Entrepreneurship Orientation of Artisanal Fishery on the Use of Internet of Things Technology in Achieving Sustainable Competitive Advantage: A Case Study in the Province of Banten, Indonesia

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ABSTRACT

Artisanal fishery is known as a significant producer of fish catch products. over 90 million tons of fish production each year worldwide and more than half of them produced by small-scale fishers. Preserving the sustainability of artisanal fishery will be beneficial not only for the artisanal fishers but also to the environment and community. Our research focuses on the role of entrepreneurship orientation of artisanal fishery on the use of Internet of Things Technology in achieving sustainable competitive advantage. This research was conducted by surveying 106 artisanal fishers throughout the residencies of Pandeglang and Lebak in the province of Banten, Indonesia. Research finds that artisanal fishery entrepreneurship orientation has a strong influence on technology. It is also believed that technology would substantially bring artisanal fishery towards a sustainable competitive advantage, not only to the fishermen themselves, but also maintaining the sustainability of the environment and the community.

Keywords

Internet Of things, Artisanal Fishery, Entrepreneurship Orientation, Sustainable Competitive Advantage.

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Introduction

With the world population reaching 9 billion inhabitants in 2050, food security proves to be a challenge to global climate change. An uncertain world economy has also caused great concern around the world for the competition of natural resources. To this extent, world fish consumption has reached 20kg per capita in 2016 compared to 9.9 kg per capita in 1960, 14.4 kg in 1990 and 18.1 kg in 2009 (FAO, 2016). Consumption per capita will significantly increase along with the growth of world population. Total fish production in 2014 amounted to167 million ton of fish , where 93 million came from capture and 73.8 million from aquaculture (Gerintya, 2017).

According to the Ministry of Marine Affairs and Fisheries of Indonesia(KKP), there are over 600,000 fishing vessels operating in Indonesian waters and 90% of them are small fishing vessels below 30 Gross Tons. The food consumption per capita in Indonesia is 50 kg per capita, or double of the world average fish consumption (Kementerian Kelautan dan Perikanan Republik Indonesia, 2018).

The high demand of fishery product indicates that the fishery industry is a promising business where strong demands over limited supply would bring a lot of fortune to players in the industry, including fishermen, factories and all players within the supply chain. In 2016, Indonesia's fish production reached 23.51 million fish compared to 13.6 million fish in 2011. Aquaculture production leads the growth from 7.93 million in 2011 to 16.68 million in 2016 or had reached almost 100% growth. On contrary, fish capture production only grew around 20% between 2011 and 2016. This slow growth of fish capture in Indonesia is similar to other countries like Kenya and other nations around the world. This is called the declining fisheries phenomenon (Cinner, Daw, & McClanahan, 2009b).

Researchers studying and tried to resolved the declining fisheries phenomena from promoting fishery management programs to ease the pressure of declining fisheries up to exploring the readiness of fishermen to exit fisheries activities (Anderson, Anderson, Chu, & Meredith, 2014; Cinner et al., 2009b; Pollnac, Bavinck, & Monnereau, 2012; Satumanatpan & Pollnac, 2017). The declining of fishery phenomena will surely be a blow to artisanal fishery, especially when 90% of Indonesian fishermen are considered as artisanal fishers.

This phenomena will lead artisanal fishers to lose and quit their jobs (Muallil et al., 2013). When fishermen are unemployed with no other expertise it will lead them to unemployment and fall into extreme poverty and may potentially lead to an increase of crime rate as well, posing a challenge for the Indonesian government. Declining fishery will lead to collapse of the fishery industry including the closing down of fish processing plants which will then contribute to less tax contribution to the state. At a higher level, people around the world will also be threatened with problems of food security due to the excess demand of food supplies.

Therefore, sustainability practice through the balance between community, economics, and ecology in achieving sustainability in fisheries is very much needed (Anderson et al., 2014). These sustainability efforts can be achieved by employing new technology available such as the Internet of Things (IOT) technology.

(Krotov, 2017) identifies that IOT would be the next great business opportunity considering its capabilities. IOT capabilities include how the technology can be flexibly integrated with the current Internet infrastructure so that users are able to check their objects' wellbeing anytime and anywhere. The heart of IOT capability is through its ability to communicate easily to the sensors attached and communicate with them through the existing Internet networks, and then present the results as analytical data (Dunn et al., 2018; Lamont, 2017; Li, Liu, Liu, Lai, & Xu, 2017; Luo et al., n.d.; Nolin & Olson, n.d.). With the advancement of new technology, the gamble of fishing activities is no longer an option, according to the Indonesian Minister of Marine Affairs and Fisheries. ("Susi Beberkan Modus Baru Pencurian Ikan di Indonesia," n.d.; Saville, Hatanaka, Sano, & Wada, 2015).

Interviews with fishery and IOT experts indicate that data accuracy is strongly needed for the poor data country in fishery industries. Inaccurate sets of data will lead to a wrong policy decision and will then harm the existence of artisanal fishery in the future. The use of IOT technology in fishery is expected to overcome the data inaccuracy in capture fishery (Nopitasari. T, Personal Communication, August 9, 2018). Therefore, the declining of fishery and its wider potential problem will impact the stakeholders of the fisheries industry and artisanal fisheries. Hence, we will need to investigate antecedent indicators that influence sustainable competitive advantage in fishery.

Through this study, we need to find out whether artisanal fishery entrepreneur orientation strongly influences technology orientation. We also wanted to know whether artisanal fishery entrepreneurship orientation strongly influences sustainable competitive advantage. Another question was does artisanal fishery entrepreneurship orientation strongly influence the intention to use IOT? Was technology orientation as a mediating variable to artisanal fishery entrepreneurship orientation a strong influence to sustainable competitive advantage? Furthermore, we wanted to know if technology orientation as a mediating variable of artisanal fishery entrepreneurship orientation strongly influences the behavior to use IOT. We also posed the question of whether the intention to use behavior technology as mediating variables of entrepreneurship orientation strongly influenced sustainable competitive advantage.

Theoretical Background and Hypothesis

2.1 Sustainable Competitive Advantage

The resource base view (RBV) of a firm was initially introduced by J.B Barney back in 1991 as the unique resources of a company must be competitive in the world of competition. These strategic resources must consist of the following characteristics: valuable, rare, imperfectly imitable, and strategically irreplaceable (Barney & Arikan, 2001; Cesar, Guimarães, & Imed, 2017). Other resources can also be influenced by the implementation of these strategic resources, such as the effort of the growing company's productivities which results in gaining the firm's competitive advantages (Cesar et al., 2017; Makadok, 2001)

The triple bottom concept describes economic, environmental, and social impact sustainability as measurements and frameworks for companies to measure its level of sustainable efforts (Clark, Auerbach, & Longo, 2018; Elkington, 1998; Ha-Brookshire, 2017). Although environmental sustainability is mostly seen as an effort to maintain a sustainable environment, nowadays it is placed at a more strategic position as a company's strategic advantage (Araos & Ther, 2017; Valero-Gil et al., 2017). These strategic competitive advantages are outcomes from environmental strategic advantages, such as minimizing the number of waste produced and dipping the number of production inputs which leads into the firm's efficiency, productivity and competitiveness (Severo, Guimarães, Dorion, & Nodari, 2015; Cesar et al., 2017).

Besides the values mentioned above (valuable, rare, imperfectly imitable, and strategically irreplaceable), environmental sustainability can also be added and fits as a strategic competitive advantage for being highly competitive as well as sustainable in their business performance (Cesar et al., 2017). In the context of artisanal fishery, sustainable competitive advantage is an important factor to consider as it will lead to long term prosperity in their fishing efforts as well as preserving the sustainable environment at sea (Sen & Homechaudhuri, 2017; Torres-Guevara & Schlüter, 2016).

2.2. Entrepreneurial Orientation

Opportunities for the business owner to achieve its goal are always available (Mazzei, Flynn, & Haynie, 2016), it is just the matter of how and the degree of willingness for one to endeavor risk, complexity, and uncertainties (Berglund, 2015; Shepherd, Williams, & Patzelt, 2015). Therefore, entrepreneurial orientation refers to one's efforts in the searching of new possible opportunities (Engelen, Gupta, Strenger, & Brettel, 2015), through innovations to be implemented in its organizations (Davidsson, 2015; McMullen & Shepherd, 2006).

Entrepreneurial orientation is closely related to the process of strategy making activities which will lead entrepreneurs to a fresh activity (Covin, Green, & Slevin, 2006; Wales, 2016). Entrepreneur orientation (Covin & Wales, 2012) was developed on five main principles, which include: risk taking behavior, attitude towards innovation, proactiveness and adaptation to environment changes, and the degree of attitude when facing competition (Gupta & Gupta, 2015; Hughes & Morgan, 2007).

Therefore, entrepreneurship orientation among artisanal fishers as independent business owners is one measurement framework to measure the degree of entrepreneurial attitude of artisanal fishers towards innovations and gaining sustainable competitive advantages. We hypothesize the entrepreneur orientation as follows:

H1: Artisanal fishery entrepreneur orientation is positively associated with sustainable competitive advantage.

2.3. Technology Orientation

Since its introduction in 2003, the user technology acceptance model has been widely used to bring technology closer to humans (Galletta & Zhang, 2015; Marangunić & Granić, 2015; Venkatesh, Morris, Davis, & Davis, 2003). The theory unifies views and analyses of user behavior acceptance models towards the use of technology (Dwivedi, Rana, Jeyaraj, Clement, & Williams, 2017; Marangunić & Granić, 2015). This unified view of user behavior towards technology is called the Unified Theory of Acceptance and Used of Technology (UTAUT) and is a combination of the Theory of Reason Action (TRA) that explains one attitude whether it is a positive or negative attitude or behavior towards the use of technology with the Theory of Technology Acceptance Model (TAM) (Marangunić & Granić, 2015; Mathieson, 1991). This predicts the user perception to the technology through the usefulness of the technology and perceived ease of use of the technology itself and The Theory of Planned Behavior (TPB) as an extension to TRA (Dwivedi, Rana, Chen, & Williams, 2011; Dwivedi et al., 2017; Venkatesh et al., 2003; Williams, Rana, & Dwivedi, 2015). In addition to TRA, TPB acts as a control element to behavior and intention towards the use of technology as developed by Ajzen and Fishbein (Venkatesh, Thong, & Xu, 2016; Yzer, 2017).
In the context of artisanal fishery, it is important to understand the behavior attitude of the fishermen to the use of this new technology and how they perceive the use of technology towards sustainable competitive advantage. Therefore, we hypothesize this as follow:
H2: Artisanal Fishery Entrepreneurial Orientation positively influences Technology Orientation
H4: Technology Orientation positively influences Intention to Use Behavior
H6: Technology Orientation positively influences Sustainable Competitive Advantage

2.4. Intention to Use

The theory of planned behavior by Ajzen describes the relationship of their intention to behave and certainly appear to be used by variety of behavioral research (Buana, 2016), and individual actions regarding intentions and ways to build relationships between attitudes and behavior (Ajzen & Fishbein, 2005; Buana, Hidayat, Prayogi, & Vendy, 2017). Correspondingly, personal attitudes toward behavior explain that a person has a good or unpleasant evaluation of what is in the individual's mind and also describes the difficulties felt in carrying out certain behaviors (Barnard, Bradley, Hodgson, & Lloyd, 2013; Buana et al., 2017; Hargreaves, 2011). This is called Perceived Behavioral Control (PBC) that measures self-efficacy and is mostly related to the difficulty of doing behavior and control, where level of personal performance is included within the PBC (Buana et al., 2017; Carver & Scheier, 1981; Duckworth & Gross, 2014). Therefore the behavior intention to use technology refers to the degree of willingness of one to use the technology and would come voluntarily from the artisanal fisher itself (Marangunić & Granić, 2015; Venkatesh et al., 2003). The intention to use IOT in artisanal fishery is hypothesized as follow:
H3: Artisanal Fishery Entrepreneurial Orientation positively influences Behavior Intention to Use Technology
H5: Behavior Intention to Use Technology positively influences the Sustainable Competitive Advantage

Therefore, the proposed model for this research is as follow:

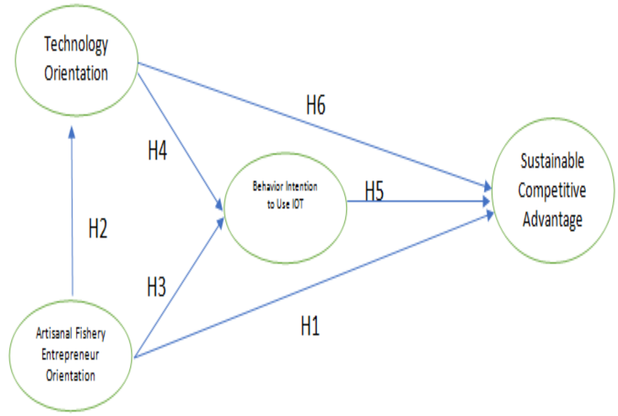

Figure 1. A model of Artisanal Fishery Entrepreneurship Orientation toward Sustainable Competitive Advantage.

Methodology

The research was conducted in Indonesia in the Banten Province, the westernmost province on the island of Java. Banten Province is surrounded by the Java Sea in the north, the Sunda Strait in the west and the Indian Ocean in the south. The samples for artisanal fishery were taken in the southern part of the province on the coast of Pandeglang and Lebak residencies. Banten Province has a population of 11 million people with 7,000 small fishing boats operating in the province ("BPS Provinsi Banten," n.d.). The surveys were sent out to 200 small-scale fishermen and 106 survey papers were returned. The samples were taken in the month of June 2018. The smart partial least square method 3.0 software was used to calculate the output of the samples (Ringle, Wende, & Becker, 2015).

Results and Discussion

As to the descriptive results, the average age of the fisherman sample were 36 years old, where the youngest fisherman was aged 22 years and the eldest at 60 years of age. 53% of the respondents were junior high school graduates, while 33% only attended elementary school. The average monthly income from fishing for 71.1% of the respondents was under 68 USD per month, while 27% were between 68 USD to 206 USD per month.
The fishing vessels used to catch fish for 77% of the respondents were below 10 Gross Tons and 22% were between 10 and 30 Gross Tons, therefore the research justifies the object of artisanal fishery. The number of work days spent at sea was between 10 and 20 days per month for 58.5% of the respondents, while 32.1% spent less than 10 days at sea. Due to this low monthly average income, we then asked them relating to their level of satisfaction on becoming a commercial fisherman, whether they wanted to quit their jobs or not. 88% of the respondents expressed that

they have no other job other than working as fishermen, while 56% of the total respondents say that they wanted to quit their jobs as fishermen.

99% of the respondents use a mobile phone and 1% owned more than one phone. 51% of the respondents already use smartphones, while the other 49% were still using featured phones. The data also found that 71.7% of the respondents do not use social media, while the other 28.3% have used social media with a combination of Facebook, Instagram, Twitter, Line, WhatsApp.

From these descriptive results we can see that the samples taken in Banten Province fit the criteria of the artisanal fishery indicator, e.g. the size of the boats are less then 30GT, where boats under 10GT were the majority. Furthermore, the number of days at sea was at an average of 20 days, compared to large-scale fishers that are capable of spending months at a time at sea. All of the descriptive indicators above prove that the samples are indeed artisanal fishers (FAO and World Fish Center, 2008;Cinner, Daw, & McClanahan, 2009a). The respondents chosen were in fact users of ICT. This can be seen from the 51% of the respondents used a smart phone. The use of Internet is still a question mark, as only 28.3% of the respondents actively use social media. The use of social media indicates that they are also active users of the Internet. Therefore, we can assume that the artisanal fishers in the province of Banten are ready to accept Internet technology.

Through our research we also found that these artisanal fishers are indeed people who fall under the bottom of the pyramid. (Prahalad & Hart, 2010) indicates that 4 billion people around the world live under 2 USD per day. In our case we found that 71.1% of our respondents live with an income of less than 68 USD per month or less than 2.2 USD per day. These indicators may explain why 56% of the respondents would like to quit their jobs as fishermen. Other literature also include social wellbeing factors as the willingness of the fisherman to quit their jobs due to the decline of fish catch(Cinner et al., 2009a). In our studies we discovered that low monthly income factors from their fishing efforts may influence their willingness to quit their jobs as fishermen. Why their income so low ?. We assume that there has been a declining fishery phenomenon in our studied area at Banten Province. Therefore it is justifies that technology perhaps can play an important role for sustainable fishery in Banten Province.

In seeking the relationship between variables, we used SMART-PLS 3.0 to calculate the data sample collected from the artisanal fisheries in Banten Province. Table 1 shows how the variables and dimensions are constructed. First, we conducted a confirmatory factor analysis to test convergent validity through the outer model testing. Only after confirming that the variable construct met its validity and reliability test did we perform the inner model testing to find out the path coefficient between latent variables. The results of the testing is shown on Figure 2 and Figure 3.

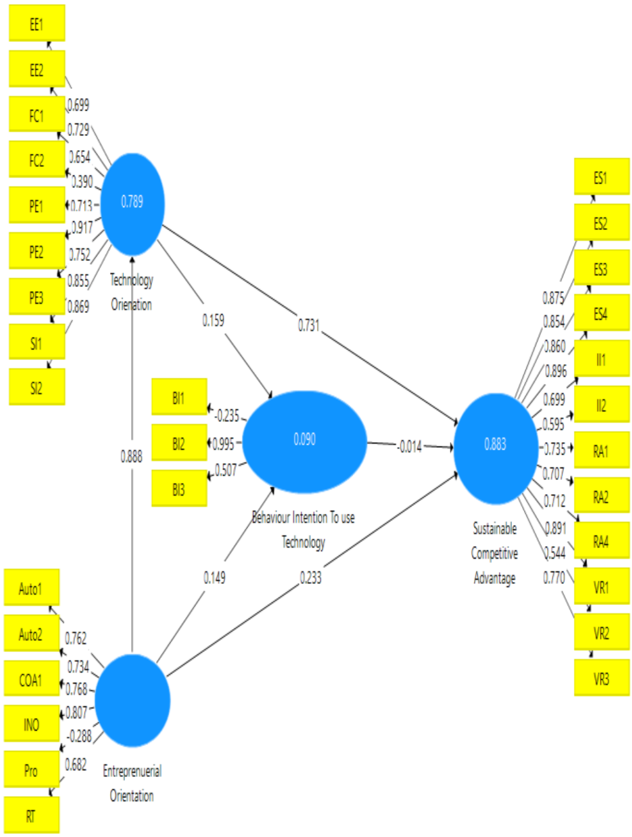

Figure 2. Outer Model Method to test the indicator validity for its individual latent variable

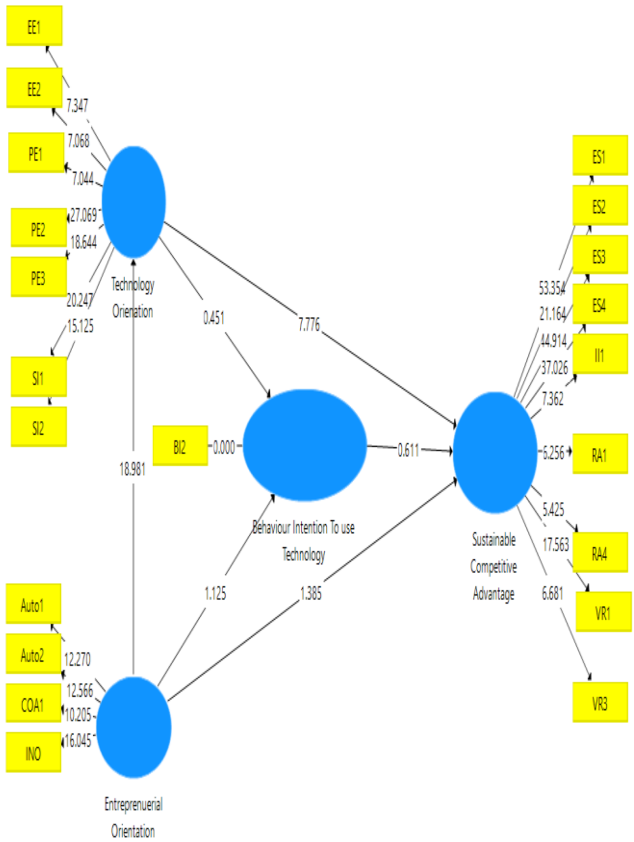

Figure 3. Inner model testing to test the significance between Latent Variables

Through our outer model testing, we find out that several loading factor indicators fall below 0.7. By general guidelines, the loading factor must be above 7.0 to be able to construct the latent variable (Garson, 2016). Therefore, when the loading factor scores falls below 0.7, the indicators do not reflect the causal effect of its latent variables. Items below 0.7 are then excluded. The loading factor indicator items that were excluded are proactiveness, facilitating condition 2, valuable Resources 1, valuable Resources 2, behavior intention 1, behavior intention 3, imperfectly Imitable 2, risk taking, facilitating condition, rare resources. Excluding these indicators above, we find that the all of the loading factors are above 0.7. The Average Variance Extracted (AVE) were above 0.5. As for the reliability test, we find out that the Cronbach's alpha is greater than 0.7 and composite reliability is also greater than 0.7. (Garson, 2016) argues that these indicators may fit the reliability and validity construct as they are all above the general guideline scores to support reliability and validity.

In the inner model testing, we find that Hypothesis 1 falls below 1.96 with the confident level of 95% or (t= 1,612 and P>0.05). Therefore, artisanal fishery entrepreneurship orientation does not influence sustainable competitive advantage. Whilst in Hypothesis 2, we find out that artisanal fishery entrepreneurship orientation positively influenced the technology orientation, (t= 18,981 and P<0,05). In Hypothesis 3 we discover that artisanal fisheries orientation does not influence the intention behavior use of technology (t = 1,125 and P>0,05). While in Hypothesis 4 we find out that technology orientation does not influence the behavior use of technology (t = 0,451 and P>0,05). In hypothesis 5 we do not see the significance between the behavior to use intention to sustainable competitive advantage (t=0,611 and P>0,05). Whilst in Hypothesis 6 technology orientation does influence the sustainable competitive advantage (t=7,776 and P<0,05).

The operationalization of the variables can be seen on **Table 1**, as follows:

No	Variable	Definition	Dimension	Indicator
1.	Entrepreneurial Orientation	The way the Entrepreneur is looking for any new possibilities or innovation for their Company (Hughes & Morgan, 2007)	Risk Taking (RT)	Perceived risk
			Innovativeness (RT)	Perceive level of Innovativeness
			Pro Activeness (PRO)	Perceived Anticipating Competition
			Competitive Aggressiveness (COA)	Level of offensive move against competition
			Autonomy (AUTO)	Level of autonomy in jobs
2	2. Technology Orientation	The Unified Theory of Acceptance and Use of Technology. Reverts to a model of measurement to the Intention to Use Technology that measures levels of Performance Expectance, Effort Expectancy, Social Influence, Facilitating Condition (Venkatesh et al., 2003)	Performance Expectance (PE)	Perceived level of income and productiveness
			Effort Expectancy (EE)	Perceived ease of use Perceived of Easiness to operate
				Perceived Social Pressure
				Perceived peer pressure
			Social Influence	Perceived

	(SI)	infrastructure readiness
	Facilitating Condition (FC)	Perceived Knowledge to operate the system Perceived of Using IOT This Year
	Behavior Intention (BI)	Perceived of using IOT Next year Plan on Using IOT Next Year
3. Sustainability Competitive Advantage (Cesar, Guimarães, & Imed, 2017) (Kuncoro & Suriani, 2017)		
Valuable Resources: key resources represent value for exploring market opportunities or assisting the organization in defending itself against environmental threats through an increase in revenue and/or a reduction in spending	Valuable Resources (VR)	Perceived that technology gives them the advantage of saving fuel Perceived that the use of IOT can expand market opportunity
Rare Resources: key resources are unavailable for other organizations. These resources are very difficult for competitors to acquire.	Rare Resources (RA)	Perceived that fishermen have unique resources with the use of technology Perceived that better knowledge would bring them extra advantage Perceived that IOT can bring efficiency to their work.
	Imperfectly Imitable resources (II)	Perceive that the use of technology will bring competitive advantage compared to others Perceived that use of technology will becoming something

Strategically Irreplaceable (Durable): key resources are difficult to replace with another strategic equivalent.	that is not easy to duplicate
Environmental Sustainability: the company values environmental sustainability (ES)	Perceived that technology will well inform the level of fish stocks Perceived that the use of IOT will bring positive impact to environment preservation
In the use of key resources in the productive process and product development, the company is also committed to the well-being of workers, society and the environment	Perceived that the use of IOT will bring benefit to the workers Perceived that the use of IOT would bring positive impact to nations

(Barlian et all., 2018)

Conclusion and Recommendation

Through our research we find out that the entrepreneurship orientation of artisanal fishery strongly influences technology orientation, which means that the artisanal fishers in Banten Province as personal business owners in the fishery industry have a strong belief and perception that technology will play an important role in supporting their fishing activities. (Saville, Hatanaka, Sano, & Wada, 2015) noted that their research in the Japan coastal area of Hokkaido show that the use of ICT technology has given significant benefits to the sea cucumber fishermen community. The use of ICT and real time information on catch sharing among fisherman has significantly increased the catch numbers and revenue of the fishermen by preserving the environment and obeying the maximum catch quota per fishermen per fishing season. Through the Hokkaido model we can see that aside of IOT capabilities in determining the catch area through their spatial catch information, there is also the emergence of the IOT alliance, where information is well distributed among the IOT users in almost real time and gives information regarding their catch activities (Chen, 2014).

With the use of IOT, the flow of critical information can now be easily distributed to the stakeholders along the supply chain, such as the real time number of fish caught by the fishermen up to real time notifications for marine protected areas (MPA) where they can be open or closed for fishing activities due to certain circumstances or other fishing management rules associated to environment sustainability achievement (Oviedo & Bursztyn, 2017). Such actions will give an opportunity for artisanal fishers to use this information to support their strategic actions and decisions by spending minimum effort in order to gain optimum fish catch. These routine activities by using IOT technology will give the fishermen sustainable competitive advantage by smartly preserving the environment.

In the context of achieving sustainable competitive advantage, the fishermen strongly believe that the use of technology will bring substantial sustainable competitive advantages, such as valuable resources and information that is brought to them by technology, rare resources where valuable data from technology will enrich their information towards their fishing efforts, imperfectly imitable by providing a unique pattern of fishing activities to each individual fisher, strategically irreplaceable where the use of technology will become a part of their daily activities which would lead artisanal fishers to voluntarily use technology.

Despite the strong influence of technology orientation in artisanal fishery orientation, it still fails to influence the intention to use behavior of the IOT. The voluntarily use of technology from artisanal fishery is still questionable. This may be due to several factors, such as the relatively low monthly income of artisanal fishers. The results also align with the statistical data test where the intention to use behavior's R Square results only 6,32 % it is mean that there are other 93,68% unknown antecedent variables that can supports this latent variable.

We find that 71% of the respondents fall into the bottom of the pyramid. Therefore, despite the high importance of the data collected by other stakeholders such as the people in the industry, the government, environmentalists and people in general, without proper data collection and participation from the fishermen themselves it is difficult to determine the fishery management measures that need to be taken to achieve sustainability in fisheries. (Gorospe et al., 2016) argues that the poor data from the countries of the Association of South East Asian Nations (ASEAN) which include Indonesia, confirms that the poor data in fisheries will lead to the wrong prescription in fisheries management. Therefore (Gorospe et al., 2016) strongly suggest the employment of Science and Technology (S&T) in the collection of data in poor nations so that the right fishery management measures can be performed correctly.

The important role of artisanal fishers for the right data collection must be taken into account as they are the ones in the front line of sustainable fishery efforts. Reference (Neitzel *et al.*, 2017) argues that any information gathered from the artisanal fishers must be returned to the artisanal fishers themselves. The artisanal fisher must understand the importance of the data and how to use the data for their own sustainable competitive advantage. Furthermore, (Neitzel *et al.*, 2017) argues that all the data gathered from artisanal fisher through funds from the government, NGOs or industries are mostly used for the institutions themselves but not for the artisanal fishers.

Therefore, we see the missing link in the equation where the artisanal fishers are absent as data users. There is a stereotype and mindset that comes from the thought that artisanal fishers are mostly less educated people, therefore could not read, use and comprehend the information as they are supposed to (Neitzel *et al.*, 2017). The marginalization and denial of artisanal fishers as the main supplier of catch fish production will lead to inaccurate data and in the end will be detrimental to the artisanal fishermen themselves (Nopitasari. T, Personal Communication, August 9, 2018).

All parties must overcome this literacy problem within the artisanal fishers by providing the easiest information that can be comprehended by the artisanal fishers (Neitzel et al., 2017) . Without the participation of artisanal fisher in the complex and broad fisheries supply chain, the voluntary use and intention to use of IOT technology will become impossible. Subsidizing the large number of artisanal fishers to use IOT technology through the government, NGOs, or the industry is merely impossible due to the investment values needed to be invested in each boat. Voluntary use of technology from the artisanal fishers can only be achieved as long as the data and information given back to the fishermen supports their sustainable competitive advantage.

Further research for this paper is to investigate and overcome the problem of poor data collection using blockchain technology and the psychological mindset of the fishermen towards the use of technology as antecedent of intention to use behavior. Blockchain technology is an open ledger technology that promotes the openness, confidentiality, integrity, and availability of the data since the data is captured from IOT devices in the middle of the sea up to the tables of the customer. Other important research topics that further need to be taken is the psychological wellbeing of the artisanal fishermen in using technology. We need to further study artisanal attitudes towards IOT technology and IOT alliance which will require a psychological interaction between fishermen and their stakeholders.

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