EXPLORING OF FACTORS RELATED TO THE E-FISHERY TECHNOLOGY ADOPTION IN FISH AND SHRIMP FARMING BUSINESS

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Abstract

Digital innovation in the field of work and human activities has changed the behaviour and habits of people today in doing their work and activities. It is by the emergence of various mobile applications in almost every field of work or human activities such as transportation, purchasing, business, etc. But not all digital innovations can be accepted. Most people are rather difficult to accept and then adopt a digital innovation in their activities/fields of work. For example, digital innovations that try to be applied in the field of fish/shrimp farming using mobile applications. This happens because of differences in individual characteristics in the diffusion of innovation that can be grouped into five groups, namely Innovators, Early Adopters, Early Majority, Late Majority, and Laggards. As a result, this condition chasm between Early Adopters and Early Majority in technology adoption life cycle. This chasm caused eFishery Technology to stop spreading to the early and late majority. This research uses a company called eFishery as a case study on technology adoption. eFishery makes digital innovations in the field of fish/shrimp farming by providing eFishery technology (a mobile application that is connected to a smart fish/shrimp feeder). Based on the finding factors, fish/shrimp farmers who have Early Majority and Late Majority characteristic need proven data and facts about eFishery technology usability & efficiency factors, ease of use of eFishery technology, and technology & company reputation in community which will have an impact in influencing them to adopt eFishery technology in fish and shrimp farming business.

Keywords: Cultivating System, Digital Inovation, Mobile Application & Technology Adoption.

1. Introduction

eFishery developed eFishery technology; a smart fish and shrimp cultivation system through the mobile application and smartfeeder. eFishery technology aims to provide fish and shrimp farmers in Indonesia with better effectiveness and efficiency in doing fish/shrimp farming activities, especially in feeding issues. eFishery technology allows fish/shrimp farmers to set up fish/shrimp smart feeders to communicate and interact with farmers over the Internet, and it can be remotely monitored and controlled cultivation activity through eFishery mobile application. Currently, the problems faced by the company are difficult to introduce eFishery technology to fish and shrimp farmers with characteristics like early majority and late majority on the theory of technology adoption life cycle and encourage them to use and adopt the eFishery technology as cultivation channel.

This situation caused eFishery technology fall into Technology Adoption Life Cycle (TALC) Chasm (see Figure 2). Until the chasm is successfully bridged, eFishery technology will not spread to early majority and late majority adopter categories, therefore 34% of the market will not be captured, and revenues will demonstrate little growth. Bridging the chasm on TALC

requires a solution that minimizes the risk and impact of using new technology like eFishery Technology. In essence, it must cater to the characteristics of the pragmatists. Therefore, this study aims to explore the factors encourage fish and shrimp farmers in Indonesia with the early majority and the late majority characteristic to use and adopt eFishery technology as the cultivation channel in fish/shrimp farming activities..

2. Basic Theory

2.1 Diffusion of Innovation (DOI)

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. Diffusion is a special type of communication concerned with (Rogers, 1983). In diffusion of innovation there are 5 adoption processes: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation.

2.2 Technology Adoption Life Cycle (TALC)

The technology adoption lifecycle is a sociological model that describes the adoption or acceptance of a new product or innovation, according to the demographic and psychological characteristics of defined adopter groups (Bohlen & Beal, 1957). There are five categories of adopters: (1) Innovators, (2) Early adopters, (3) Early Majority, (4) Late majority, and (5) laggards, (see figure 1).

Figure 1 : Adopter Categorization on The Basis of Innovativeness

Source : (Rogers, 1983)

If the adoption curve presented a smooth transition from stage to stage, as illustrated above, it would be predictable and easy to navigate. However, this continuous curve ignores a critical element, the chasm. This critical point in the TALC, identified in Figure 2, emphasizes a disconnect between stages two and three. This stage is significant because it is a true representation of the chaos and turmoil existing at this point in the adoption life cycle. If not properly bridged, new technology can stall and possibly fall to the bottom of the chasm, never to be heard from again.
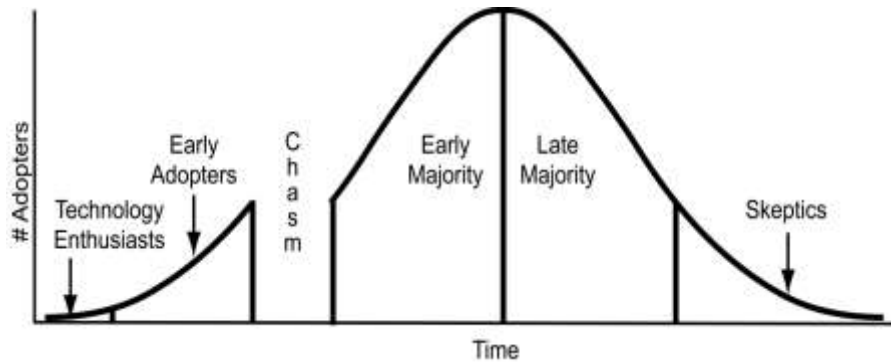
Figure 2 : Technology Adoption Life Cycle Chasm
Source : (Todd & Grim, 2002)

2.3 Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT is a theory that aims to explain user intentions to use an information system and subsequent usage behaviour. The theory holds that there are four key constructs: 1) performance expectancy, 2) effort expectancy, 3) social influence, and 4) facilitating conditions
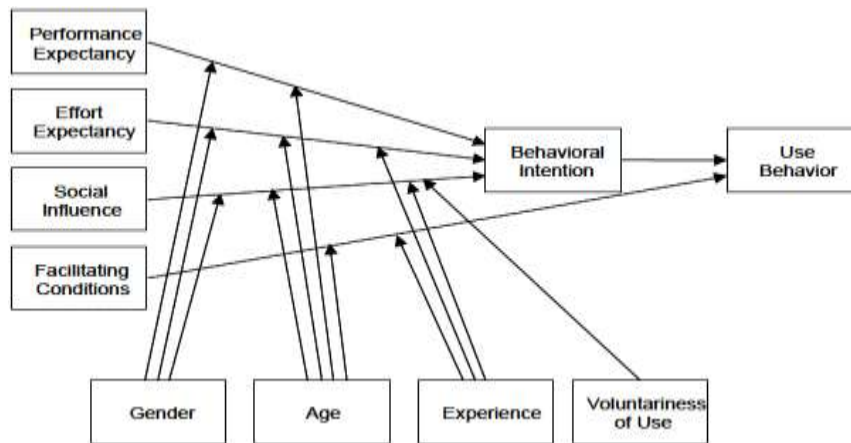

Figure 3 : Unified Theory of Acceptance and Use of Technology Research Model
Source : (Venkatesh V et al., 2003)

(Venkatesh V et al, 2003) on formulating the UTAUT described performance expectancy, effort expectancy, social influence factors have an influence on behavioral intention to use technology, while facilating conditions have an influence on use behavior (see figure 3).

2.4 Technology Acceptance Model (TAM)

TAM is a theory that models how users come to accept and use technology. (Davis et al, 1989) model suggests that when users are presented with new technology, a number of factors influence their decision about how and when they will use it, notably:

- Perceived usefulness (PU) – the degree to which a person believes that using a particular system would enhance his or her job performance

- Perceived ease-of-use (PEOU) – the degree to which a person believes that using a particular system would be free from effort.

3. Methodology

This research framework begins with qualitative research because the qualitative method is suitable for studying culture and cultural practice in the marketplace (Moisander, Valtonen , 2006). Therefore, in this study doing in-depth interviews with mobile application developer and eFishery technology users. The author asks a number of questions to them about the important factors that can persuade people to use and adopt eFishery's mobile application as a cultivation channel on shrimp and farming activities.

The next step after doing an in-depth interview and find the factor about what can persuade people or fish/shrimp farmers in order want to adopt eFishery technology in fish/shrimp farming business activities is doing quantitative research. In this study, Quantitative method useful for measuring the impact of the finding factors from in-depth interview result against eFishery technology prospective user. The finding factor will be used as a basic question for quantitative research using a questionnaire. Through questionnaires that have been distributed. it will then be analyzed to conclude about what factors in the decision process encourages people to adopt eFishery technology.

4. Result and Discussion

The results of the interview with aquaculture farmers regarding factors that will encourage them in order want to involve and adopt mobile application as fish/shrimp cultivation channel it produces reasons and adoption pattern as shown in Figure 3.
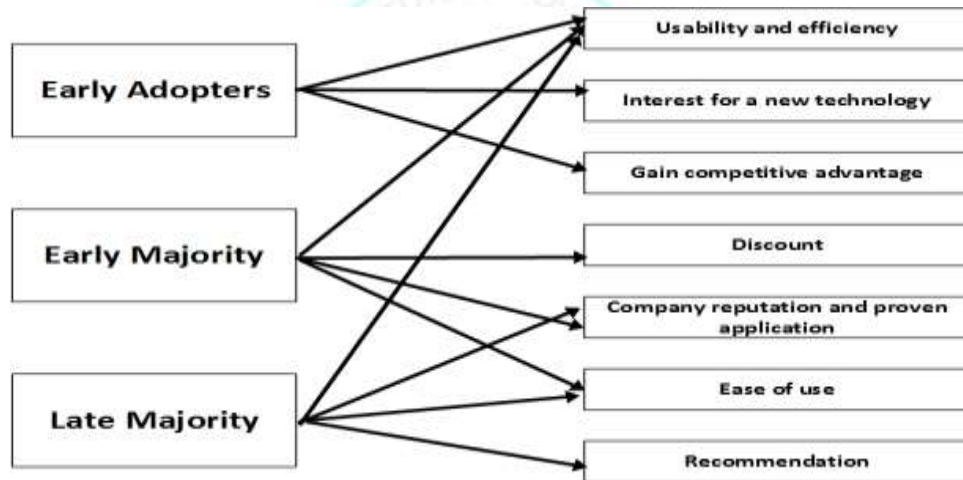

Figure 4 : Factors Related to Technology Adoption on eFishery Technology

From figure 4, it can be concluded that there three main factors that influence and encourage fish/shrimp farmers in adopting mobile application as cultivation channel. First, Usability and efficiency provided by the mobile application (eFishery technology) in cultivating activities. Second, the ease of use in performing eFishery mobile application functions. Third, eFishery technology has been proven in the community as a technology that is beneficial for fish/shrimp farming activities. These three factors are then used as a basic question for quantitative research using a questionnaire..

The survey (questionnaire) are conducted online using the Google form. This research was conducted based on sample size, this was done to make research and data collection faster and more efficient than collecting the entire population. Expression for sample size will use the formula of David (2013). Minimum samples must be calculated because the results of this sample calculation are the minimum portion of data needed for surveys to represent the entire population. The Author assumes that need to have a 95 percent confidence level, and also

assumes population variance at maximum, occurs when the population proportion is equal to 0.50, and The population proportion is to be estimated within an error of 10 percentage points (or 0,1). Based on the calculation use Aaker formula show the minimum sample size for the survey is one hundred respondents.

Table 1: Profile of Respondent

Domicile	Java Island	56.2%
	Sumatera Island	33.9%
	Outside Java and Sumatera Island	9.9%
Ages of Respondent	20-35	30.6%
	36-50	50.4%
	51-65	19.0
Spending time on smartphone	< 1 hour	15.7%
	1 until 5 hours	17,4%
	> 5 hours	66.9%

The respondent domicile of this study was from various regions in Indonesia but grouped into 3 regions namely Java island, Sumatera island, and outside Java and Sumatera island. The questionnaire got 121 responses with the age range between 20 until 65 years old. To validate the three main finding factors from the in-depth interview about the factor that effects to technology adoption on the mobile application as cultivation channel (eFishery technology). 121 respondents with profile shown in Table 1 have been asked with three variable questions as shown in table 2. Eleven respondents answered never and did not want to try to cultivating fish/shrimp through the mobile application, hence totally 110 respondents answers were relevant. The data obtained from the questionnaire were then processed using IBM SPSS statistics to prove the validity & reliability of each variable.

Table 2: Description of Variable

Variable	Description
V_1	The impact of mobile application eFishery technology provide various features ability and efficiency needed in helping fish/shrimp farming activities, affect prospective customer to try the cultivation through the mobile application
V_2	The impact mobile application eFishery technology user interface design such as layout, buttons, graphic images generate the ease of use and encourage people to use eFishery mobile application in fish/shrimp farming activities
V_3	The effect of mobile application eFishery technology has been proven in the community as a technology that is beneficial for fish/shrimp farming activities encourage fish/shrimp farmers to try cultivation through a mobile application and adopt eFishery technology

Table 3 : Validity Test Result

		V1	V2	V3	Total_Score
V1	Pearson Correlation	1	,480**	,372**	,814**
	Sig. (2-tailed)		,000	,000	,000
	N	110	110	110	110
V2	Pearson Correlation	,480**	1	,244*	,762**
	Sig. (2-tailed)	,000		,010	,000
	N	110	110	110	110
V3	Pearson Correlation	,372**	,244*	1	,702**
	Sig. (2-tailed)	,000	,010		,000
	N	110	110	110	110
Total_Score	Pearson Correlation	,814**	,762**	,702**	1
	Sig. (2-tailed)	,000	,000	,000	
	N	110	110	110	110

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

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4: Validity Test Output Summary

Variable	r count	r table	Sig. (2-tailed) value	Validity
V1	0,814	0,195	0,000	Valid
V2	0,762	0,195	0,000	Valid
V3	0,702	0,195	0,000	Valid

From Table 3 and Table 4, it can be explained :

- the value of r count V1,V2,V3 > r table 0,195

- Sig. (2-tailed) for correlation V1,V2,V3 with Total_Score is equal to 0,000 < 0,05 and Pearson Correlation V1,V2,V3 is positive

It means that the variable V1, V2, and V3 is declared valid, the item question can be used as an accurate data collection tool in the research. The value of Cronbach's Alpha in reability statistics is 0.634 > r table 0.195 (N = 110 significance of 5%)), we can conclude that all three variables V1, V2, and V3 are reliable.After testing the reliability and validity towards variables V1, V2, V3, it can be concluded that the variables V1, V2, and V3 as valid and reliable variables that can be used as an accurate data collection tool in the research. Hence, from the results of the research questionnaire,

- 61,90% of respondents answered the usability and efficiency features provide by eFishery mobile application in helping fish/shrimp farming activities as an important factor in stimulating them to use and adopt mobile application in cultivation activities.

- While 56,4% of respondents answered eFishery mobile application user interface (UI) design such as layout, buttons, graphic images generate the ease of use eFishery technology, and drive them to use eFishery mobile application in fish/shrimp farming activities

- Finally, 53,6% of respondents answered the proof of eFishery technology in the community as a technology that is beneficial for fish/shrimp farming activities, encourage them to try cultivation through a mobile application and adopt eFishery technology

- **Analysis of Result using UTAUT**

The findings of the research have similarities to the Unified Theory of Acceptance and Use of Technology. According to findings in quantitative research, 33,60% of the 110 respondent reasoned want to use application due to the usability and eficiency offered by mobile application in assisting fish/shrimp farming activities. This is due to the usability and efficiency factor that can be done by eFishery technology will fulfill customer performance expectancy to help them to achieve an advantag in fish/shrimp farming activities. Venkatesh described Effort expectancy is the level of ease related to the use of the system/technology by the user (Venkatesh et al., 2003). The finding based on quantitative research 32,70% of the 110 respondent, reasoned want to use mobile application due to ease to use on fish/shrimp cultivation activities. This is related to UTAUT key constructs particularly the effort expectancy.

Venkatesh et al., (2003) described Social influence is the extent of someone's perception that other people who are important to him/her think that he/she should/ use a new technology/system). The finding based on quantitative research 23,60% of the 110 respondent, reasoned want to use application proved to be useful in fish/shrimp farming activities because when the application proved in a community, especially to the important people for them, they will think to use (adopt) the technology. This is related to UTAUT key constructs, especially social influence.

In a conclusion, fish and shrimp farmers with characteristics like the early majority and late majority in TALC theory will accept and use technology when four key constructs of UTAUT that is performance expectancy, effort expectancy, social influence, and facilitating condition can be fulfilled by the company to the technology they provided. Usability & efficiency improvement on the application will meet performance expectancy, while application UI design ease to use on fish/shrimp cultivation activities will meet effort expectancy, and application proved to be useful in fish/shrimp activities will meet social influence. When the company has fulfilled it all, it will generate facilitating condition were an innovation offers by company is perceived as being consistent with existing values, experience, and needs of fish & shrimp farmers with early & late majority characteristic, where this condition will affect the Use Behavior of them to adopt eFishery technology.

- **Analysis of Result Using Technology Acceptance Model**

The findings factors are also compared with TAM. Perceived usefulness (PU) in adopting/accept eFishery technology implied through the result of in-depth interview and questionnaire through the factor of eFishery mobile application has various ability and efficiency features needed in helping fish/shrimp farming activities. Author concludes prospective customer realize Perceived usefulness (PU) in the eFishery technology through various features and efficiency that can be done by eFishery technology that would enhance their job performance on fish/shrimp farming activities.

While Perceived ease of use (PEOU) in adopting eFishery technology implied by factor ease of use mobile application user interface, where this factor plays a role as a degree of fish/shrimp farmers believes that the ease of use mobile application user interface factor would be free them from effort too difficult to run applications in helping fish/shrimp farming activities. Kashadah et al., (2017) in his study to Identify Factors Influence Digital Learning Technology Adoption and Utilization in Developing Countries stated perceived usefulness and perceived ease-of-use component of technology acceptance model has an impact to support digital technology adoption process.

- **Analysis of Result Using Technology Acceptance Model**

Diffusion of Innovation theory used in this research to understand and analyzed how eFishery technology spread among adopters categories in TALC. As already described in Section 2.1 Diffusion of Innovations theory mentioned have five stages of the adoption process. Figure 6 explains show how finding factor obtained through in-depth interview and questionnaire combine with technology acceptance model theory.
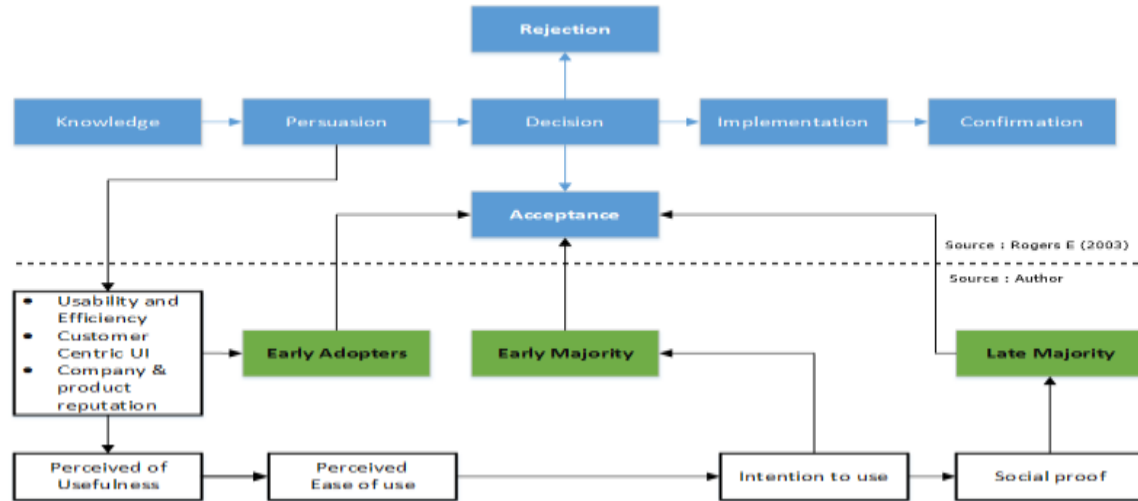

Figure 6 : Technology Penetration Process on Adopters

After knowing the factors that have a role in the eFishery technology adoption process, the finding factors are then used as persuasion in order adopters (fish/shrimp farmers with an early majority and late majority characteristic) interested in innovation and actively seeks related information/details about eFishery Technology. By applying the finding factors in TAM persuasion stage it will fulfill performance expectancy, effort expectancy, social influence and facilitating condition. Finally, we will generate Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) factors that will affect Intention to use eFishery technology and social proof that as a technology that is beneficial for fish/shrimp farming activities

5. Conclusion

Early majority and the late majority have 64% market shares, while the early adopters only have 13.5% (see Figure 1). The company has the challenge to jump the chasm that exists between the early adopters and early majority to gain bigger market shares..

The factor that encourages fish/shrimp farmers to decide to adopt the changes in conventional cultivation methods to be modern cultivation methods (using the mobile application as fish/shrimp cultivation channel system) are :

- Usability and efficiency caused by mobile application eFishery technology which raised performance expectancy and perceived usefulness the use of eFishery technology services in fish/shrimp farming activities

- UI design to meet the perceived ease of use and generate user experience free from confusion in using technology in aquaculture activities

- The company reputation generated by eFishery technology services created by the company that has been proven to work and useful in the fish/shrimp farming, that builds a sense of security and trust that technology will be beneficial and not cause negative effects in fish/shrimp farming activities.

The reason behind the decision to adopt the technology eFishery or not is based on the characteristics of each group of adopters in TALC where Innovators and Early Adopters have character happy to get lastest technology and appreciate the benefits of new technology like eFishery technology. Then, other social segments such as the early majority and late majority accept and adopt technological innovations with skepticism, and require more time. They tend to delay the technology adoption process until they get proven evidence and facts, and wait for the environment and technological infrastructure to be ready, and reflect on the majority of people around them whether they have adopted technology or not. Until proven evidence and fact about eFishery technology not visible for them, and the technology not use by majority in their fish/shrimp cultivation pond then people with early majority and late majority characteristic will not adopt eFishery technology.

In the adoption process, the early majority will adopt the eFishery technology when performance expectancy, effort expectancy, social influence and facilitating condition fulfilled by the technology. Then, the eFishery technology should fulfil Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) from the prospective user in order generated behavioral intention to use and adopt eFishery technology in fish/shrimp farming activities. On the other hand, The reputation of the company and eFishery technology plays an important role in forming a behavioral intention for the late majority. Fish/shrimp farmers with late majority characteristic need social influence from the early majority in order finally want to adopt eFishery technology and eliminate doubts and have risk tolerance on technology to be adopted.

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