019). This includes the incorporation of drone technology for

e-mail: nurfaiz@umk.edu.my

mechanisation in paddy granary areas, with an emphasis on assessing technology adoption levels to optimise revenue, quality, and overall efficiency. With the challenges of insufficient labour and lack of youth joining the agriculture workforce, dependence on modern mechanisation is crucial and a must to continue the survival of paddy farming in Malaysia.

In the Malaysian context, the utilisation of drone technology has gained prominence, particularly among young farmers, owing to its potential to increase crop yields and revenue (Schmeitz, 2020). Drones offer multifaceted applications in agriculture, encompassing tasks such as crop watering, seedling sowing, fertiliser and crop protection chemical spraying, area capacity assessment, and monitoring of coastal weather conditions. Notably, the use of Ultra-Low Volume (ULV) technology through drones has been implemented to spray a fine mist of liquid absorption into paddy crops.

The effective utilisation of drone technology necessitates a knowledgeable and skilled user base. The Fourth Industrial Revolution (IR4.0) has been embraced by Malaysian paddy farmers as a transformative mechanism for producing superior and higher-quality paddy (Man *et al*., 2019). As a result, becoming adept at drone technology operation has become a hallmark of modern farming practices.

Despite the increasing popularity of drone technology for spraying fertilisers and crop protection chemicals in paddy fields across Malaysia, certain regions, such as in Kelantan, present challenges. For example, low adoption of using drone services among farmers for paddy cultivation activities especially for the crop protection procedure even though farmers know the existence of drone application for paddy cultivation and its advantage (Azizul *et al*., 2023). Hence, misperception and doubts about the inefficiency of drone spraying to help improve the cultivation activities compared to the on-ground spraying procedure were circulated among the paddy farmers in the region. Therefore, this study aims to comprehend the factors influencing the paddy farmers' community in Jajahan Bachok who resist the adoption of drone technology for paddy farming activities.

MATERIALS AND METHODS

Conceptual framework

The research framework was prepared to identify farmers' acceptance of using drones as mechanisation for paddy cultivation in Jajahan Bachok, Kemubu Agriculture Development Authority (KADA), Kelantan granary areas as shown in *Figure 1*.

The independent and dependent variables employed in this study are depicted in *Figure 2* in which knowledge, attitude, and practice are the independent variables included in this study. The dependent variable is the amount of level of acceptance among farmers towards using drones as part of mechanisation for paddy cultivation in Jajahan Bachok, KADA, Kelantan granary areas.

Research procedure

The questionnaire was created based on the problem statement and the objective of this project. Thus, the entire questionnaire was developed in simple and easy to understand format by the targeted respondent especially the paddy farmers based on their specific socio-demographic characteristics. The main element on the questionnaire was setup according to the environmental issues, and practices of drones in paddy plantations only. These aspects were essential to evaluate the level of acceptance of farmers towards using drones

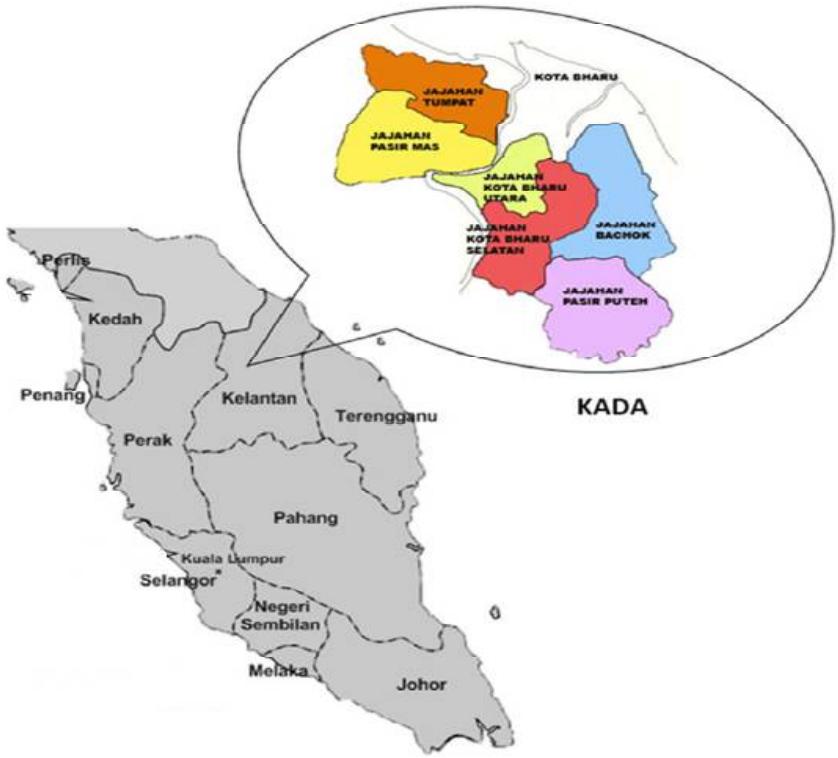

Figure 1 Data collection for the study was performed around Jajahan Bachok

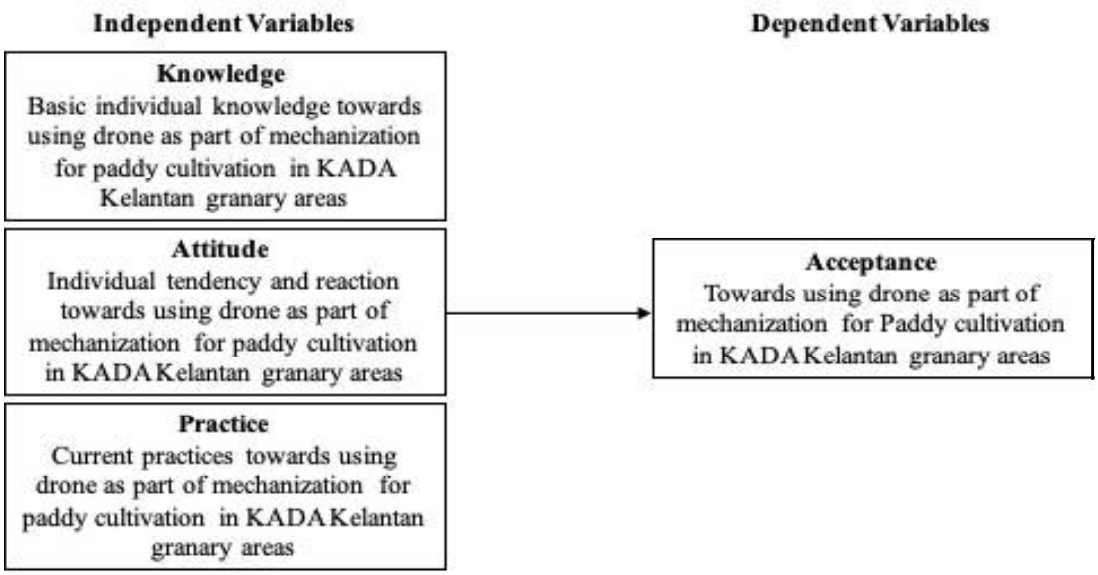

Figure 2 Diagram of conceptual framework

as mechanisation for paddy cultivation. In this research, the questionnaire was designed based on a five-point Likert scale, i.e. strongly disagree, disagree, average, agree, and strongly agree (Adam & Pebrian, 2017). The questionnaire comprised of the following:

a) Section A: There were 11 questions in this section on demographic information such as gender, age, education level, farming experience and family background. In this section, the question was divided into three parts which were knowledge, attitude, and practice,
b) Section B: Under knowledge there were eight questions about farmers using drones as mechanisation for paddy cultivation,
c) Section C: There were nine questions under attitude enquiring about using drones to mechanise paddy cultivation,
d) Section D: Included ten questions on the practice of farmers towards using drones as mechanisation for paddy cultivation, and
e) Section E: Included eight questions on farmers' acceptance towards using drones as mechanisation for paddy cultivation.

Data collection

The process of data collection was performed from 9 November 2021, until 9 December 2021. The respondents were chosen through the use of a simple random sampling process. The participants in this study totalled 82 farmers who answered the survey questions. According to Allen (2011), the sample size was determined using the rule of thumb. This rule was to select a sample size larger than 30 respondents and not more than 500 respondents. Furthermore, excellent quality findings can be achieved even if the total sample is less than 50, and not very good results can be obtained if the sample size is too small (De Winter *et al*., 2009). This is because the data analysed are less accurate. However, Littler (2015) stated that the larger the sample size, the more information will be gathered as it can help reduce sampling errors. Hence, a pilot study was performed to test the questionnaire developed by distributing the questionnaire to 30 extension officers in KADA, Kelantan to achieve the outcome and sufficiently measure the viability of the questionnaire. Several extension officers from KADA office were brought in to help speed up the data collection procedure. The data collection method was carried out by specially trained enumerators, and the average time required to complete the questionnaire was 20-30 minutes on average. The data were analysed using SPSS 26.0 to perform data entry and analysis about the demographic profile, independent and dependent variables.

Statistical analysis

The data cleaning was done by examining the frequency and descriptive statistics and encoding and entering data. Statistical tool like the SPSS 26 programme was used to analyse data using descriptive statistics such as the mean, frequency, minimum, maximum, percentage, and standard deviation. The reliability test and Spearman correlation analysis were utilised for inferential statistical analysis in this study.

In this study, descriptive analysis was used to describe the basic feature of the data. It provides simple summarisation data that is easy to interpret and understand. Descriptive data were required to calculate the mean of the nominal collected data during this inquiry in order to figure out the frequency and percentage

of farmers. The data was analysed based on farmers' acceptance, knowledge, attitude, and practice towards using drones as mechanisation for paddy cultivation.

Reliability test

The validity and consistency of the questionnaires were ensured by using a reliability test to evaluate systematic variation in a scale. In reliability testing, Cronbach's Alpha method was used in the study. It is acceptable to have an acceptable value of 0.7, but it is desirable to have an acceptable value of 0.8. Cronbach's Alpha reliability is summarised in *Table 1*.

Spearman correlation coefficient (r_s)

The Spearman correlation analysis was used to compute the statistical significance of the cross-tabulation table. In this study, the rule of thumb for interpreting the size of Spearman's Rho correlation coefficient (*Table 2*) was used to analyse the relationship related to the objective, which was to identify the relationship between knowledge, attitude, and practices toward the acceptance of drones as mechanisation for paddy cultivation.

RESULTS AND DISCUSSION

Demographic profile and detailed background of paddy farmers

Descriptive analysis was used in this study to analyse the demographic profile of farmers, to describe their socio-demographic information. For instance, age, gender, marital status, race, educational level, parents involvement in paddy cultivation, distance from house to paddy field, years of experience in planting paddy, area of planting paddy, estimation of paddy yield production per hectare, and price to use drone services.

The demographic characteristics and detailed profiles of paddy farmers who participated in the survey have been delineated in *Tables 3* and *4*. The majority of respondents engaged in rice farming were between the ages of 41 and 60, a trend consistent with prior research conducted by Azizul *et al*. (2023), which reported similar findings. Furthermore, the data revealed that a significant proportion of rice farmers possess only secondary educational qualification, indicating a persistent deficiency in higher educational attainment within this demography. This protracted

TABLE 1
RELIABILITY TEST PERFORMED IN THE STUDY IN KADA, KELANTAN GRANARY AREAS

Section	*Questionnaire theme*	*No of questions*	*Pilot study (Cronbach Alpha)*
Section A	Farmers' knowledge towards using drones as mechanisation for paddy cultivation	8	0.810
Section B	Farmers' attitude towards using drones as mechanisation for paddy cultivation	9	0.885
Section C	Practice of farmers towards using drones as mechanisation for paddy cultivation	10	0.884
Section D	Farmers' acceptance towards using drones as mechanisation for paddy cultivation	8	0.798

TABLE 2
RULE OF THUMB FOR INTERPRETING THE SIZE OF A CORRELATION COEFFICIENT

Size of correlation (%)	*Interpretation*
0.90 to 1.0 (-0.9 to -1.00)	Very high positive (negative) correlation
0.70 to 0.90 (-0.70 to -0.90)	High positive (negative) correlation
0.50 to 0.70 (-0.50 to 0.70)	Moderate positive (negative) correlation
0.30 to 0.50 (-0.30 to -0.50)	Low positive (negative) correlation
0.00 to 0.30 (0.00 to -0.30)	Negligible correlation

Source: Mukaka (2012)

TABLE 3
THE DEMOGRAPHIC PROFILE OF PADDY FARMERS WHO PARTICIPATED IN THE SURVEY

Variables		*Frequency*	*Percentage (%)*
Age	20 - 30 years	6	7.3
	31 - 40 years	14	17.1
	41 - 50 years	27	32.9
	51 - 60 years	26	31.7
	61 - 70 years	9	11.0
Sex	Male	81	98.8
	Female	1	1.2
Marital Status	Married	74	90.2
	Divorced	1	1.2
	Unmarried	7	8.5
Race	Malay	82	100.0
Level of education	No formal education	3	3.7
	UPSR	3	3.7
	SRP/PMR/PT3	17	20.7
	SPM	48	58.5
	Vocational certification	1	1.2
	STPM/STAM	6	7.3
	Diploma	1	1.2
	Degree/master's degree/ Doctor of Philosophy	3	3.7

stagnation in educational levels underscores a noteworthy dearth of young, skilled individuals entering the agricultural sector. Consequently, it underscores the imperative of national initiatives aimed at bolstering the local agricultural workforce with contemporary knowledge and skills, particularly considering the advent of the IR4.0. The timely implementation of the Malaysia Drone Technology Action Plan 2022-2023

TABLE 4
DETAILED PROFILE OF PADDY FARMERS WHO PARTICIPATED IN THE SURVEY

Variables		*Frequency*	*Percentage (%)*
Is your father/mother involved in planting paddy?	Yes	60	73.2
	No	22	26.8
Distance from your house to the paddy field?	1 - 5 km	64	78.0
	6 - 10 km	14	17.1
	11 - 15 km	4	4.9
How long have you been planting paddy?	Less than 1 year	2	2.4
	1 - 5 years	10	12.2
	6 - 10 years	26	31.7
	11 - 15 years	28	34.1
	More than 16 years	16	19.5
What is the area under paddy?	1 - 2 hectares	4	4.9
	3 - 4 hectares	6	7.3
	5 - 6 hectares	13	15.9
	7 - 8 hectares	15	18.3
	9 -10 hectares	21	25.6
	More than 10 hectares	23	28.0
What is the yield of paddy per season per hectare (tonne/ha)?	Less than 2 tonnes	3	3.7
	2 - 3 tonnes	6	7.3
	3 - 4 tonnes	14	17.1
	4 - 5 tonnes	53	64.6
	More than 5 tonnes	6	7.3
What is the cost of using drone services in your area per hectare?	Less than RM25	5	6.1
	RM26 - RM50	67	81.7
	More than RM100	10	12.2

(MDTAP30) by the government, geared towards enhancing drone technology adoption within the country, aligns strategically with these imperatives.

Furthermore, in the Jajahan Bachok region, farmers persist in cultivating paddy as their primary source of income, often inheriting this practice from previous generations. The majority of rice farmers in this area boast over a decade of farming experience and manage more than 4.05 hectares of paddy fields. This indicates a recognition among farmers of the necessity to expand their cultivation areas to optimise income generation. Notably, most surveyed rice farmers demonstrate the capability to achieve paddy yields ranging from 4 to 5 tonnes per hectare per season, a performance level consistent with the national average production target per farmer.

Drone services in the Jajahan Bachok area are typically priced based on the cultivated hectarage. Despite offering a range of services, including crop protection input spraying, fertiliser application, and seed broadcasting, drone operators in the region commonly charge per service on a per hectare basis. The absence

of regulatory oversight or standardised pricing mechanisms has led to variable pricing among different operators. According to the survey data, 67 (81.7%) farmers reported paying between RM26 and RM50 for drone services, with the second largest group consisting of 10 (12.2%) farmers paying more than RM100, and a smaller group of 5 (6.1%) farmers paying less than RM25. Despite the fluctuating and unregulated pricing structure across the Jajahan Bachok region, these findings underscore the farmers' willingness to embrace drone technology due to its perceived importance and the significant role it plays in mechanising farm management activities.

Knowledge among paddy farmers about drones as part of mechanisation for paddy cultivation

This section discusses the assessment of farmers' knowledge regarding the use of drones in mechanising paddy cultivation, employing descriptive analysis. The findings, detailed in *Table 5*, reveal insights into farmers' perceptions and acceptance of drone technology. The analysis indicates that majority of farmers acknowledge drones as an effective tool introduced by government agencies to ease various paddy cultivation tasks, such as spraying pesticides, sowing seeds and monitoring the crop growth across larger areas in much shorter time and minimise the manpower requirement. This aligns with the assertion by Subramanian *et al*. (2021) that drones excel in delivering pesticides to crops and are immensely adopted by most of the farmers. In fact, referring to the impact on production, rice farmers believed that drone usage could enhance their yields highlighting a positive perception of the technology's potential benefits. However, 15.9 per cent expressed uncertainty about the risks associated with the use of drones, emphasising the need for a comprehensive training programme to address safety concerns. In terms of issue of misconception of handling pesticide application practices, farmers understood the requirement to learn on how to use recommended dosages for effective spraying results in the field during the spraying process. This discrepancy may have stemmed from misconceptions, as noted by Shetty *et al*. (2010), regarding the environmental impacts of pesticides. The overall knowledge level among farmers on drone utilisation in paddy cultivation within Jajahan Bachok, KADA Kelantan granary areas was high, with a mean score of 4.04. The findings suggested that farmers were well-informed about drone applications and benefits. This high level of knowledge significantly influenced farmers' acceptance of drone technology for mechanising paddy cultivation.

The survey shows that 79.3 per cent of paddy farmers possess high knowledge levels as indicated in *Table 6*. This aligns with the idea that informed farmers can optimise drone technology for improved agricultural practices, promoting better yields. The study recommends conducting training programmes to address safety concerns, and emphasising adherence to recommended pesticide dosages. Additionally, promoting awareness of proper drone operation practices will further enhance farmers' confidence in utilising this technology. This aligns with the insights from Azizul *et al*. (2023) suggesting that farmers respond positively to training initiatives on drone use.

Attitude among farmers using drones as part of mechanisation for paddy cultivation

This section discusses the outcomes of the descriptive analysis on the attitude among

TABLE 5
DESCRIPTIVE ANALYSIS OF KNOWLEDGE AMONG FARMERS USING DRONES AS PART OF MECHANISATION FOR PADDY CULTIVATION IN KADA KELANTAN GRANARY AREAS

Statement	*Percentage (%)*					*Mean*	*S.D*	*Level*
	*1**	*2**	*3**	*4**	*5**			
Drones are new technologies introduced by government agencies in paddy cultivation work, such as spraying pesticides/weeds, cultivating and sowing seeds.	0	6.1	7.3	54.9	31.7	4.12	0.792	High
Drones facilitate fieldworks such as spraying pesticides, sowing fertilisers and seeds in the fields.	0	0	6.1	57.3	36.6	4.30	0.581	High
The use of drones can increase production.	1.2	0	18.3	51.2	29.3	4.07	0.766	High
I acknowledge the risk when using drones, such as spraying drift, drone crash and safety distance.	0	15.9	24.4	48.8	11.0	3.55	0.891	Moderate
The use of drones can save operating time and reduce man-power while doing paddy cultivation activities.	0	0	3.7	50.0	46.3	4.43	0.567	High
The use of drones is an effective alternative to monitor the growth of paddy cultivation for a wider area.	1.2	3.7	7.3	54.9	32.9	4.15	0.803	High
The herbicide/insecticide mixture for spraying using a drone should follow the dosage recommended by the pesticide manufacturer for effective spraying results in the field.	2.4	3.7	12.2	54.9	26.8	4.00	0.875	High
Drone operation in paddy fields must be done by a qualified operator and obtain a license and permit to increase farmers' confidence (consumers).	0	17.1	17.1	41.5	24.5	3.73	1.019	High

*Indicator: 1. Strongly Disagree; 2. Disagree; 3. Average; 4. Agree; 5. Strongly Agree
Notes: mean values correspond to: Low- 1.0 - 2.33, Moderate- 2.34 - 3.66, High- 3.67 - 5.0.

TABLE 6
LEVEL OF KNOWLEDGE AMONG FARMERS USING DRONES AS PART OF MECHANISATION FOR PADDY CULTIVATION IN KADA KELANTAN GRANARY AREAS

Factor	*Frequency*	*Percentage (%)*	*Mean*	*Standard deviation*
Knowledge			4.04	0.472
Low				
Moderate	17	20.7		
High	65	79.3		

farmers about using drone as part of the mechanisation for their paddy cultivation activities. The statement "I recommend using the drone method instead of the old method in spraying and sowing seeds/fertiliser operations" reveals that 86.6 per cent of farmers agree or strongly agree, indicating a widespread acknowledgement of the efficiency improvement associated with drone technology in daily farming operations. Similarly, the statement "I prefer to use a drone because it is easy to manage and cost-effective" reflects a positive inclination, with 81.7 per cent of farmers expressing agreement or strong agreement. This suggests that farmers perceive drones as a practical and cost-efficient alternative for estimating expenses related to paddy cultivation. Moreover, the analysis highlights that 86.6 per cent of farmers express a favourable disposition towards using drone services if they are economically viable in the cultivated area. This emphasises the importance of affordable drone services in promoting technology adoption among farmers.

The study also indicates that 81.7 per cent of farmers are willing to seek advice from KADA extension officers or refer to experts on using drones in paddy cultivation operations. This underlines the pivotal role of agricultural extension services, with KADA serving as a primary reference for farmers seeking guidance. Furthermore, 80.5 per cent of farmers express interest in attending training courses on drone usage in paddy fields. This underscores the farmers' eagerness to enhance their knowledge and understanding of drone applications, aligning with the potential benefits highlighted by Chuang *et al*. (2020). While the majority of farmers exhibit positive attitudes, challenges such as limited availability of drone service providers (56.8%) and concerns about high charges (43.9%) hinder widespread adoption. The study recommends addressing these barriers to accelerate the integration of drone technology into paddy cultivation practices.

The findings also indicate that 79.3 per cent of farmers believe that government subsidies for drone services could significantly enhance their adoption (*Table 7*). This emphasises the crucial role of government support in reducing financial burdens and promoting widespread drone technology usage among farmers. The study reveals a high level of positive attitude among farmers in Jajahan Bachok, KADA Kelantan granary areas towards the utilisation of drones in paddy cultivation. The findings underscore the importance of addressing barriers, providing affordable services, and implementing government subsidies to foster the seamless integration of drone technology into agricultural practices. This research

TABLE 7
THE MEAN SCORE OF ATTITUDES AMONG FARMERS USING DRONES AS PART OF MECHANISATION FOR PADDY CULTIVATION IN KADA KELANTAN GRANARY AREAS

Factor	*Frequency*	*Percentage (%)*	*Mean*	*Standard deviation*
Attitude			3.99	0.526
Low	1	1.2		
Moderate	13	15.9		
High	68	82.9		

contributes valuable insights for policymakers, agricultural extension services, and drone service providers seeking to enhance farmers' acceptance and utilisation of innovative technologies in the context of paddy cultivation.

Practice among farmers using drones as part of mechanisation for paddy cultivation

The impact of farmers' practices on the acceptance of drone mechanisation in paddy cultivation is a critical factor. From the survey, the statement "I am confident that drones can save time, increase the yield of my paddy crop, and save labour costs for the long-term" reveals that 46.3 per cent of farmers agree, 45.1 per cent strongly agree, while 8.5 per cent express disagreement or agreement. This signifies that integrating drones into mechanisation of paddy cultivation is perceived favourably by farmers.

Similarly, the statement, "I use drones as a precise farming method to increase crop yields and profits" shows 53.7 per cent agreement, 30.5 per cent strong agreement, and 13.4 per cent expressing varying degrees of disagreement or agreement. This implies that farmers find drones user-friendly and effective, aligning with findings by Abdullahi *et al*. (2015) that endorse drones for precision agriculture due to their reliability, timeliness, and cost-effectiveness. Regarding resource optimisation, the statement, "I use drones to reduce the number of inputs needed for cultivation, such as water and pesticides" indicates 50 per cent agreement, 19.5 per cent strong agreement, and 15.9 per cent expressing disagreement or agreement. This suggests that usage of drones in mechanisation offers cost benefits to farmers by reducing overall field operating expenses.

Furthermore, farmers prioritise the expertise of drone operators, as evidenced by 59.8 per cent agreement and 32.9 per cent strong agreement with the statement, "I make sure that the drone operation in my paddy granary area is done by a trusted and skilled party to prevent losses." This underscores the importance of qualified drone operators in ensuring successful mechanisation. The use of drones for crop protection chemicals is endorsed by 53.7 per cent agreement and 32.9 per cent strong agreement with the statement, "I use drone mechanisation for crop protection chemicals as cover for both pesticides and herbicide spraying because it can reduce the risk of pesticides to humans". This emphasises the potential of drones to minimise health risks associated with traditional pesticide application.

Additionally, the statement, "I am confident drone technology can determine the optimal amount of spray material needed and ensure spraying is done evenly on the crop" gains

substantial support with 61 per cent agreement and 26.8 per cent strong agreement. This indicates high confidence in the accuracy, efficiency, and efficacy of drone technology in paddy cultivation. Farmers exhibit a significant reliance on agricultural officers or experts, with 48.8 per cent agreement and 23.2 per cent strong agreement with the statement, "I always refer to KADA agricultural officers or experts on all problems related to the use of drones." This reliance highlights the farmers' confidence in obtaining accurate information and adhering to regulations.

The adoption of drones for spraying activities is evident, with 43.9 per cent agreement and 25.6 per cent strong agreement with the statement, "Now I have used drones for all spraying activities in paddy fields." Farmers find this mechanised approach more comfortable, efficient, and less hazardous compared to traditional methods. Regarding compliance with authorities, 45.1 per cent of farmers agree with the statement, "I followed the procedures prescribed by the authorities in the use of drones for spraying activities in paddy fields." This indicates a substantial adherence to regulations set by KADA authorities.

Concerns about uneven spray coverage were expressed by a minority of farmers (15.9% agreement and 39.0% disagreement or agreement) with the statement, "I think drones for paddy cultivation are inappropriate because the field's input spray is uneven and does not cover the entire area." However, this concern is outweighed by the majority, supporting the efficiency of drone applications in providing even spray coverage.

Statistical evidence of the significant impact of farmers' practices on drone acceptance, with a high mean score of 3.85 and a standard deviation of 0.529 is shown in *Table 8*. This suggests that the farmers generally favour and engage in the practice of using drones as part of paddy cultivation mechanisation. This finding aligns with the study by Azizul *et al*. (2023), reinforcing the notion that farmers are inclined to adopt new technologies that enhance paddy production. In conclusion, the usage of drones in paddy cultivation field operations offers convenience, efficiency, and overall benefits to farmers in the region.

Level of acceptance of farmers using drones as part of mechanisation for paddy cultivation

The study aimed to gauge the acceptance of farmers towards utilising drones as part of mechanisation for paddy cultivation. Therefore,

TABLE 8
THE MEAN SCORE OF PRACTICE AMONG FARMERS USING DRONES AS PART OF MECHANISATION FOR PADDY CULTIVATION IN JAJAHAN BACHOK, KADA KELANTAN GRANARY AREAS

Factor	*Frequency*	*Percentage (%)*	*Mean*	*Standard deviation*
Practice			3.85	0.529
Low	1	1.2		
Moderate	24	29.3		
High	57	69.5		

further analysis was performed involving the mean scores and standard deviations, categorised into low (1.0 - 2.33), moderate (2.34 - 3.66), and high (3.67 - 5.0) levels. A questionnaire was distributed emphasising on the farmers' acceptance towards the utilisation of drones. The first statement in the questionnaire, "I know about the mechanism of drone technology in paddy granaries," received a high mean score (M=4.73, SD=0.545). A significant 78 per cent strongly agreed, indicating widespread farmers' acknowledgement of drone technology's mechanisms in paddy cultivation. Whilst the second statement, "I believe the mechanism of drone technology is effortless," garnered a mean score (M=4.49, SD=0.892), with 72 per cent strongly agreeing. This suggests that farmers perceive drone technology as a labour-saving and efficient mechanism for paddy field activities, in consistent with findings by Wachenheim *et al.* (2021).

Furthermore, the majority of farmers (30.5%) either disagreed or agreed, while 39 per cent agreed with the statement, "I think drone technology in paddy granaries is a priority in improving the quality of my paddy crop". This underscores farmers' belief that drone technology plays a crucial role in enhancing rice yield quality. Regarding the willingness to learn about drone technology, the statement, "I can take the time to learn about drone technology" received a mean score (M=4.59, SD=0.982), indicating farmers' readiness to acquire knowledge and integrate drone technology into paddy operations. The statement, "I am interested in using drone technology for better paddy crop yields," achieved a high mean score (M=4.59, SD=0.959) in which rice farmers, with 72 per cent strongly agreeing, expressed interest in utilising drones for improved crop yields, influenced by observed successes among fellow farmers.

Conversely, the statement, "I think the cost of using a drone in my paddy field is very affordable," received a moderate mean score (M=3.28, SD=0.959) where the farmers expressed varied opinions, with some finding drone services affordable, while others cited financial constraints. The statement, "I am interested in being exposed to the importance and benefits of drone technology to my paddy crop," garnered the second-highest mean score (M=4.67), indicating farmers' strong interest in understanding the advantages of drone technology for enhancing paddy crops. The final statement, "Financial factors caused me to use drone technology for my paddy granary area," achieved a mean score (M=4.51, SD=0.805). A substantial 69.5 per cent strongly agreed, suggesting that financial considerations, such as cost-effectiveness, motivate farmers to adopt drone technology.

The overall mean score for acceptance is high (M=4.23, SD=0.516) as shown in *Table 9*. This indicates that farmers in KADA Kelantan granary areas exhibit a high level of acceptance towards using drones as part of paddy cultivation mechanisation. This aligns with the study's objective, emphasising the need for government support to further promote drone technology application among farmers. Increased subsidies and assistance in acquiring drone technology, as suggested by Zheng *et al.* (2019), could further enhance the widespread adoption of this technology in paddy cultivation. The acceptance level, summarised in *Table 9*, is high with 80.5 per cent of farmers showing high acceptance thereby reinforcing the positive reception of drone technology in the studied region.

The relationship between knowledge, attitude and practices in relation to farmers' acceptance towards using drones as part of mechanisation for paddy cultivation

The study focused on exploring the relationship between farmers' knowledge, attitude, and practice concerning the acceptance of using drones as part of mechanisation for paddy cultivation.Spearman's Correlation was employed for the analysis, with knowledge, attitude, and practice as independent variables, and farmers' acceptance as the dependent variable. The primary aim was to test the hypothesis regarding the relationship between knowledge, attitude, and practice concerning farmers' acceptance of drone usage in paddy cultivation. The null hypothesis (H_0) posited no significant relationship, while the alternative hypothesis (H_1) suggested a significant connection.

The results, as presented in *Table 10*, demonstrated a weaker correlation between knowledge and farmers' acceptance (0.128), indicating a minimal association. Despite knowledge traditionally being a strong determinant of technology use, some farmers might lack specific knowledge, as suggested by Barnes *et al*. (2019). Attitude also exhibited a weaker correlation (0.019) with farmers' acceptance, suggesting that farmers' positive attitudes, influenced by training and personal experiences, play a minor role in their acceptance of drone technology.

Practice, too, showed a weaker correlation (0.202) with farmers' acceptance. This implies that the actual application or implementation of practices related to drone technology did not significantly influence farmers' acceptance. Hailu *et al*. (2016) suggested that consumers might perceive technology as valuable but challenging to use, impacting its adoption. Overall, the correlation analysis indicated weak relationship between knowledge, attitude, and practice concerning farmers' acceptance of using drones in paddy cultivation. Despite the high mean score (4.23) for farmers' acceptance, suggesting a generally favourable disposition, this was not strongly associated with knowledge, attitude, or practice.

The study attributed the low acceptance, in part, to the age demographics of the farmers. Only 7.3 per cent were categorised as young (20 to 30 years old), while a significant majority fell into the older age groups. Older farmers, especially those above 65, exhibited a strong preference for traditional farming methods, resisting the adoption of modern technology. This resistance is consistent with the Organisation for Economic Co-Operation and Development's (OECD) assertion that

TABLE 9
THE MEAN SCORE OF ACCEPTANCE AMONG FARMERS USING DRONES AS PART OF MECHANISATION FOR PADDY CULTIVATION IN KADA KELANTAN GRANARY AREAS

Factor	*Frequency*	*Percentage (%)*	*Mean*	*Standard deviation*
Acceptance			4.23	0.516
Low				
Moderate	16	19.5		
High	66	80.5		

TABLE 10
RESULT OF SPEARMAN'S RHO COEFFICIENT CORRELATION ANALYSIS

Spearman's rho		*Knowledge*	*Attitude*	*Practice*	*Acceptance*
Knowledge	Correlation	1.000	0.320**	0.390**	0.128
	Coefficient sig. (2-tailed)	-	0.003	0.000	0.253
	N	82	82	82	82
Attitude	Correlation	0.320**	1.000	0.486**	0.019
	Coefficient sig. (2-tailed)	0.003	-	0.000	0.866
	N	82	82	82	82
Practice	Correlation	0.390**	0.486**	1.000	0.202
	Coefficient sig. (2-tailed)	0.000	0.000	-	0.69
	N	82	82	82	82
Acceptance	Correlation	0.128	0.019	0.202	1.000
	Coefficient sig. (2-tailed)	0.253	0.866	0.69	-
	N	82	82	82	82

**Correlation is significant at the 0.01 level (2-tailed)

transitioning to new agricultural practices requires a cultural shift, particularly among older farmers. While farmers in KADA demonstrated an overall acceptance of drone technology for mechanisation in paddy cultivation, the slow adoption was influenced by factors such as age-related resistance to change. The study rejected the hypothesis of a significant relationship between knowledge, attitude, and practice, emphasising the need for targeted strategies to address the barriers to technology adoption, especially among older farmers in the region.

CONCLUSION

In conclusion, the study was aimed to assess farmers' acceptance of drone technology as part of mechanisation for paddy cultivation in the Jajahan Bachok, KADA, Kelantan granary areas. The study revealed a high level of acceptance, indicated by a mean value of M=4.23, although this acceptance did not correlate significantly with independent variables. Farmers demonstrated agreement on drone knowledge (M=4.04), attitude (M=3.99), and practice (M=3.85). Despite this acceptance, the Spearman correlation showed that though farmers knew about drone (knowledge) but this did not strongly affect their willingness to accept or use drone during the cultivation activities (correlation of 0.128). However, farmers' attitude towards drone (correlation of 0.019) and their actual practices related to use of drone in farming (correlation of 0.202) are more closely linked to their overall acceptance of this technology. In simpler terms, attitudes and practices play a more significant role in influencing the adoption of drone technology in farming compared to knowledge alone. Overall, while farmers acknowledged the potential benefits of drone technology in paddy granary areas, their slow adoption was attributed to factors such as limited drone service availability and perceived high costs. This is proven in this survey result, where 43.9 per cent of farmers mentioned that the high cost of services hindered their intention to utilise

drone spraying services within their paddy fields. Additionally, a significant 70.75 per cent of farmers agreed that drone operators in their areas were limited and unable to provide sufficient services to all farmers in the region. To bridge this gap, it is recommended that drone service providers conduct training and demonstration sessions to educate farmers, enabling them to make informed decisions about the suitability of drone technology for their needs. Hence, the government should take proactive measures to address the challenges posed by the insufficient number of drone service providers and the limited involvement of young individuals or entrepreneurs in agricultural mechanisation services. This can be achieved by introducing subsidies or coupon for drone application and usage to the farmer and service provider. Moreover, offering business seed funding to young individuals would not only encourage and motivate more young people to establish drone spraying businesses in the paddy granary areas but also address the challenge of insufficient labour within the paddy cultivation sector.

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