Advances in Agricultural Technology & Plant Sciences
ISSN: 2640-6586

Academic Strive
Researcher's Perception is our Reality

Research Article *Volume 4 Issue 5*

Application of Drone in Precision Farmimg: A Survey on Willingness Oil Palm Smallholder in Tanjung Sedili, Johor

Dani N*

University Technology MARA, Malaysia

***Corresponding author:** Nazurah Dani, 1Universiti Teknologi MARA (UiTM), Cawangan Melaka Kampus Jasin, Malaysia, Email: nazurah.dani1233@gmail.com

Received Date: August 08, 2021; **Published Date:** September 01, 2021

Abstract

Oil palm smallholder is one of the main contributors towards the oil palm industry in producing fresh fruit bunch for crude palm oil production in mill. The production form the smallholder would be around quarter of oil palm production for GDP for every year. However, nowadays sustainability of oil palm production was the key to bring a good quality of oil palm since the land sources become limited to b expended. As the remedy on this problem precision agriculture is the best way improve the quality of the production and it also will increase profitability of the smallholder itself. Unmanned Aerial Vehicle (UAV) or drone in remote sensing the branch of technology that been developing to improve the efficiency of management practices for smallholder in their planting area. The application type of UAV itself is variety that includes in vegetation health and disease detection, pest monitoring and yield monitoring. Somehow there are lot barrier to implement this technology since social demographic factor and readiness of the smallholder to move from conventional practices to precision farming. Those factors are cost, land area, labor and age that need further investigation to point out their major factor that restricts them.

Keywords: Smallholder; UAV; Application Type of UAV; Social Demography; Management practices of Smallholder

Abbreviations: MPOCC: Malaysian Palm Oil Certification Council; UAV: Unmanned Aerial Vehicles; PA: Precision Agriculture.

Introduction

The Malaysia Oil Palm Board also stated that palm oil is very attractive product since has a diversity of product from food until to fuel and the market price is below with other vegetable oils in the market (MPOB, 2019a). In Malaysia itself there are two type of smallholder producing palm oil in the market chain which is independent small holders and organized smallholder. In average, the small holder could have around 40.6 ha per person that been managing by themselves. Another statistic shows that on December 2018, the hectarage oil palm cover of smallholder is round 17% from all oil palm planted area which is 99,4022 ha in Malaysia. However, the land expansion in oil palm cultivation is limited since the rain forest in need to be preserved as oxygen's sources for world [1]. Regarding on those issues there is a need to decrease on opening new land for oil palm but it needs an action to increase the productivity at the

same time [2]. According to the Decisive Farming, precision agriculture is making all the farming activity will be more accurate and controlled with the approach of technology such as robotics, drones and GPS- based soil sampling. Oil palm (*Elaeis guineensis*) industry in Malaysia also implementing precision agriculture that allows remotes sensing as the new types of management in field. Remote's sensing is of the branch in the precision agriculture nowadays since it can help many farmers or producer to manage their farm precisely. Unmanned Arial System (UAV) or drone is one the advance in agriculture since it can provide many benefits to the farmers especially the oil palm smallholder to get the good quality of yield [3]. The advancement of the technology makes anything will be possible with the help of that could gather much information faster and precise. Thus, the information technology will provide full aspect needed in oil palm management which is the health and growth condition from spatially and temporally. Some might be rural farmers who, due to their remote locations, have extremely challenging significant exposure to mills and markets. Their crops are commonly low in yield, they use little to no technology, and soil destruction is rampant due to forest clearing, land burning, and fertilizer use [4].

Literature Review

Oil palm smallholders in Malaysia are divided into two types: independent smallholders and organized smallholders. Individual farmers who own 40.46 hectares or smaller and run their farm individually are classified as independent smallholders. Yap also said that likewise, smallholders play a vital part in the palm oil market, with smallholders occupying 38.8 percent of the total oil palm planted area in Malaysia, with independent smallholders accounting for 16.7 percent that also being supported number by MSPO itself on current situation (Malaysian Palm Oil Certification Council (MPOCC), 2021). Nonetheless, the technology and planting technologies utilized by smallholders differ significantly from those employed by large-scale planters in terms of cost and understanding of the application of cutting-edge technology. According to the journal in 2019, the precision agriculture is the solution to the issues regarding on the technical since the application need to be precise, so the it will reducing uncertainties in the agriculture management.

PA in the oil palm sector is centered on the use of remote sensing methods, which collect temporal and geographically distributed data on plants, soil, and environmental conditions of broad plantation regions. Furthermore according to Shafri, he saidthat characteristic of the oil palm itself making it more suitable for precision agriculture since their planting practices also the unique topography pattern and can easily be distinguishable with other plant especially on satellite imagery [5]. The first consideration on technology in the precision agriculture is remote sensing that usually used before the UAV technology development in monitoring all aspect agriculture for the past 35 yea [6]. Traditional (PA) operations in oil palm plantations, such as remote sensing and spraying, would be substituted by integrated fixed-wing or multirotor unmanned aerial vehicles (UAV), which allow data collecting to be instantaneously available for quick choices [7]. According to him from another journal saying that UAV will help for boosting oil palm productivity necessitates optimizing input returns while conserving resources by sensing, measuring, and assessing plantation health [8].

Methodology

A random sampling procedure will be employed to choose respondents from among agricultural laborers. Structured questionnaires will be used to collect data in June 2021. The sample towards these surveys is using around 100 oil palm's smallholders in the research in around Tanjung Sedili, Johor area and at the specific site is high density of oil palm cultivation area. To address communication issues, the surveys will be available in both Bahasa Malaysia since the population of the respondents is Malay. In this questioner it will be 2 section that need to be fill up by the respondent which is the 13 liker scale from 1-5 which is disagree until agree with the specific statement question regarding on their management practice that practically related to the UAV specification type. Also, at the end of questioner there is also few questions regarding on their demographic profile that include their gender, age, land size of oil palm and their monthly income. All question in the would open ended question that has few answers. Then, after the questionnaire being distributed all the result would be generated into excel format and will go through for critical data processing on SPSS version 21 for analysis on correlation and regression result.

Section A

The study followed established procedures recommended by Churchill (1979) and Gerbing and Anderson (1988) for developing the application of UAV measuring instrument, which included conceptual definitions for yield monitoring, vegetation indices and variable rate application Table 1.

UAV application types	Item code	Statement
Vegetation health and disease detection, this application type will help for early detection on any infection toward oil palm.	F4	I could guarantee each oil palm get sufficient nutrient from the fertilizer.
	P2	I could identify the number of oil palm had diseases.
	F5	I could know the soil fertility at the oil palm field.
Pest monitoring, this application type will gave accurate identification of spots of insect of pest infestation.	P3	I am could always monitor the health of oil palm regularly.
	P1	I am aware the oil palm tree had a problem regarding on pest and diseases
	P4	I could finish control and monitor pest and diseases activity in a short time.
Yield monitoring, this application type will give an optimal amount of inputs for creating further sustainability.	F4	I could guarantee each oil palm get sufficient nutrient from the fertilizer.
	F5	I could know the soil fertility at the oil palm field.
	H1	I could forecast the oil palm yield monthly.
	H5	I could make decisions to improve the oil palm performance based on yield
	F1	I know suitable fertilizer for the oil palm growth.
	F2	I am following fertilizer scheduling of oil palm precisely.

Table 1: UAV Applications and Statement.

Section B

On the second section, on this survey it would be few questions regarding on the of social demography of the respondent since it has some influence towards the application of this study. This influential factor was chosen based on previous study influence of demography factor that include age, gender, land size and level of education that significant value to the end result [9] (Table 2).

Social demographic factor	Optional answer
Gender	Male
	Female
Age Groups (Years)	20-29
	30-39
	40-49
	50-70
Land area groups (acres)	1-5
	6-10
	11-15
	16-20
Monthly income of oil palm yield (RM)	1000-3000
	4000-6000
	7000-9000

Table 2: Demographic Factor.

Results and Discussion

Correlation between Application Type for UAV with The Management Practices Score

Pearson's correlation analysis assesses the degree that quantitative variables are linearly related in a sample. In other words, it is used to test the linear relationship between two quantitative variables. In this study, Pearson correlation was used to examine the relationship between management scores among the respondents with UAV application type. Vegetation health and diseases detection with the management practices of the respondent. The strongest correlation is between instrument "I could guarantee each oil palm get sufficient nutrient from the fertilizer" with management practices score (($r = 0.766$; $p < 0.000$). Then, the lowest correlation in this vegetation health and disease detection was on instrument "I could identify the number of oil palm had diseases" with the management practices score which is $r = 0.920$ ($p < 0.000$). All the r values were range from +0.6 to +0.7, which indicated that all the variables had a very strong positive correlation.

According the statement saying that management practices in vegetation health and disease detection could be done accurately using applicable method that could be imply by the oil palm grower which is the combination technology hardware such as UAV and software such remote sensing spectrometer. All those software are the process between Early Detection of Ganoderma Basal Stem Rot of Oil Palms Using Artificial Neural Network Spectral Analysis using the

algorithm concept [10]. The strongest correlation could be found on instrument "I could finish control and monitor pest and diseases activity in a short time" with the management practices score which is r = 0.851 (p < 0.000). Then, as for the instrument "I am aware the oil palm tree had a problem regarding on pest and diseases" with management practices score show correlation on r = 0.765, (p < 0.000). That correlation value has significant impact on the application of pest monitoring of oil palm since it according to the journal saying that the UAV will help on early detection of Ganoderma diseases in the planting area. According to Shamsiri [8], the UAV imagery platform outfitted with a thermal camera and high-resolution RGB vision sensors was the remedy for accurately identifying areas in oil palm plantation fields plagued with specific diseases and pests [8].

Multiple linear regression between social demographic profile with management practices of smallholder

Multiple linear regressions using factor score was employed to identify the most influential factor for the respondents to practice sustainable practices. Factor scores were considered as independent variables for predicting the factor that highest influence towards the application of UAV by the smallholder using the following multiple regression model,

	Coefficients	SE	t- value	Probability	Tolerance	VIF
Practices Score	54.952	7.209				
Gender	-0.142	2.612	-1.219	0.227**	0.863	1.159
Age	0.013	0.101	0.110	0.912	0.877	1.141
Land area	-0.284	0.290	-2.593	0.011***	0.974	1.026
Monthly income	-1.216	2.173	-0.560	0.000**	0.	3.457
Foreign worker	0.055	2.393	0.023	0.982	0.903	1.107
R Square	0.100			SE estimate	10.221	
Adjusted R Square	0.053 Durbin-Watson	1.711				

Table 3: Multiple Linear Regression Model.

+Firstly, at Table 1 the coefficient value for constant and the factor is 54.952.The t- value for gender, age, land area, monthly income, availability of foreign worker variables were -0.142, 0.013,-0.284, -1.216, 0.055and respectively. All the three variables were significant at 5% and 10% level of significance.. The tolerance value for gender, age, land area, monthly income, availability of foreign worker variables were 0.863, 0.877, 0.974, 0.956, 0.903. These values fall under acceptable range. The VIF gender, age, land area, monthly income, availability of foreign worker were 1.159, 1.141, 1.026, 3.457, 1.107 respectively. All the VIF values were in acceptable level. It also parallel on study from Chanyoung Ju 2018 said that this technology system will help to reducing cost and labor requirement and the efficiency of the agricultural since the smallholder need to cover all the cost by themselves [11]. Another related study also supported this result which is economic advantages, as with many mechanical technologies, also seem to be significantly greater for big operations that can expanded their fixed costs over several acres and reduce operational costs through technology [12].

Recognizing the drivers of willingness of smallholder towards the social demographic variable will facilitated us to analyze the influencing factors for UAV application for smallholder in that area. The model fits well, having fulfilled the conditions for a predictive model in the significance and classification tests. The model'sgoodness-of-fitisindicatedbyasignificant modelChisquarevalue of 13.042 and probability of p\0.000, showing that the null model, which includes only the constant, has a poor fit and adding the predictors creates a better fit. The best- fitting model was created in six steps with the forward selection LR test. Nagelkerke's R2 (0.252) indicates a moderate relationship between the predictors and the prediction. The Hosmer–Lemeshow test also shows a good fit for the model. Classifying the dependent variable indicates that 84.1% of all cases are correctly classified to adoption of precision farming. This is better than the classification of 70.0% in the null model another indication that the model with predictors is significantly better. The result show the good influence in willingness of the smallholder towards the towards the land area, monthly income and the availability of the foreign worker. However, the some negative relationship

also could be seen on the gender and age. The Wald criterion employs p-values to illustrate the significant power of all predictors in the entire model. The Wald criterion is a Chi squared-based significance test.

Variable	Estimated	Wald	S.E. Coefficient (B)	P- Value (Sig.)	Odds Ratio/ Exp(B)
Ager	0.027	0.908	0.029	0.352	1.028
Gender	-0.877	1.15	0.818	0.937	0.416
Land area	1.941	1.858	1.424	0.011	6.963
Monthly income	-0.838	0.374	1.374	0.039	0.433
Foreign workers	-1.441	3.686	0.75	0.045	0.237
Constant	1.217	0.552	0.552	0.458	3.378
Cox and Snell R^2			0.147		
Nagelkerke R^2			0.252		
-2 Log likelihood			56.665		
Chi-square (Z^2)			13.042***(df = 5)		
Hosmer and Lemeshowgoodness of fit test			Z^2 = 10.934 (P-value = 0.205)		
Overall percentage (%)			84.1%		

Table 4: Estimation Of variables.

The value EXP (B) show that when land area was rise with one unit the ratio would be 6.96 times greater and it show that smallholder 6.96 more willing to apply the UAV for their oil palm. Another indication could be seen on the monthly income that show when the monthly income was rise with one unit ratio it will be 0.433 greater and it show that the smallholder 0.433 more willing to use the UAV for their oil palm management. Although, another demographic profile factor does not significant relationship towards application of UAV for oil palm by the smallholder. According to that, the result parallel with previous study regarding on the demographic factor impacted the adoption of new technology from their conventional practices which is farm size, labor and monthly income. Also other sociodemographic factors such as age and gender did not significantly related towards the results [13,14].

Conclusion

Oil palm was the main contribution income in the agriculture in for the grower and the consumer. This industry been contributing to GDP index annually since the consumption of the product were broad which is from local and international. Therefore, the grower for this industry also wider which could be divided into to main group which is big plantation that been monopolize by estate company or small scale plantation that been develop by smallholder. According to this study, the objective had been achieved to identify the suitable UAV application type that which is considered on vegetation health and disease detection, the pest monitoring and yield monitoring could be used by them since it was good investment for long term oil palm planting. This study also carried out was is the factor affecting the barrier that prevent the smallholder to applied UAV which is regarding on their social demographic profile that include the age, gender, land area, labor and monthly income of the smallholder and it show some of the factor really significant. Even though, the smallholder did not produce large scale of production somehow their population quite large. Somehow this oil palm grower needed some transformation which is precision agriculture (PA). PA was one of sustainable way to improve in the production and the quality of the oil palm by the smallholder. Unmanned aerial vehicle was one of the branches of precision agriculture that could be applied by the oil palm smallholder.

References

1. Herdiansyah H, Negoro HA, Rusdayanti N, Shara S (2020) Palm oil plantation and cultivation: Prosperity and productivity of smallholders. Open Agriculture 5(1): 617-630.

2. Dubos B, Baron V, Bonneau X, Dassou O, Flori A, et al. (2019) Precision agriculture in oil palm plantations: diagnostic tools for sustainable N and K nutrient supply. OCL 26(5): 1-8.

3. Tsouros DC, Bibi S, Sarigiannidis PG (2019) A review

on UAV-based applications for precision agriculture. Information 10(11): 1-26.

4. Rahman S (2020) Malaysian Independent Oil Palm Smallholders and their Struggle to Survive 2020. ISEAS Perspective 144: 1-16.

5. Bujang AS, Bakar BHA (2019) Precision Agriculture in Malaysia. International Workshop on ICTs for Precision Agriculture, pp: 1-130.

6. Mulla DJ (2013) Twenty five years of remote sensing in precision agriculture: Key advances and remaining knowledge gaps. Biosystems Engineering 114(4): 358-371.

7. Shamshiri RR (2016) A Lecture note on Unmanned Aerial Vehicles (UAV) to Support Precision Agriculture Research in Oil Palm Plantations, pp: 1-3.

8. Shamshiri RR, Hameed IA, Balasundram SK, Ahmad D, Weltzien C, et al. (2019) Fundamental Research on Unmanned Aerial Vehicles to Support Precision Agriculture in Oil Palm Plantations. Agricultural Robots - Fundamentals and Applications.

9. Thomas RC, Kenyon P, Morris S, Ridler A, Hickson R, et al. (2015) Influence of demographic factors on the use of farm management tools by New Zealand farmers. New Zealand Journal of Agricultural Research 58(4): 412-422.

10. Hoe JH, Shukor SAA (2019) Monitoring Oil Palm Tree Health-A Review. IOP Conference Series: Materials Science and Engineering 705(1): 1-10.

11. Ju C, Son H Il (2018) Multiple UAV systems for agricultural applications: Control, implementation, and evaluation. Electronics 7(9): 1-19.

12. Basso B, Antle J (2020) Digital agriculture to design sustainable agricultural systems. Nature Sustainability 3(4): 254-256.

13. Paustian M, Theuvsen L (2016) Adoption of precision agriculture technologies by German crop farmers. Precision Agriculture 18(5): 701-716.

14. Schmaltz R (2017) What is Precision Agriculture and How is Technology Enabling it.