

## Diffusion of oil palm farming innovation amongst smallholders



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### ABSTRACT

Palm oil is an important cash crop for Malaysia and determining the factors affecting the diffusion of this cash crop is considered a viable strategy for attracting farmers to take up palm oil farming. This study seeks to measure the influence of palm oil innovation characteristics, the level of knowledge, social system and communication channels towards acceptance of agricultural innovation among smallholder palm oil farmers. Diffusion of Innovation Theory is adopted in formulating the theoretical framework to measure how the palm oil innovation is diffused among the smallholder farming community. This study employed a quantitative approach to obtain data from smallholder farmers in an area in Sarawak, East Malaysia. A survey using a questionnaire was used to collect data from ninety-nine (99) sampled respondents representing the smallholder palm oil farmers. From the findings, only the characteristics of innovation and communication channels significantly influenced the acceptance of oil palm innovation among the farmers on the East Coast of Malaysia. However, unlike the characteristics of innovation, which positively influenced innovation acceptance, the influence of communication channels was negative. The use of communication channels, especially radio and new media for development should be geared up as an aspect of development communication.

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### 1. Introduction

With 50 percent of all products in European supermarkets containing palm oil and rising demand for biofuels in the EU, palm oil has emerged as the fastest-growing monoculture in the world. While consumption is spreading all over the world, production is still centered in Malaysia and Indonesia, which account for more than 80 percent of global production (Pye and Bhattacharya, 2013). Over the last couple of years, palm oil has become a widely and controversially discussed topic in Europe. This is not so much because of the plant itself, which is actually quite useful, but because of the rapid expansion of oil palm plantations across South-East Asia which is seen as causing the destruction of rainforests (Pye and Bhattacharya, 2013).

Palm oil is an important cash crop in Malaysia. Determining the factors affecting the diffusion and

acceptance of this cash crop is considered to be one of the most important strategies for attracting farmers to take up oil palm farming. The Malaysian government under different leaders have always attached importance to farming, especially cash crop and oil palm in particular. Prime Minister Abdallah Badawi's era witnessed the efforts put in promoting and making farming attractive to the people using the campaign tagline, "Pertanian adalah perniagaan" (Farming is a business). In attracting the people, a systematic diffusing of oil palm and its related innovations are crucial as Malaysia is one of the oil palm exporting countries.

Innovation is an idea, practice, or object perceived as new by an individual or other units of adoption. Innovation in agriculture is generally defined as the implementation of ideas, products, practices, processes, new services or apparent improvements in certain environments with attention to benefit the society and the individuals (Rogers, 2003). The diffusion process typically involves both mass media and interpersonal communication channels. In today's world, information technologies such as the Internet and cell phones—which combine aspects of mass media and interpersonal channels, represent formidable tools of diffusion (Morris and Ogan, 1996). Diffusion is the process by which an innovation is

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communicated through certain channels over time among the members of a social system (Rogers, 2003).

A central notion in the study of innovation is that technologies possess attributes or characteristics and that these characteristics have systematic effects on diffusion and assimilation. Innovations possess certain characteristics (relative advantage, compatibility, complexity, trialability, observability) which, as perceived by adopters, determine the ultimate rate and pattern of adoption (Rogers, 2003). Tornatzky and Klein (1982) provided a meta-analysis spanning Rogers' five characteristics and several others.

Communication channels range from conventional to new media of communication. Watermelon farmer's in Kenya use radios, fellow farmers and telephone calls to acquire agricultural information on watermelon production while extension officers, television, mobile text messages, farm magazines, and newspapers were channels that were least used (Ogola, 2015). This shows the importance of communication channels and agents in the diffusion of agricultural information. Radios, fellow farmers and telephone calls had numerous strengths, hence they were considered more advantageous by farmers than the other channels. Further, extension officers and radio were the two channels considered by many farmers in the study to have accurate information. In addition to the other channels, interpersonal communication channels are thus useful in the diffusion process.

In addition to the attributes of the innovation and communication channels, it is claimed that the value and the social system of the individual are critical to innovation adoption (Daghfous et al., 1999). Understanding the diffusion of any innovation can greatly increase the possibility of attracting many people to venture into such innovation (Rogers, 2003). In the context of palm oil and its relevant innovation, factors affecting the diffusion of this farm produce are very important to be determined. There have been numerous studies in relation to innovation diffusion ranging from family planning, technology to agricultural innovation to mention but a few (Sahin, 2006; Tanakinjal et al., 2010).

Education level, the extent of advice on the adoption of agricultural innovation, innovativeness, organization participation, agricultural knowledge, motivational activities and diffusion network had significant positive relationships with the role of opinion leadership in the diffusion of agricultural innovation. Annual income had no significant positive relationships with the role of opinion leadership in the diffusion of agricultural innovation. Besides, age and family size of the respondents had no significant negative relationship with the role of opinion leadership in the diffusion of agriculture. Besides opinion leaders, women were not left out in the diffusion of agricultural innovation as they played an indispensable role in agriculture and in improving the quality of life in rural areas (Ayoade and Akintonde, 2012). However, their contribution

often remains concealed due to some social barriers and gender bias.

This paper advances a conceptual model that integrates innovation attributes, communication channels and societal system factors that affect acceptance and diffusion of palm oil agricultural innovations. Understanding the diffusion of palm oil innovation can greatly increase the possibility of attracting more farmers to venture into palm oil farming (Rogers, 2003). It is important to understand the factors affecting the diffusion of any innovation in order to help speed up its uptake. In the context of palm oil and its relevant innovation, factors affecting the diffusion of this farm produce must be identified. This study will focus on the influence of the innovation characteristics or attributes of palm oil, level of knowledge, communication channels and societal background on the diffusion and acceptance of the palm oil innovations among smallholder farmers in East Malaysia.

This study embarks on the following objectives: To determine the level of understanding of palm oil innovation characteristics and the role of social system and communication channels in diffusion of the oil palm agricultural innovation among smallholder oil palm farmers; To measure the influence of palm oil innovation characteristics, the level of knowledge, social system and communication channels towards acceptance of agricultural innovation among smallholder oil palm farmers. This study employed a quantitative approach to obtain data from smallholder farmers in an area in Sarawak, East Malaysia. A survey using a questionnaire was used to collect data from ninety-nine (99) sampled respondents representing the smallholder oil palm farmers. Prior to the actual data collection, a pilot study involving 30 respondents was conducted to test and fine-tune the questionnaire.

## 2. Diffusion of innovation theory

Rogers's (2003) diffusion of innovation theory will be used to formulate the research framework for this study. The theory explains how innovations and ideas spread across the populations. He says in a social system the innovation is communicated by the process of diffusion. Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. Innovation is an idea, practice, or object perceived as new by an individual or other units of adoption (Rogers, 2003).

The diffusion of innovation theory analyses how the social members adopt the new innovative ideas and how they made the decision towards it. Both the mass media and interpersonal communication channel is involved in the diffusion process. The theory heavily relies on Human capital. According to the theory, innovations should be widely adopted in order to attain development and sustainability. In real-life situations, the adaptability of the culture

played a very relevant role where ever the theory was applied. Rogers proposed four elements of diffusion of innovations they were shown in Fig. 1.



Fig. 1: four elements of diffusion of innovations

### **Innovations**

An idea, practice, or object perceived as new by an individual. It can also be an impulse to do something new or bring some social change.

### **Communication channel**

The communication channels take the messages from one individual to another. It is through the channel of communication the Innovations spreads across the people. It can take any form like word of mouth, SMS, any sort of literary form, etc. Facebook, as the biggest social network site, has at the time of writing, effectively become a reflection for the Internet as such (Schaffar, 2016).

### **Social system**

An interrelated network group joints together to solve the problems for a common mission. The social system refers to all kinds of components, which construct the society like religion, institutions, groups of people etc. Further, Roger identifies the Mechanism of Diffusion of Innovation Theory through the six following stages:

### **Knowledge**

An Individual can expose the new innovation but they are not showing any interest in it due to lack of information or knowledge about the innovation.

Rogers' four main elements that influence the spread of new ideas (innovation, communication channels, time and a social system) rely heavily on human capital. The ideas must be widely accepted in order to be self-sustainable. Designers must consider various cultures and communities to predict how, why and at what rate new ideas and technology will be adopted. By categorizing consumers, the designer can identify particular segments with a market sector to gain feedback. By engaging with these stereotypes, the designer can utilize their experiences with a prototype in order to guide further development.

The impact of Rogers' innovation characteristics on the adoption of an innovation can be considered in terms of:

### **Relative advantage**

Relative advantage is "the degree to which the innovation is perceived as better than the idea it supersedes. Relative advantage refers to the extent to which the innovation is more productive, efficient,

costs less, or improves in some other manner upon existing practices".

### **Compatibility**

Compatibility is 'the degree to which the innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters. Innovation must be considered as socially acceptable to be implemented. And some innovations require much time and discussion before they become socially acceptable'.

### **Complexity (simplicity)**

Complexity (simplicity) is "the degree to which the innovation is perceived as difficult to understand and use".

### **Observability**

Observability is "the degree to which the results of the innovation are visible to others. The chances of adoption are greater if folks can easily observe the relative advantages of the new technology. In fact, after some adopt, observability can improve the diffusion effect, a critical component of technology transfers".

### **Trialability**

Trialability is "the degree to which the innovation may be experimented with on a limited basis. Innovations are easier to adopt if they can be tried out in part, on a temporary basis, or easily dispensed with after trial".

The diffusion of innovation theory is suitable to be used in this study. In the context of this study, the theory can be used as a guide to evaluate the impact and the role of communication channels for the dissemination of palm oil innovation among the farmers who have ventured into the palm oil industry. The various communication channels will be studied to evaluate their influence on the diffusion of oil palm innovation. The traditional and new media thus will be studied to understand their effects on the diffusion of oil palm and its related products and services among the youth. Hence, the effects of television, radio, newspaper and the new media on the diffusion of oil palm will be measured.

In addition, the characteristics of palm oil innovations will be studied to see their influence on the diffusion and acceptance of palm oil. The five characteristics put forward by Rogers, viz. Relative advantage, trialability, compatibility, observability, and complexity will be studied to evaluate their effect on the diffusion of oil palm innovation.

Since the study is conducted among smallholder farmers, who live in a social system, it is compelling to study the effects of their social environment on the diffusion of oil palm innovation. This will add more insight in understanding the factors that influence the diffusion of the oil palm and its related products and services among the farmers who, largely, are tied to their social environment.

## 2.1. Social system and diffusion of innovation

The social structure of society can be considered as a network of interdependence between individuals and eventually, will become an important network in the success of a community development program (Saad et al., 2017).

Findings show that if the person who brought a reform in the village was highly respected, it would be more easily accepted by the villagers as agreed by most (Mean=4.16, SD=0.60) of the respondents. This is followed by the statements, "The smallholder oil palm plantation farmers in this village are easy to accept something new if it is beneficial" (mean=4.15, SD=0.72) and "If the innovation is related to the work or activity we are doing now, it is easier to accept" (mean=4.15, SD=0.68). The mean scores for the social system are all high indicating an agreement by the farmers on the need for the social system in adopting an innovation. Studies have pointed out a number of societal factors such as socio-economic factors, agro-ecological variables, and farmers' perception as important determinants of diffusion of agricultural innovation ranging from improved maize varieties to palm oil. Among these factors, extension contact, education, farm size, credit availability, use of fertilizer, low land area, yield and profitability are found to be major determinants that have strong positive influences. The diffusion studies are found to be more focused on socio-economic variables in comparison to agro-ecological variables and farmers' perception (Iqbal et al., 1999; Kafle, 2010). In a similar study, Ghane et al. (2011) explored the effect of social influence and innovation characteristics in the adoption of integrated pest management (IPM) practices by paddy farmers in three provinces of Iran. The results of structural equation modeling showed that the hypothesized model fit the data. There is a positive and direct relationship between social influence, compatibility and trialability of and adoption of IPM practices.

## 2.2. Characteristics of innovation and diffusion

Senyolo et al. (2018) claimed that the inadequate adoption of innovative technologies in farming still remained a problem. Senyolo et al. (2018) sought to identify available climate-smart agricultural technological innovations in South Africa and explored their characteristics and context of use using an exploratory research approach. An overview of climate change risks and variability in South Africa and a framework to classify the technological innovations is established based on a literature review. Interviews with expert stakeholders are used to characterize and collect information on available technologies. Results indicate that conservation agriculture, rainwater harvesting and seed varieties that are drought tolerant and early maturing may be the most suited technologies for climate-smart agriculture in South Africa, particularly for smallholder farmers.

However, high initial investment costs, additional labor requirements and management intensity associated with conservation agriculture and rainwater harvesting may pose problems within the South African context. Drought Tolerant and Early Maturing Seed Varieties were noted as less costly and less management intensive, creating better prospects for adoption. The study served as an initial assessment through the exploration of the available climate-smart agricultural technologies in South Africa. It is essential given that the agricultural sector is faced with the dilemma of responding to climate change-related challenges whilst increasing the productivity of farmers.

Farquharson et al. (2013) set to test the processes of farm-level change and the adoption of new technologies in Cambodia and its relation to the adaptability characteristics of the technology. The literature posits that technologies can be assessed in terms of relative advantage, compatibility, complexity, trialability and observability. Farquharson et al. (2013) claimed that other socio-economic factors might also be important in the adoption process. They tested the propositions among commercial upland farmers in north-west Cambodia for rhizobium inoculation of legume seeds to increase crop yields. In promoting this technology, the objective was to increase farm income and help to reduce poverty and improve food security.

## 2.3. The relative advantage of an innovation

The experiences of a selection of farmers in New South Wales in implementing innovative land management practices and processes were highlighted by McKenzie (2013). The findings revealed that the implementation of new practices and processes requires an ongoing process of innovation and change—something which is too often ignored when the focus is on the point of 'adoption'. Despite the innovation, processes being time and resource-consuming, and without any guarantee of success, the farmers interviewed were working to implement changes. If researchers and policymakers could contribute to this effort through the creation of new opportunities, not only would an enabling environment for innovation be created but also opportunities for sustainability. The importance of fostering ongoing innovation that enhances both agricultural productivity and sustainability cannot be overemphasized. In this study, the smallholder farmers agreed on the importance of the relative advantage of an innovation. The statement, "I will adopt an innovation if it can help increase my income" was highly agreed (Mean=4.25, SD=0.66) by most of the respondents. This is followed by the statements, "I support any innovation if it can support me to diversify my income" (mean=4.18, SD=0.63) and "I will support innovation if it can minimize my workforce" (mean=4.17, SD=0.66). As in the case of a social system, the mean scores for relative advantage are also high, pointing to the relevance of this dimension in acceptance of an

innovation. In determining the factors affecting farmers' adoption of innovation in Delta State of Nigeria, (Egwu, 2015), the most prominent factors that hinder the adoption of agricultural innovation by farmers in Delta State are poor extension services from change agents, climatic, fund/incentives and fear of loss and cost of innovation while factors such as superiority, profitability, simplicity and compatibility of an innovation promote its adoption.

#### 2.4. Compatibility of an innovation

If innovation is compatible with an individual's needs, then uncertainty will decrease and the rate of adoption of the innovation will increase. Thus, even naming innovation is an important part of compatibility. What the innovation is called should be meaningful to the potential adopter. What innovation means also should be clear. This is part of the complexity attribute (Sahin, 2006). The compatibility of innovation is in relation to its diffusion as agreed by the smallholder farmers. The statement, "I will adopt poisoning techniques if poison safety measures are clearly stated" was highly agreed (Mean=4.37, SD=0.65) by most of the respondents. This is followed by the statements, "I will use pruning machinery if the pruning will not be damaged" (mean=4.32, SD=0.65). The mean scores for compatibility are all high reinforcing the importance of this dimension in the process of diffusion of palm oil innovation.

#### 2.5. Complexity (Simplicity) of an innovation

The complexity of an innovation is in relation to its diffusion as agreed by the smallholder farmers. The statement, "I will adopt new technology in farming if it is not hard for me to understand and use" was somehow agreed (Mean=3.76, SD=0.82) by most of the respondents. This is followed by the statements, "I do not have difficulties in using the trimming machine for my farming activities" (mean=3.75, SD=0.77) and "I do not have difficulties in using pesticides spraying machine on my crop" (mean=3.72, SD=0.77). The finding shows all the mean scores for complexity are high, an indication of the influence of this dimension on acceptance of palm oil innovation.

#### 2.6. Trialability of an innovation

The trialability characteristic of innovation is in relation to its diffusion as agreed by the smallholder farmers. The statement, "I have no problem engaging in oil palm farming because my family is also involved" was somehow agreed (Mean=4.06, SD=0.73) by most of the respondents. This is followed by the statements, "My involvement in the oil palm sector made me interested in becoming a farmer" (mean=3.98, SD=0.68) and "I am daring in trying new things related to oil palm agriculture innovation" (mean=3.97, SD=0.65). The mean scores

for trialability are all high, yet confirming the relevance of this dimension in the diffusion of the palm oil innovation. Trialability is positively correlated with the rate of adoption. The more innovation is tried, the faster its adoption is. As discussed in the implementation stage of the innovation-decision process, reinvention may occur during the trial of the innovation. Then, the innovation may be changed or modified by the potential adopter. Increased reinvention may create a faster adoption of the innovation. For the adoption of an innovation, another important factor is the vicarious trial, which is especially helpful for later adopters. However, Rogers (2003) stated that earlier adopters see the trialability attribute of innovations as more important than later adopters (Sahin, 2006).

#### 2.7. Observability of an innovation

The observability attribute of innovation in relation to its diffusion as agreed by the smallholder farmers. The statement, "I see many smallholders of oil palm earn a good income in this sector" was somehow agreed (Mean=4.09, SD=0.64) by most of the respondents. This is followed by the statements, "I am involved in oil palm agriculture as this sector is a major contributor to national income (mean=4.02, SD=0.59)" and "Overall, this new technology is very valuable to me" (mean=3.94, SD=0.74). The mean scores for observability are all high pointing to the relevance of this dimension in diffusing palm oil innovation. The study surveyed farmers who have been involved in a project testing and demonstrating rhizobium inoculation (along with other technologies) and statistically analyzed the results. The researchers found that, with respect to their rhizobium-adoption intentions, relative advantage (incentive) is the predominant characteristic, with observability also being important. Other socio-economic characteristics in their adoption, intentions included whether they grew legumes, the source of the first contact, the period since the technology was introduced, and the size of the farm (Farquharson et al., 2013).

#### 2.8. Communication channels and diffusion of innovation

Past studies have revealed that the role of communication channels is very pertinent in the diffusion process where they are found to be present at every stage. A study by Siangu (2015) showed that channels of communication have had a significant effect on the diffusion of innovation. On the basis of this analysis, Siangu (2015) established that communication channels used in the diffusion of innovation were influential in the way the social system received and reacted to innovation. The study, therefore, recommends that continued utilization of the various communication channels available in the diffusion of innovation is key to remaining competitive.

Mahamood et al. (2016) claimed that the use of communication technology as the innovation in the agricultural information delivery channel among farmers is still low, especially among the developing countries. This phenomenon has sparked the researcher's initiatives to study the agricultural information delivery channel, particularly in agricultural development activities among the farmers under the auspices of the Muda Agricultural Development Authority (MADA). In soliciting the decision-making phase of accepting the innovation, there are a few drawbacks of the channel as it was shown by Innovation Diffusion Theory. The rapid development of communication technology has led to a two-way, interactive and easy-access media channel, which previously dashingly dependent on conventional media and agricultural agency. The study variables include the relative advantages, the trialability, the suitability, the complexity, and the observability as had been described by Rogers (2003). Additionally, variables such as effort expectancy, performance expectancy, social influences and facilitating conditions are taken into account to facilitate the dissemination of information on the paddy plantation. This study will use a quantitative method in which opinions through a questionnaire will be collected. A total of 398 farmers were involved as the respondents of the study. The quantitative data were analyzed using SPSS Version 21. The study is expected to improve the use of communication technology channels in paddy plantation to gain better and more knowledge on paddy plantation in order to increase rice production.

Ochiengo (2014) investigated the influence of communication on the adoption of agricultural innovation and technology. The study used a case of the System of Rice Intensification (SRI), which was introduced to farmers in the Mwea Irrigation Scheme in 2009. The study findings showed that the education of the farmers and the experience of the farmer influence the adoption of SRI. In terms of communication, the frequency of interaction between farms and extension officers, availability of information on SRI were the most significant determinants of adoption whereas the source of information was the least. The barriers of adoption were the investment costs and inadequate information on SRI. The study concluded that the frequency of communication between the farmers and extension agents was a significant communication factor affecting the adoption of SRI among the Mwea Irrigation Scheme farmers.

Kigatiira et al. (2018) investigated the effect of communication channels used between extension officers and farmers on the adoption of Irish potato farming. The target population for this descriptive study comprised farmers from four sub-locations (Kimbo, Gathuine, Kiamio, Mburugiti) of Kibirichia Ward in Meru County and all the three extension officers involved in the production of the Irish potato crop. The findings of the study revealed that the mass media and interpersonal channels of

communication used for information exchange between farmers and extension officers enhanced adoption of Irish potato farming. The mass media used were posters, leaflets and letters while interpersonal communication channels included meetings, demonstrations, mobile phone calls, SMS, seminars, field days and workshops. Further, farmers reported that they understood extension information disseminated through the communication channels because they created an enabling environment for information exchange (feedback). The use of mass media and interpersonal channels to communicate extension information leads to the high adoption of agricultural innovations. The researcher recommended that there is a need to find the effect of communication channels used between extension officers and farmers on the rate of adoption on Irish potato farming. In this study communication channels comprise of interpersonal communication, conventional media and new media

### 2.8.1. Interpersonal communication and diffusion of innovation

Farmers' use and preference of extension communication channels in Benue State, Nigeria were assessed (Okwu and Daudu, 2011). Interpersonal communication channels were generally found to be more available, accessible and used by the farmers than the mass media to obtain information on improved farm technologies. Relatives/friends/neighbors constituted the most regularly available, accessible and used interpersonal channels although extension agents and television were mentioned by the farmers as the most preferred interpersonal channel and mass medium, respectively. Chi-square analysis shows that there is a significant relationship between frequency of communication channels used by farmers and their educational level, sex, farm size and farming experience. It is recommended that rural radio booster stations and community rural television stations are established to feature special programs targeted at rural farmers. To ensure regular availability and accessibility of extension agents (the farmers most preferred channel), efforts should be made to employ more extension agents. This study shows, "I often deal with related institutions to get the latest information and the best ways from planting to harvesting" was highly agreed (Mean=3.74, SD=0.86) by most of the respondents. This is followed by the statements, "I often ask advice from farmers/entrepreneurs who have succeeded on how to succeed like them (mean=3.68, SD=0.90)" and "I'm willing to share new ideas with youth and residents here" (mean=3.67, SD=0.86).

### 2.8.2. Conventional media and diffusion of innovation

Ogola (2015) sought to establish the communication channels used by watermelon

farmers in Yimbo East Ward to access Agricultural information, the impact of the Agricultural information and challenges the farmers experience while trying to access the information. The study found out that most of the watermelon farmers use radios, fellow farmers and telephone calls to acquire agricultural information on watermelon production while extension officers, television, mobile text messages, farm magazines and newspapers were the channels which were least used. The study concluded that radios, fellow farmers and telephone calls had numerous strengths, hence they were considered more advantageous by farmers than the other channels. Further, extension officers and radio were the two channels considered by many farmers in the study to have accurate information. There is, therefore, a need to establish a community FM radio station to promote the dissemination of information on watermelon production and knowledge to farmers in the region because of numerous advantages of radio. Farmers need to be engaged, persuaded and shown the benefits of a variety of communication channels and through farmer's field days and demonstrations in order for them to learn, ask questions and provide their own feedback to the extension officers as well as researchers. In this study, conventional media such as radio and television do not play a meaningful role in the process of diffusion in the life of the smallholder palm oil farmers. The statement, "I read pamphlets/magazines issued by agricultural agencies for information on innovation" was highly agreed (Mean=3.71, SD=1.21) by most of the respondents. This is followed by the statements, "I watch television to find out about the palm oil industry. (mean=3.63, SD=0.88)" and "The success news of farmers published in the press prompted me to be involved in this sector" (mean=3.59, SD=0.85).

### 2.8.3. New media and diffusion of innovation

Similar to conventional media, all the items for new media scored an average mean, an indication that the new media are not being largely used as agents of diffusion by the palm oil farmers. The statement, "The Internet makes it easier for me to get new ideas related to oil palm" was the highest (Mean=3.05, SD=1.31) though average, among the items. This is followed by the statements, "The new media is my main source of information on the oil palm industry (mean=3.03, SD=1.27)" and "I trust information regarding the latest developments of oil palm posted via social media" (mean=3.00, SD=1.33). It is timely that the farmers in East Malaysia make full use of the new digital technology to learn about palm oil innovation. The new digital technology has had a tremendous impact on civil society. Thongsawang (2016) claimed that the new digital and social media applications have affected the organization of Thai immigrants on both individual and institutional levels, with a particular focus on the Royal Thai Embassy in Berlin. The new media have brought about changes in communication and their

implications have had important ramifications on communities. The case of Thai immigrants is not different from Myanmar where social media, especially Facebook, was said to dominate everything: businesses, public, media, etc. Facebook and news applications are very important for the people as they receive news through these applications (Einzenberger, 2016).

### 2.9. Acceptance of innovation

All the items under acceptance of innovation achieved a high mean score pointing to the fact that the farmers are ready to accept any new palm oil innovation that will improve their life. The statement, "To encourage acceptance spare parts of farming machinery should be easy to obtain." was highly agreed (Mean=4.22, SD=0.66) by most of the respondents. This is followed by the statements, "If crop yields can increase, I have no hesitation in accepting any new palm oil innovation" (mean=4.21, SD=0.69)" and "The innovation should be cheap and profitable" (mean=4.21, SD=0.69). The general mean of the variables as shown in Table 1. To create new knowledge, technology education and practice should provide not only a how-to experience but also a known-why experience (Seemann, 2003). In fact, an individual may have all the necessary knowledge, but this does not mean that the individual will adopt the innovation because the individual's attitudes also shape the adoption or rejection of the innovation (Sahin, 2006). Overall, except for communication channels, all the variables affecting the acceptance of oil palm innovation among the smallholder farmers revealed high means indicating that they play important role in accepting the oil palm innovation among the farmers.

**Table 1:** General mean of the variables

Items	Mean*	SD
Social system	4.13	0.56
Relative advantage	4.18	0.56
Compatibility	4.16	0.49
Complexity	3.71	0.71
Trialability	3.98	0.54
Observation	3.98	0.55
Interpersonal communication	3.63	0.75
Conventional communication	3.57	0.91
New Media	2.94	1.20
Innovation acceptance	4.17	0.61

\*Strongly Disagree (1), Disagree (2), Somehow Agree (3), Agree (4), Strongly Agree (5); Low (1-2.32), Average (2.33-3.66), High (3.67-5)

### 2.10. Influence of innovation characteristics on acceptance of oil palm innovation

The influence of social background, level of knowledge, characteristics of innovation and communication channels that showed in Table 2, account for 51.9 percent of the variance inherent in innovation acceptance. This suggests that the model of innovation acceptance is moderately high in explaining the influence of the variables on the palm oil innovation acceptance among the smallholder oil palm farmers.

Moreover, the value of the F model showed significant statistical influence ( $F= 27.486$ ,  $\rho<.000$ ). This demonstrates that the built model in determining important factors influencing acceptance of innovation is valid. Therefore, the null hypothesis was rejected due to the fact that there was strong statistical evidence to conclude that the model for innovation acceptance based on social background, level of knowledge, innovation characteristics and communication channels influence oil palm farmers to engage in oil palm farming, is valid. Based on the findings, social background ( $\beta= .155$ ,  $\rho> .01$ ) and level of knowledge ( $\beta= .065$ ,  $\rho> .05$ ) are insignificant. While the characteristics of innovation have positive and significant influence ( $\beta= .927$ ,  $<.05$ ), communication channels have negative and significant influence ( $\beta= -.358$ ,  $<.01$ ). Therefore, the null hypothesis was rejected as there was strong statistical evidence to

conclude that innovation acceptance was based on social background, level of knowledge, innovation characteristics and communication channels in influencing farmers to participate in the oil palm sector. However, it can be concluded that the characteristics of innovation and communication channels are the only factors that significantly influence the acceptance of oil palm innovation. Unlike characteristics of innovation, which positively influence innovation acceptance, the influence of communication channels was negative.

To get further insight into the data, multiple regression of all the dimensions with acceptance of innovation was carried out. Interestingly only trialability ( $\beta=0.397$ ,  $\text{sig}=0.000$ ) and compatibility ( $\beta=0.334$ ,  $\text{sig}=0.000$ ) were significant, with a substantial beta and t value effects. Beta and t values of the dimensions were shown in Table 3.

**Table 2:** Social background, level of knowledge, characteristics of innovation and communication channels account

	B	t value	Sig.	Adjusted R <sup>2</sup>	F	Sig.
(Constant)	0.375	0.801	0.425			
Social background	0.155	1.457	0.148			
Level of Knowledge	0.065	0.583	0.501	0.519	27.486	0.000**
Innovation characteristics	0.927	5.756***	0.000			
Communication channel	-0.358	-3.729***	0.000			

Note: \*\* Significance level at 0.01

Despite the fact that social background does not have a significant influence on the acceptance of innovation, nevertheless, it is still an important factor for the farmers as it scored a high mean. Thus, it is clear that the social system plays an important role in bringing about changes in agriculture among smallholder farmers. It is also evident that the mean scores for complexity are all average. This could be related to the level of education of the farmers as most of them only have primary education.

**Table 3:** Beta and t values of the dimensions

Dimensions	Beta	T	Sig.
Conventional Media	-.129	-1.267	.209
New Media	.089	.869	.387
Interpersonal Communication	-.152	-1.598	.114
Observability	.025	.252	.802
Trialability	.397	4.016	.000
Complexity	-.005	-.066	.948
Compatibility	.334	3.979	.000
Relative advantage	.063	.642	.523
Spraying technique	.079	.699	.486
Farming equipment	-.008	-.071	.944
Social background	.090	.824	.412

The farmers attested to the importance of the Internet as they agreed that the Internet makes it easier for them to get new ideas related to oil palm. The social impacts of the internet and social media are best understood as the result of the organic interaction between technology and social, political, and cultural structures and relationships (Lengauer, 2016). However, it did not have a positive influence on their acceptance of oil palm innovation.

From the findings, only the characteristics of innovation and communication channels significantly influenced the acceptance of oil palm innovation among the farmers on the East Coast of

Malaysia. However, unlike the characteristics of innovation, which positively influenced innovation acceptance, the influence of communication channels was negative. This might be because the available communication channels did not provide the farmers with information on agricultural innovation, rather mainly for entertainment or general news. The age group of the farmers who are mainly above 40 years of age and do not use new media as compared to the younger generation might have limited their information source for agriculture innovation. According to Saad et al. (2018), for the village community, newspapers, radio and television are their main source of information. Efforts to search for information through the internet is still less. For a village far from the city center, they do not have the internet to get information. Thus, reliance on sources of information is not fully developed. Although there are constraints in obtaining information via websites, social media are important intermediaries for all the informants interviewed.

Furthermore, education and income might be among the stumbling blocks to getting access to information on agriculture innovation via communication channels both conventional and new media. A large number of the farmers have only primary to secondary education coupled with their low household income, hence impeding access to vital agriculture innovation information. Palm oil smallholders have to turn to new farming and harvesting technologies to be more productive for generating high income (Awang, 2016).

Diving deeper into the data, it was found that only trialability and compatibility dimensions of innovation characteristics had a significant influence

on the acceptance of innovation. Both dimensions had substantial beta and t value effects. This could mean the farmers were not exposed to communication channels and did not use communication channels to get information on farming innovation. This might seem like an irony with new media channels of communication becoming commonplace in the community. The reason for lack of usage could be explained by the very nature of the farming community, which is rural and might not have access to the Internet. In contrast, the urban residents in Malaysia, for example, are said to use new media in transforming their living standards (Salman et al., 2015). Similarly, the digital maturity of Malaysians is said to be at an encouraging level meaning Malaysians, in general, use the Internet and its related technology in their day to day activities ranging from social usage to education and shopping online (Azman et al., 2014). Moreover, their knowledge of agricultural innovation did not also have any influence on their acceptance of agricultural innovation. Similarly, the societal background of the farmers did not influence their acceptance of agricultural innovation. This could be due to the societal environment, which is low in education and income. The finding of this study did not concur with Farquharson et al. (2013) where relative advantage (incentive) is the predominant characteristic, with observability also being important. Meanwhile, the findings of the study by Egwu (2015) supported the findings of this study in relation to the positive influence of compatibility on acceptance of farming innovation. The results of Egwu's (2015) study showed that compatibility promotes the adoption of farming innovation.

### 3. Conclusion

It is obvious from the study that, in promoting a farming innovation in a rural setting among less-educated farmers, much importance should be put on the innovation characteristics, especially, trialability and compatibility. Farmers, especially those living in rural areas of developing countries as this study shows, due to their low level of education and low income, tend to give face value to innovation. The use of communication channels for development should be geared up as an aspect of development communication. This is a missed opportunity as farmers nowadays do have social media account and innovative ways of farming could be diffused to the farmers via social media apps. Studies have shown the influence of communication technology channels in diffusing innovative farming techniques (Mahamood et al., 2016; Siangu, 2015). If researchers and policymakers could contribute to this effort through the creation of new opportunities, not only would an enabling environment for innovation be created but also opportunities for sustainability. The importance of fostering ongoing innovation that enhances both agricultural

productivity and sustainability cannot be overemphasized.

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### Compliance with ethical standards

### Conflict of interest

The authors declare that they have no conflict of interest.

### References

- Awang AH, Hashim K, Ramli Z, Lyndon N, and Ali MN (2016). The effects of technology transfer, good agriculture practices on the productivity of independent palm oil smallholders. *Journal of Economic and Management Perspectives*, 10(4): 300-304.
- Ayoade AR and Akintonde JO (2012). Constraints to adoption of agricultural innovations among women farmers in Isokan Local Government Area, Osun State. *International Journal of Humanities and Social Science*, 2(8): 57-61.
- Azman H, Salman A, Razak NA, Hussin S, Hasi MS, and Hassan MA (2014). Determining digital maturity among ICT users in Malaysia. *Jurnal Komunikasi: Malaysian Journal of Communication*, 30(1): 22-34. <https://doi.org/10.17576/JKMJC-2014-3001-02>
- Daghfous N, Petrof JV, and Pons F (1999). Values and adoption of innovations: A cross-cultural study. *Journal of Consumer Marketing*, 16(4): 314-331. <https://doi.org/10.1108/07363769910277102>
- Egwu EW (2015). Factors affecting farmer's adoption of agricultural innovation in Delta State. *Global Journal of Agricultural Economics, Extension and Rural Development*, 3(2): 177-182.
- Einzenberger R (2016). "If it's on the internet it must be right": An interview with Myanmar ICT for development organisation on the use of the internet and social media in Myanmar. *Austrian Journal of South-East Asian Studies*, 9(2): 301-310.
- Farquharson RJ, Martin RJ, McCorkell BRUCE, Scott JF, Sotheary E, Phaloeun CHAN, and Sokun B (2013). Characteristics of an agricultural innovation and incentives for adoption: Rhizobium in Cambodia. *International Journal of Environmental and Rural Development*, 4(2): 44-39.
- Ghane F, Samah BA, Ahmad A, and Idris K (2011). The role of social influence and innovation characteristics in the adoption of integrated pest management (IPM) practices by paddy farmers in Iran. In the International Conference on Social Science and Humanity IPEDR, IACSIT Press, Singapore, Singapore, 5: V2-217- V2-220.
- Iqbal M, Bashir A, and Farooq U (1999). Factors affecting the adoption of hybrid maize varieties in the irrigated Punjab. *International Journal of Agriculture and Biology*, 1(3): 149-151.
- Kafle B (2010). Determinants of adoption of improved maize varieties in developing countries: A review. *International Research Journal of Applied and Basic Sciences*, 1(1): 1-7.

- Kigatiira KK, Mberia HK, and Wangula K (2018). The effect of communication channels used between extension officers and farmers on the adoption of Irish potato farming. *International Journal of Academic Research in Business and Social Sciences*, 8(4): 377-391.  
<https://doi.org/10.6007/IJARBS/v8-i4/4020>
- Lengauer D (2016). New media in Southeast Asia: Concepts and research implications. *Austrian Journal of South-East Asian Studies*, 9(2): 187-193.
- Mahamood AF, Mohammed R, and Ahmad MK (2016). The use of communication technology channel in agricultural development by Malaysia Muda agricultural development authority (MADA). *Asia Pacific Journal of Education, Arts and Sciences*, 3(2): 27-36.
- McKenzie FC (2013). Farmer-driven innovation in agriculture: Creating opportunities for sustainability. Ph.D. Dissertation, University of Sydney, Sydney, Australia.
- Morris M and Ogan C (1996). The internet as mass medium. *Journal of Communication*, 46(1): 39-50.  
<https://doi.org/10.1111/j.1460-2466.1996.tb01460.x>
- Ochiemo JT (2014). Influence of communication on adoption of agricultural innovation: A case of the system of rice intensification in MWEA irrigation scheme. M.Sc. Thesis, School of Journalism at the University of Nairobi, Nairobi, Kenya.
- Ogola PA (2015). Assessing communication channels and the impact of agricultural information used by farmers in watermelon production in Limbo East Ward, Siaya County. M.Sc. Thesis, University of Nairobi, Nairobi, Kenya.
- Okwu OJ and Daudu S (2011). Extension communication channels usage and preference by farmers in Benue State, Nigeria. *Journal of Agricultural Extension and Rural Development*, 3(5): 88-94.
- Pye O and Bhattacharya J (2013). The palm oil controversy in Southeast Asia: A transnational perspective. ISEAS Publishing: Institute of Southeast Asian Studies, Singapore, Singapore.  
<https://doi.org/10.1355/9789814311458>
- Rogers EM (2003). *Diffusion of innovations*. 4<sup>th</sup> Edition, Free Press, New York, USA.
- Saad S, Abdullah MY, and Lyndon N (2017). Peranan pemimpin pendapat dalam penyebaran inovasi penanaman kelapa sawit. *Jurnal Komunikasi: Malaysian Journal of Communication*, 33(2): 73-88.  
<https://doi.org/10.17576/JKMJC-2017-3302-06>
- Saad S, Salman A, Abdullah MY, Lyndon N, and Azima AM (2018). Personal characteristics of opinion leader in influencing youth involvement in oil palm industry. *International Journal of Academic Research in Business and Social Sciences*, 8(13): 130-141.
- Sahin I (2006). Detailed review of Rogers' diffusion of innovations theory and educational technology-related studies based on Rogers' theory. *Turkish Online Journal of Educational Technology-TOJET*, 5(2): 14-23.
- Salman A, Abdullah MYH, Mustaffa N, and Mahmud WAW (2015). Sustaining internet usage in the emerging digital economy: Transforming urban living? *Journal of Asian Pacific Communication*, 25(2): 169-180.  
<https://doi.org/10.1075/japc.25.2.01sal>
- Schaffar W (2016). New social media and politics in Thailand: The emergence of fascist vigilante groups on Facebook. *Austrian Journal of South-East Asian Studies*, 9(2): 215-234.
- Seemann K (2003). Basic principles in holistic technology education. *Journal of Technology Education*, 14(2): 28-39.  
<https://doi.org/10.21061/jte.v14i2.a.3>
- Senyolo MP, Long TB, Blok V, and Omta O (2018). How the characteristics of innovations impact their adoption: An exploration of climate-smart agricultural innovations in South Africa. *Journal of Cleaner Production*, 172: 3825-3840.  
<https://doi.org/10.1016/j.jclepro.2017.06.019>
- Siangu GW (2015). Role of communication channels in the diffusion of organizational innovations: A case study of mumias sugar Company-Kenya. Ph.D. Dissertation, Moi University, Eldoret, Kenya.
- Tanakinjal GH, Deans KR, and Gray BJ (2010). Innovation characteristics, perceived risk, permissibility and trustworthiness in the adoption of mobile marketing. *Journal of Convergence Information Technology*, 5(2): 112-123.  
<https://doi.org/10.4156/jcit.vol5.issue2.13>
- Thongsawang S (2016). Mobile technology in the lives of Thai immigrants in Germany. *Austrian Journal of South-East Asian Studies*, 9(2): 295-300.
- Tornatzky LG and Klein KJ (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, EM-29(1): 28-45.  
<https://doi.org/10.1109/TEM.1982.6447463>