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The Influence of Socio-Demographic Factors in Adopting Good Aquaculture Practices: Case of Aquaculture Farmers in Malaysia

Rozana Samah[1] & Roslina Kamaruddin[1]

[1] School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia, Malaysia

Correspondence: Rozana Samah, School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia, Malaysia. E-mail: zanafara87@gmail.com

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Abstract

This study examined the influence of socio-demographic characteristics on the level of Good Aquaculture Practices (GAqP) among aquaculture farmer in the Northern part of Peninsular Malaysia. Primary data was obtained from survey that was conducted on 121 brackishwater and freshwater pond aquaculture farmer in the states of Kedah and Penang. Descriptive analysis was applied to identify the socio-demographic characteristics of aquaculture farmer and their level of GAqP. Multiple Linear Regression model was used to analyze the relationship between socio-demographic factors and the level of GAqP. The findings has revealed that the level of GAqP among brackishwater pond farmer is satisfactory where almost 84 per cent of farmer practicing GAqP at the level of 60 per cent and above with the mean value of 71.9 per cent. While the mean level of GAqP for freshwater pond farmer was at 50.3 per cent with only 18.6 percent of them practicing GAqP at the level of 60 per cent and above. Age and having technical knowledge related to aquaculture were the main factors that significantly influence to the level of GAqP among aquaculture farmer. Therefore measures related to the enhancement of technical knowledge among aquaculture farmer should be deliberated in the formulation of aquaculture development programs to ensure the sustainable development of aquaculture in Malaysia.

Keywords: sustainable, good aquaculture practices, Malaysia, socio-demographic

1. Introduction

In Malaysia, aquaculture has been developed since the 1920s, began with freshwater and following by brackishwater and marine aquaculture in the 1930s. Aquaculture is a very important sector for Malaysia in dealing with food safety issues especially when marine capture fisheries production growth were decreasing. This situation due to limited stocks of marine fisheries and fishing beyond the sustainable reproductive capacity (Roslina, 2009). Furthermore, the demand for fish by Malaysian today is high. According to the Ministry of Agriculture and Agro-based Industry Malaysia [MOA] (2011), the fish demand in Malaysia is expected to increase from 1.3 million tonnes in 2010 to 1.9 million tonnes in 2020 with a growth of 3.3 per cent per annum. Therefore, the sustainable aquaculture development effort is very important in order to ensure the demand of fish can be met and consequently food safety is assured.

Aquaculture is the farming activity or the production of aquatic species which include various species of fish, shrimp, shellfish, seaweed and ornamental fish that carried out under controlled conditions. In aquaculture production, management practices are a very important aspect. Good management practices are fundamental to the sustainable production of high productivity and quality of aquaculture products. According to Dhuyvetter, Morris, & Kastens (2011), a well-managed farms can obtain higher profits and consistent as compared with other farms at the same level of resource utilization. Therefore, aquaculture farmers are recommended to practice good aquaculture management.

Aquaculture management practices are concerned with farming practices adopted by aquaculture farmers. According to Pillay & Kufty (2005); Galanopoulos & Aggelopoulos (2006), the concept of management practices are associated with the entire technical operation of a farm and monitoring of the daily activities of the farm where it covers activities such as nutrition programs, food and diet, animal health, and more. In Malaysia, there are efforts relating to Code of Good Aquaculture Practices (GAqP) have been introduced by the Department of Fisheries in 2005. Currently, the Code of Good Aquaculture Practices or Good Aquaculture Practices Scheme is known as Preliminary Farm Certification Program (PRP).

The aspects of GAqP that highlighted in PRP is covering the aspects of (i) Site Selection (ii) Pond Design (iii) Seed Management (iv) Food Management (v) Water Management (vi) Disease Management (vii) Waste Water Management (viii) Pesticides Management (ix) Post Harvest Management (x) Records and Data. Therefore, in this study the authors use all these aspects as indicators for measuring the level of GAqP by aquaculture farmers. The objectives of this study were to (i) identify the socio-demographic characteristics of aquaculture farmers in Kedah and Pulau Pinang (ii) identify the level of good aquaculture practices by aquaculture farmers in Kedah and Pulau Pinang (iii) analyze the relationship between socio-demographic characteristics of farmers and the level of GAqP.

The results of this study can be used as a reference for the improvement of existing programs in order to improve the level of good management practices among aquaculture farmers in order to ensure the sustainable development of an aquaculture in Malaysia.

2. Method

The study was conducted in the states of Kedah and Pulau Pinang which are located in the northern part of Peninsular Malaysia. This study was purposively involved the aquaculture farmers from brackishwater and freshwater pond systems. Pond systems are the main contributor to the total aquaculture production as compared to other culture systems which are cage, tank, pen, canvas, ornamental fish, and seaweed.

2.1 Sampling Procedures

The stratified random sampling technique was applied to select the sample. Department of Fisheries has provided the list of aquaculture farmers that involved in brackishwater and freshwater pond systems. Based on the list, the total number of aquaculture farmers in Kedah was 804 (160 farmers from brackishwater pond system and 644 farmers from freshwater pond system). While in Pulau Pinang, the total number of aquaculture farmers was 104 (55 farmers from brackishwater pond system and 49 farmers from freshwater pond system).

For each state, we stratified the total number of aquaculture farmers by district. In Kedah, brackishwater pond system was practiced in three districts namely Kubang Pasu, Kota Setar, and Kuala Muda / Yan. Therefore, sample for freshwater pond system was also stratified by the same districts as brackishwater pond system. In Pulau Pinang, most of brackishwater and freshwater pond aquaculture farmers were from districts of Barat Daya, Seberang Perai Utara, Seberang Perai Tengah and Seberang Perai Selatan. This resulting the total number of aquaculture farmers in both state were 216 (110 farmers from brackishwater pond system and 106 farmers from freshwater pond system).

The sample from each district was then randomly selected. The total number of successful aquaculture farmers interviewed was 121 which were 62 farmers from brackishwater pond system and 59 farmers from freshwater pond system, which represented 56 per cent of total population. Average farm size of brackishwater and freshwater pond system were 4.20 hectare and 0.80 hectare respectively.

2.2 Data Collection

Data was collected through survey using a structured questionnaire. Data on socio-demographic characteristics of the aquaculture farmers includes information such as age, education level, experience, and knowledge related to aquaculture. Besides that, information on ten aspects of good aquaculture practices as mentioned in introduction part, which was highlighted in Preliminary Farm Certification Program (PRP) was collected (refer to Appendix for set of questions). For each aspect, the information was collected by observation from enumerator and by asking the aquaculture farmer themselves (if necessary) whether the related aspect was practiced or not. Then, the level of GAqP was calculated and expressed in percentage unit.

2.3 Data Analysis

The survey data were analyzed using Statistical Packages for Social Sciences (SPSS). Descriptive analysis such as frequency, mean, maximum and minimum, standard deviation, and percentage were applied to identify the socio-demographic characteristics of aquaculture farmers in Kedah and Pulau Pinang and to identify the level of GAqP practiced by aquaculture farmers in Kedah and Pulau Pinang. While Multiple Regressions Model were used to analyze the relationship between socio-demographic characteristics and the level of GAqP. The linear regression model as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + U \quad (1)$$

where,

Y = Level of Good Aquaculture Practices (GAqP)

X_1= Age (years)

X_2= Level of education

X_3= Experience (years)

X_4= Level of knowledge related to aquaculture activity

U = Error term

3. Results

3.1 Socio-demographic Characteristics of Aquaculture Farmers

Table 1 presents the socio-demographic characteristics of respondents in both states, Kedah and Penang. The result showed the majority of fish farmers (about 70%) for both systems aged less than 50 years old with the mean age of brackishwater and freshwater pond farmers are 46 and 45years old respectively. Most brackishwater (59.7 per cent) and freshwater (71.2 per cent) pond farmers in both states attained the highest educational level at secondary school. While, the percentage of farmer that never attend school was the lowest. In term of experience in aquaculture activity, the majority (67.7 per cent) of the brackishwater pond farmer had 6 to 20 years of experience with a mean of 11 years. For freshwater pond farmer, 69.5 per cent of them had 1 to 10 years of experience with a mean of 8 years. Furthermore, results also showed that majority of aquaculture farmer for both systems in both states had a good level of aquaculture knowledge.

Table 1. Distribution of aquaculture farmer in Kedah and Penang according to socio-demographic characteristics

ITEM	**Brackishwater Pond**			**Freshwater Pond**		
1. Age (years)	***Kedah (n=34)***	***Pulau Pinang (n=28)***	***Total (N=62)***	***Kedah (n=45)***	***Pulau Pinang (n=14)***	***Total (N=59)***
Mean	45	47	46	45	44	45
Std. Deviation	9.46	10.90	10.12	12.43	8.98	11.64
Minimum	28	32	28	23	28	23
Maximum	64	70	70	69	60	69
Percentage (%)						
➢ <30 years	8.8	0.0	4.8	13.3	7.1	11.9
➢ 30-40 years	26.5	35.7	30.6	24.4	28.6	25.4
➢ 41-50 years	35.3	32.1	33.9	28.9	50.0	33.9
➢ 51-60 years	26.5	17.9	22.6	22.2	14.3	20.3
➢ >60 years	2.9	14.3	8.1	11.1	0.0	8.5
2. Level of Education						
Percentage (%)						
➢ No School	2.9	0.0	1.6	0.0	0.0	0.0
➢ Primary School	5.9	42.9	22.6	15.6	0.0	11.9
➢ Secondary School	67.6	50.0	59.7	68.9	78.6	71.2
➢ Diploma/Bachelor and above	23.5	7.1	16.1	15.6	21.4	16.9
3.Experience (years)						
Mean	12	9	11	8	9	8
Std. Deviation	7.63	4.43	6.46	6.95	5.65	6.65
Minimum	2	3	2	1	2	1
Maximum	28	20	28	30	20	30

Percentage (%)						
➢ 1-5 years	29.4	21.4	25.8	51.1	28.6	45.8
➢ 6-10 years	29.4	46.6	37.1	20.0	35.7	23.7
➢ 11-20 years	29.4	32.1	30.6	24.4	35.7	27.1
➢ 21-30 years	11.8	0.0	6.5	4.4	0.0	3.4
4. Level of Aquaculture Knowledge (%)						
Mean	64.9	61.6	63.4	71.7	68.8	71.0
Std. Deviation	13.16	11.89	12.61	11.26	9.56	10.88
Minimum	40.0	40.0	40.0	40.0	60.0	40.0
Maximum	100.0	80.0	100.0	100.0	80.0	100.0
Percentage (%)						
➢ Low (0-44%)	5.9	14.3	9.7	2.2	0.0	1.7
➢ Medium (45-59%)	17.6	32.1	24.2	4.4	0.0	3.4
➢ Good (60-74%)	50.0	39.3	45.2	44.4	64.3	49.2
➢ Very Good (75-100%)	26.5	14.3	21.0	48.9	35.7	45.8

Source: Survey data, 2014

3.2 Level of Good Aquaculture Practices (GAqP) among Aquaculture Farmers

Figure 1 shows the mean of GAqP level among brackishwater and freshwater pond farmers based on a survey conducted on 121 aquaculture farmers in Kedah and Penang. The result revealed that GAqP level of brackish water pond system was better with the mean value of 71.9 per cent as compared with freshwater pond system (50.3 per cent). In term of frequency analysis, about 84 per cent of brackishwater farmer adopt GAqP at a level of 60 per cent and above, as compared to only 18.6 per cent of freshwater farmer (Table 2).

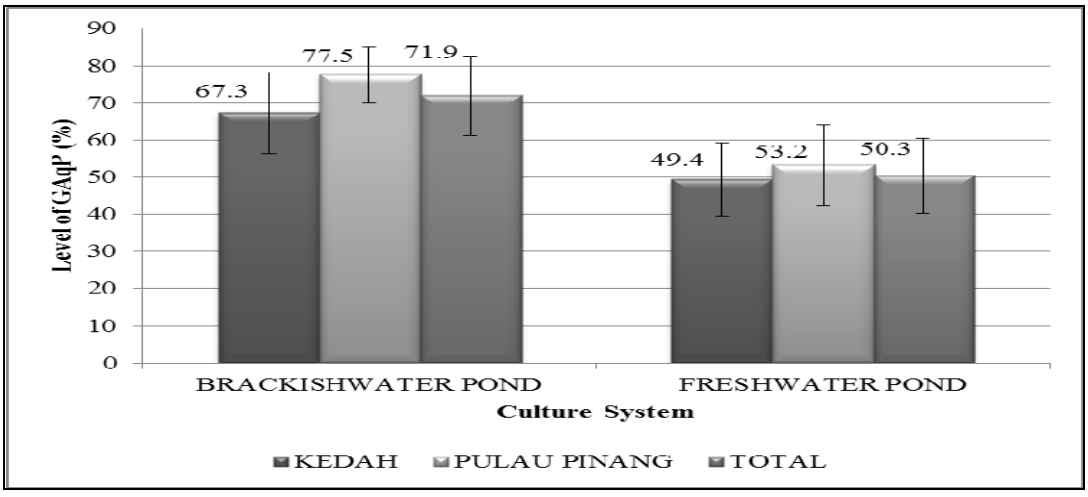

Figure 1. Mean of GAqP level by Aquaculture Farmer in Kedah and Pulau Pinang according to culture system

Source: Survey data, 2014

Table 2. Distribution of Level of GAqP by Aquaculture Farmer in Kedah and Pulau Pinang according to culture system

Level of GAqP (%)		Brackishwater Pond (n=62)			Freshwater Pond (n=59)		
		Kedah	Pulau Pinang	Total	Kedah	Pulau Pinang	Total
0-39	Count	1	0	1	6	1	7
	(%)	(2.9)	(0.0)	(1.6)	(13.3)	(7.1)	(11.9)
40-59	Count	7	2	9	32	9	41
	(%)	(20.6)	(7.1)	(14.5)	(71.1)	(64.3)	(69.5)
60-79	Count	23	12	35	7	4	11
	(%)	(67.6)	(42.9)	(56.5)	(15.6)	(28.6)	(18.6)
80-100	Count	3	14	17	0	0	0
	(%)	(8.8)	(50.0)	(27.4)	(0.0)	(0.0)	(0.0)

Source: Survey data, 2014

3.3 Relationship between Socio-demographic Characteristics and Level of GAqP

The regression results in Table 3 showed that age has a positive relationship with the level of GAqP. Age of aquaculture farmer from freshwater pond system was found to have a significant positive relationship on the GAqP level. Older farmers have higher level of GAqP than the younger farmers. In quantitative terms, increase one year of aquaculture farmer's age will cause the level of GAqP increased by 0.408 per cent.

Further, it was found that the level of education for aquaculture farmers from brackishwater pond system has a negative significant relationship on the level of GAqP. Aquaculture farmers with high education level have lower GAqP level than the less educated farmers. In quantitative terms, the level of GAqP for higher educated farmer is 5.55 per cent lower compared to less educated farmers.

Experience in aquaculture shows a negative relationship with the level of GAqP. But the relationship was not significant influence on the GAqP level by aquaculture farmers. The level of knowledge related to aquaculture activities was found to have a significant positive relationship on the level of GAqP by aquaculture farmer from freshwater pond system. More knowledgeable farmers were found to have higher GAqP levels. Regression results show each addition to the farmer's knowledge will cause the level of GAqP increased by 0.342 per cent.

Table 3. Regression results of relationship between socio-demographic characteristics and level of GAqP according to culture system

Variables	Brackishwater Pond			Freshwater Pond		
	Unstandardized Coefficient	t	Significance	Unstandardized Coefficient	t	Significance
(Constant)	80.494	10.176	0.000	-4.107	-0.267	0.790
Age	0.075	0.591	0.557	0.408	2.732	0.009
Level of education	-5.551	-2.391	0.020	3.535	1.856	0.069
Experience in aquaculture	-0.067	-0.306	0.761	-1.050	-0.349	0.729
Knowledge of aquaculture	-0.115	-1.173	0.246	0.342	3.167	0.003
	Dependent variable: Level of GAqP			Dependent variable: Level of GAqP		
	R square = 0.161; adjusted R square = 0.098			R square = 0.248; adjusted R square = 0.190		
	F-value = 2.584; $p \leq 0.05$			F-value = 4.286; $p \leq 0.05$		

Source: Survey data, 2014

4. Discussion

The result of this study indicates that aquaculture farmers who aged 50 and below are more involved in aquaculture activity in Kedah and Pulau Pinang. This finding is consistent with Roslina & Amir (2015) which stated that 63 per cent of brackishwater pond farmers in Kedah were aged less than 50 years old. Dey et al. (2008); Ng et al. (2013) also found the average age of aquaculture farmers in Malaysia are in the age of 38 years to 50 years. These ages are the most productive age in terms of capital and energy to work optimally. Age factor has an important implication to the modernization of the aquaculture sub sector, since the elderly are quite difficult to accept the changes and they are more comfortable to conduct their activities in a traditional way (MIER, 1999). However results from linear multiple regression analysis showed that older freshwater pond farmers have higher level of GAqP than the younger farmers. These results are consistent with findings by Ogbonna et al. (2014) which have found the same result and also have stated that older farmer were in their economical stage. This economical stage factor will give an impact on decision making in technology adoption. According to Langy & Mekura (2005) the older farmers was more prepared in terms of both financial and relationship with development agencies and these factors make them more willing to accept a technology.

Other positive measure in this study is the rate of illiteracy among aquaculture farmers is low, where most of them had education until secondary school, and the percentage of farmers who do not attend school is the lowest. According to Ifejika et al. (2007); Ali et al. (2010); Solomon & Kerere (2013), education can have an impact on the modernization of the techniques of fish farming where it will help farmers to obtain and understand information about a technology that is often changed. In term of technology adoption, Rahm & Huffman (1984); Saha et al. (1994) have stated that highly educated farmer will be able to make efficient adoption decision and possibility to adopt technology is high. However, the results from linear multiple regression analysis showed that highly educated brackishwater pond farmers have lower level of GAqP than the less educated farmers. This result is similar with the results from study by Nyaupana & Gillespie (2009), where education was found to be negatively correlated with Best Management Practices (BMPs) by producers of shrimp in Louisiana and also insignificant for adoption of BMPs. According to Uematsu & Mishra (2010), formal education can be a barrier to technology adoption, where education can increases farmer's human capital and gives them more lucrative incentives for employment opportunities off the farm. This situation makes the managerial time on farm decreases then resulting hard to implement new technologies.

Furthermore, the result in this study shows that brackishwater pond farmers have more experience than freshwater pond farmers. According to Salau et al. (2014), farmers who have little experience are less proficient in the management of aquaculture farms. Linear multiple regression analysis result showed that experience has no significant influence on the level of GAqP aquaculture farmers in Kedah and Pulau Pinang. In term of knowledge, most of aquaculture farmers have a good level of knowledge that related to aquaculture activity. According to Davenport & Prusak (1998), knowledge is a skill associated with the 'know-how'. Linear multiple regression analysis result showed that more knowledgeable freshwater pond farmers were found to have higher levels of GAqP. This is agree with Sakib et al. (2014) which state that knowledge plays an important role in making the right decisions in the acceptance of an innovation.

Finally, the results of the level of GAqP by aquaculture farmers indicate that the level of GAqP by farmers from brackishwater pond system is higher than freshwater pond system and this finding is consistent with studies by Roslina (2013). According to El-Sayed (2006), freshwater fish such as tilapia or catfish has an advantage in terms of disease-resistant, able to tolerate with poor environment such as low water quality and high stocking density. These advantages led most of freshwater farmers do not practice GAqP.

5. Conclusion

This study has identified the level of GAqP among aquaculture farmers in Kedah and Pulau Pinang and its relationship with the socio-demographic characteristics of farmers. Results showed the level of GAqP by aquaculture farmers from brackishwater pond was better with the mean value of 71.9 per cent as compared with freshwater pond system (50.3 per cent). Overall, we can conclude that the level of GAqP by aquaculture farmers was still far to achieve the standard of 100 per cent as required under Preliminary Farm Certification Program (PRP). The number of aquaculture farmers that practicing GAqP at the level of 100 per cent still small particularly for freshwater pond system. However, GAqP is aimed to produce safe and good quality aquaculture products and environmental friendly. Thus, the government, in particularly the Department of Fisheries have to take drastic measures to increase the GAqP level among aquaculture farmers. Knowledge transfer and knowledge sharing is very important. In fact the result from linear multiple regression analysis showed that the level of aquaculture knowledge was positively significant in influencing the adoption of GAqP that imply more

knowledgeable farmers will adopt GAqP at higher level. Therefore, the knowledge related to GAqP has to be transferred effectively to aquaculture farmers through intensive training programs. The dissemination of information by using medium that is easy to access, such as advertisement in the mass and social media should be intensified. The strong relationship between farmer and development agency is also very crucial in order to ensure the efficiency of knowledge transfer.

At this point, GAqP was carried out voluntarily by aquaculture farmers. In this case they have the right not to practice GAqP. Therefore, in order to encourage them to practice GAqP, government may introduce some incentive or subsidies. As such, government will buy the GAqP product with higher price and help them market the product with special marketing channel compared to non GAqP product. In addition, making GAqP mandatory for all aquaculture farmers also should be taken into consideration. In future, study on demand for GAqP product is needed in order to identify the willingness of consumer to pay for GAqP product at higher price as compared to non GAqP product. Thus, the government could introduce the discrimination price policy between GAqP product and non GAqP product in order to increase the income of GAqP producer.

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Appendix

Questions on GAqP

Aspect	Criteria	Practice	
		Yes	No
Site Selection	An area away from sources of water pollution (industrial, residential, area development)		
	The design and size of the pond facilitate the operation of farms		
Farm Design	There is a system of water inlet and outlet separately		
	There are treatment ponds constructed		
Seed Management	Use the quality seeds and disease-free		
Food Management	Food derived from food suppliers approved by the Department of Fisheries		
	Processing feed conditions are clean		
	Feeding schedule available		
Water Management	Examination of the main water parameters of pond is done (pH, temperature, DO)		
Disease Management	Only use medications approved by the Department of Fisheries		
Wastewater Management	Sediment from ponds are thrown into the designated area		
Pesticides Management	There pest control available		
Post-Harvest Management	Using clean equipment during harvesting		
	Use methods that do not harm the quality of the yield		
Records and Data	Have livestock management record		
	Have a harvest record (sales receipt)		
	Have financial record		