Factors Affecting the Decision of Farmers to Use *Panulirus ornatus sp* Seeds in Lombok Island, Indonesia

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Abstract: Lobster is a fishery commodity with high economic value and potential to be developed in Indonesia. One of the lobster producing regions in Indonesia is Lombok Island, West Nusa Tenggara Province. There are two species, Panulirus ornatus sp and Panulirus homarus sp which are commonly cultivated by farmers. Although specifically Panulirus ornatus sp has several advantages compared to Panulirus homarus sp, this species is relatively less cultivated by farmers. The purpose of this study was to determine the factors that influence the decision making of farmers to use Panulirus ornatus sp seeds in lobster farming business in Lombok Island. Data analysis was performed using logistic regression models. The results of this study conclude that the factors that significantly influence the decision of farmers to use Panulirus ornatus sp seeds are farmer's business experience, access to credit and access to seeds. Factor of lenght time of lobster farming has significant negative effect on farmer's decision to use Panulirus ornatus sp seeds. While the factors of age, education, number of family members and cage area did not significantly influence the decision of farmers in using Panulirus ornatus sp seeds.
Keywords: Lobster farming, Decision making, Panulirus sp, Logistic regression

1. Introduction

One of the fishery commodities that has high economic value and potential to be developed in Indonesia is lobster (*Panulirus sp*). All lobster species are known to be a source of animal protein with very high commercial value (Holthuis 1991). FAO (2017) states that lobster is one of the most expensive fishery products in international trade. The average unit value of lobster reaches US $ 20 per kilogram higher than shrimp which has an average unit value of around US $ 10 per kilogram and finfish below US $ 5 per kilogram. Even the market price of lobster in China, lobsters with a size of more than 1 kilogram is more than US $ 100 per kilogram while lobsters between 300 grams - 1 kilogram range from US $ 50 - US $ 80 per kilogram (Jones *et al*. 2015). According to Suastika *et al*. (2008) global demand for lobsters grows around 15% per year due to increased demand from China. The increasing demand for lobster in the global market is an opportunity and a challenge for Indonesia to increase its contribution to fulfill this demand. One viable effort is to increase production by developing lobster farming business and increasing productivity.

Lobster is an important component for shrimp fisheries in Indonesia. Lobster ranked fourth in Indonesia export commodities for the Crustaceans after Penaeus, Metapeaneus and Macrobrachium (Ditjenkan 2007). One of the lobster producing regions in Indonesia is Lombok Island. Commonly cultivated lobster is *Panulirus homarus sp* with the local name of sand lobster and *Panulirus ornatus sp* with the local name of pearl lobster.

Panulirus ornatus sp lobster has several advantages compared to *Panulirus homarus sp*. According to Suastika *et al* (2008) *Panulirus ornatus sp* is the most expensive species with a value reaching 37 US $ per kilogram for lobster size which reaches more than 1 kilogram. This species has also the highest level of demand in the international market, especially demand from China. *Panulirus ornatus sp* takes about 8-9 months to reach a weight size of 150 grams from a seed size of 2 cm, while *Panulirus homarus sp* takes more than 1 year. Research by Jones and Shanks (2009) states that *Panulirus ornatus sp* are very tolerant of high density conditions and can grow well at various densities applied. So that economically, the high density of *Panulirus ornatus sp* will be beneficial because it can compensate for the decline in the survival rate of lobster. *Panulirus*

ornatus sp lobster species have the highest growth rates compared to other tropical lobsters such as *Panulirus vesicolor*, *Panulirus homarus* and *Panulirus polyphagus* (Vijayakumaran and Radhakrishnan, 1997).

Although *Panulirus ornatus sp* has several advantages as mentioned above, in Lombok Island this species is less cultivated by farmers compared to *Panulirus homarus sp*. Whereas to increase production, it is very necessary to use selected seeds with prime characteritics. One of the problems to increase production in agricultural business is the low level of innovation adoption. Adoption of innovation in this case is the use of lobster seeds. The selection of lobster seed used is based on farmers' decisions. Farmers as business managers must be able to make decisions with a variety of considerations, especially economic considerations. Decision making is usually related to a series of actions from a number of alternatives, which will lead to the attainment of some farmer goals (Makeham and Malcolm, 1991). Decisions taken by farmers are based on factors such as the number of family members, farmer groups, age, education, income, and the size of the farm. Soekartawi (2005) states that several important things in influencing the innovation adoption include; age, education, courage to take risks, patterns of relationships, attitudes toward change, motivation to work, aspirations, certain belief systems, characteristics of psychology. The role of credit can also be an element of encouraging the adoption of innovations that are expected to be able to increase production, added value and people's income (Syukur, 2002). Adoption of innovation by farmers is influenced by the carrying capacity of agroecosystem, motivation, attitudes, actions, and experience of farming, capital availability, production input and intensity of farmer group meetings (Wasito 2010). This study aims to determine the factors that influence farmers' decision making to use *Panulirus ornatus sp* seeds on the island of Lombok, West Nusa Tenggara Province, Indonesia.

2. Materials and Methods

The study was conducted in Jerowaru Village (sub-village of Telong Elong) and Pare Mas Village (sub-villages of Gili Ree, Gili Bele, and Ujung Batu Putee) in Jero Waru sub-district, East Lombok district, Indonesia. The study was conducted from October to December 2015. The location of the study was selected purposively with the consideration that the location was a center for lobster farming business on the island of Lombok. Sampling was carried out using a snowball sampling technique. This is because the population is difficult to know with certainty. The number of samples taken is 106 lobster farmers.

2.1. Data Analysis

This study uses an analysis of logistic regression models to determine the factors that influence farmers' decision-making to use *Panulirus ornatus sp* seeds. Theoretically, the logit function model is formulated as :

$$\ln + \frac{P_i}{1-P_i} = \alpha + \beta_i X_i + \varepsilon \dots\dots\dots(1)$$

Where :

Pi = opportunity for farmers' decision to use *Panulirus ornatus sp* seeds (Pi = 1, if farmers use *Panulirus ornatus sp* seeds and Pi = 0, if farmers do not use *Panulirus ornatus sp* seeds)
Xi = independent variable vector (i = 1, 2, 3 ...... n)
α, β, ε = intercept, regression coefficient, random error

In the logit regression it does not assume the relationship between the dependent variable and independent linearly, but includes the factors that are considered to influence decisions in logistical relations. In this study the following test models were used:

$$\ln (P/1\text{-}P) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 D_1 + \beta_8 D_2 + \varepsilon \dots\dots\dots(2)$$

Where :

ln (P/1-P) = opportunity for farmers' decision to use *Panulirus ornatus sp* seeds(Pi = 1, if farmers use *Panulirus ornatus sp* seeds and Pi = 0, if farmers do not use *Panulirus ornatus sp* seeds)
X1 = age (years), X2 = business experiences (years), X3 = education (years), X4 = number of family members (people), X5 = cage area (m^3), X6 = lenght time of lobster farming (days), D1 = dummy of access to credit (1= credit, 0= not credit), D2 = dummy of access to seeds (1= available, 0= not available)
α = intercept, β = the regression coefficient i (i = 1, 2, 3 .... 8), ε = random error

3. Results and Discussion

3.1. Characteristics of Farmers

The average age of respondents was 43 years old, with an average farming experience 12 years. The average number of family members is 3. Respondents on average have low levels of education, 29 respondents did not complete primary school and 52 respondents completed primary education, 18 respondents graduated from junior high school and 7 respondents graduated from high school. The total floating net cage area owned by farmers varies between 16-384 m^3 with an average ownership of 97 m^3. The number of farmers who have access to credit is 67 people or 63 percent. Whereas farmers who do not have access to credit in conducting business activities are 39 people or 37 percent.

Table 1. Characteristics of Lobster Farmers in the Study Area

No	Characteristics	Lobster Farmers	
		Amount (people)	Percentage (%)
1	Age (years)		
	19 – 30	19	17.9
	31 – 40	36	34.0
	41 – 50	29	27.4
	51 – 60	12	11.3
	61 – 70	10	9.4
	Average age of farmers	43 years	
2	Education (years)		
	Didn't finish primary school	29	27
	Primary school	52	49
	Junior high school	18	17
	Senior high school	7	7
	Average education (years)	6 years	
3	Experience (years)		
	1-5	34	32.1
	6-10	27	25.5
	11-15	13	12.3
	16-20	10	9.4
	> 20	22	20.8
	Average experience (years)	12 years	
4	Family members (people)		
	1-5	98	92.5
	6-10	8	7.5
	Average family members (people)	3 people	
5	Cage Area (m^3)		
	16-50	29	27
	51-100	35	33
	101-150	22	21
	151-200	13	12
	>200	7	7
	Average cage area (people)	97 m^3	
6	Access to credit (people)		
	Access to credit	67	63
	No access to credit	39	37
	Total	106	100

3.2. Factors that influence the decision of farmers to use *Panulirus ornatus sp* seeds

Decision making of farmers to use *Panulirus ornatus sp* seeds allegedly influenced by variables of age, experience, education, the number of family members, the size of the cages owned, the length of time for lobster

farming, access to credit and easy access to seeds. The results of the analysis of factors that influence farmers' decision making using the logit function are presented in Table 2.

Based on the analysis of eight independent variables included in the model, there are four variables that significantly influence the decision making of farmers using the lobster *Panulirus ornatus sp*. Three variables have a significant positive effect and one variable has a significant negative effect. Variables that have a significant positive effect are business experience, access to credit and access to seeds. The business experience factor of farmers has an Odd Ratio value of 1.104 which means that if the farmer's business experience increases by one level, then the opportunity for decision-making of farmers using *Panulirus ornatus sp* seeds increases to 1.104 times.

Factors of farmers' access to credit have an Odd ratio value of 10.13, this means that the existence of access to credit for farmers will increase the decision-making using the seeds of *Panulirus ornatus sp* lobster by 10.13 times. The Odd ratio of the factor access to credit is the highest compared to other factors that have a positive influence such as access to seeds and business experience of farmers. Capital is one of the important production factors in agricultural business (Burhansyah, 2014). One source of capital for farmers is access to credit. The accessibility of farmers to the sources of capital is still very limited, so the lack of costs is an obstacle that is a barrier for farmers to manage and develop their farming (Nurmanaf, 2007). The available credit for farmers will increase farmers' capital so that farmers can use more seeds of *Panulirus ornatus sp* lobsters which have a higher price than *Panulirus homarus sp*.

Table 2. Logit Function Analysis Results

No	Independent Variables	B	S.E.	Wald	df	Sig.	Exp(B)
1	X1	.013	.029	.201	1	.654	1.013
2	X2	.099	.048	4.261	1	.039*	1.104
3	X3	.121	.115	1.104	1	.293	1.128
4	X4	-.031	.185	.029	1	.865	.969
5	X5	.002	.006	.166	1	.684	1.002
6	X6	-.018	.006	10.305	1	.001*	.982
7	D1	2.315	.777	8.887	1	.003*	10.130
8	D2	1.439	.633	5.177	1	.023*	4.218
9	Constant	-2.681	1.949	1.893	1	.169	.068

-2 Log likelihood = 84.012
Nagelkerke R Square = 0.508

The variable access to seeds lobster of *Panulirus ornatus sp* has an odd ratio value of 4.218. This means that the ease of access to seeds will increase the chances of making decisions using *Panulirus ornatus sp* seeds for 4.218 times. The availability of *Panulirus ornatus sp* lobster seeds in the study area is relatively less than *Panulirus homarus sp*. According to Suastika *et al* (2008) *Panulirus homarus sp* is the dominant species and its population is 3 to 9 times greater than *Panulirus ornatus sp*. So that farmers are relatively easier to get *Panulirus homarus sp* seeds, this is why the use of *Panulirus ornatus sp* lobster seeds is relatively less.

One factor that has a negative effect is lenght time of lobster farming, with an odd ratio of 0.982. This means that the opportunity for farmers to use *Panulirus ornatus sp* seeds is less than one. Farmers do not dare to allocate a long time to do lobster farming. This is because the longer the time, the greater the risk faced by farmers, especially the risk of disease, climate and weather, the risk of difficulty in fulfilling lobster feed and security risks. *Panulirus ornatus sp* mature at a weight of more than 1 kilogram, to reach this size, it certainly takes a long time. According to farmers, lobsters above 200 grams are very susceptible to disease attacks, so the risk of death or a decrease in the quality of lobster is very high. To avoid this, farmers tend to harvest faster. Moreover, until now the technology for handling losbter disease has never been obtained by farmers.

Factors of age, education, number of family members, and cage area in this study did not significantly influence the decision-making of farmers in using *Panulirus ornatus sp* seeds.

4. Conclusion

Farmers' access to credit has been found to have a positive effect on the decision to use *Panulirus ornatus sp* seeds. Farmers' capital adequacy will provide opportunities for farmers to increase their business.

Access to credit is a source of farmers' capital to finance their business. Therefore, the government is expected to provide easy access to credit for farmers to develop their businesses. Based on the results of this study it is also known that access to seeds has a significant influence on the decision of farmers to use *Panulirus ornatus sp* seeds. While the availability of *Panulirus ornatus sp* seeds in the study area is relatively less than other lobsters. This should be the responsibility of the government to be able to provide development of hatchery technology properly, so as to ensure the availability of seeds needed by farmers to develop their businesses. Factors of business experience of farmers also have a significant influence on decision making using Panulirus ornatus sp seeds. Factors lenght time of lobster farming have a significant negative effect on farmers' decision to use *Panulirus ornatus sp* seeds. The longer the time to reach adult size, the greater the risk faced by farmers, especially the risk of disease, climate and weather. The policy implications for this are to improve technology related to the handling of diseases in lobster. The government needs to increase the role of extension workers to provide guidance and assistance in addressing the problem of lobster disease.

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