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Socio-Economic Factors Influencing White Shrimp Production in Chachoengsao Province, Thailand

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Among the fishery commodities of Thailand, the frozen and processed shrimps were the most important exports for a period of not less than 30 years. However, shrimp farming industry in Thailand has suffered numerous predicaments such as decreasing in productivity and losses. Hence, currently, white shrimp (*Litopenaeus vannamei*) farming has been practiced for more than 90% of shrimp cultivation area. It could substitute for black tiger shrimp. Interestingly, this study aimed to examine social and economic data of white shrimp farmers, and analyse social and economic factors affecting the production of white shrimp. The study was carried out in Chachoengsao province, which has white shrimp farming about 19,382 Rai, accounting for 9.56 % of total white shrimp farming in the country. A simple random technique was adopted to select 45 farmers as samples. Descriptive statistics and multiple regression analysis were employed to analyse the data. The results revealed that most of white shrimp farmers were male (64.4%).Age of farmer was during 41-55 years old (35.5%).The household size consisted of 3-5 family members (71.2%).The farms size was during 1.5 to 10 Rai (66.7%).The number of family labour comprised of three people (40%). Sale price was during 100-150 Thai baht (62.2%). Finally, sales channel was at their farm (55.6%). The multiple regression analysis demonstrated that genders of the farmers, ages of a farmer, household size, farms size, number of family labour, selling price, and sales channel were related to white shrimp production. The result from this study could provide insight information to relevant organizations to improve selling and pricing system of white shrimp farmers. Furthermore, white shrimp farmers had to pay intention to white shrimp markets in order to access and acquire more information or participated in a training program related to white shrimp production.

Keywords: Socio-economic, White shrimp production, Chachoengsao, White shrimp farmer. Shrimp farming.

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Introduction

Among the fishery commodities of Thailand, the frozen and processed shrimps were the most important exports for a period of not less than 30 years. However, shrimp farming industry in Thailand has suffered numerous predicaments such as decreasing in productivity, losses, and lacks of breeding for black tiger shrimp. Hence, since 2001until now, white shrimp (*Litopenaeus vannamei*) farming has been practiced for more than 99% of shrimp cultivation area in Thailand. It could substitute for black tiger shrimp (Department of Fisheries, 2016).

Pacific white shrimp is one species of the Pacific shrimp with scientific names as *Litopenaeus vannamei* or *Penaeus vannamei*. Since shrimp can be cooked in many kinds of foods due to its increasing demand. Meanwhile, shrimp can grow and adapt to the culture development as well (Coastal Fisheries Research and Development Division, 2016). Thus, when considering the white shrimp production by the region of Thailand during the first 6 months of the year 2016, shrimp production in the upper south, the lower southern Andaman coast, and the lower southern Thailand coast (Table 1) showed an increasing significantly compared to the previous period of the year 2015 with 48.61%, 26.85%, and 20.29% respectively. White shrimp production in eastern and central region of the country were decreased with 7.56% and 4.65% respectively (Marine Shrimp Culture Research Institute, 2016).

The amount of shrimp production in the eastern and central regions has reduced because of the water availability in term of hot weather and higher temperature resulting in slower growth of shrimp and causing diseases such as white spot syndrome virus (Wongmaneeprateep *et al*., 2010).

Although the amount of shrimp production in the eastern region has declined over time due to water availability, but in this area still have a lot of farmers who engaged in white shrimp farming. Statistics from the Department of Fisheries in the year 2016 reported that the total amount of white shrimp production in eastern region is 8,249 farmers, representing 38.25 percent of shrimp farmers in the country. There are several ways that diversified farming systems can help farmers maximize their utility, such as mitigating different types of risks, providing complementary inputs, and optimizing production in the face of different biophysical or input and output market constraints (Bowman and Zilberman, 2013). Socio-economic factors influencing white shrimp production can be included, since modern shrimp farming has socio-economic costs (Bailey, 1988; Primavera, 1993; Baird and Quarto, 1994; Barraclough and Finger-Stich, 1996; Primavera, 1997). Accordingly, numerous studies attempted to investigate socio-economic impacts of shrimp culture. For example, studied by Primavera (1997) who investigated socio-economic

impacts of shrimp culture in mangroves area in Viet Nam, Neiland *et al*., (2001) and Ngo (2013) studied social and ecological challenges of market-oriented shrimp farming in Viet Nam.

Table 1. Annual white shrimp production (January-June, 2016) classified by the region of Thailand

Unit: tons

Region	The white shrimp production quantity	% Change As compared with 2015 in the same period
East	27,669.63	-7.56
Central	13,468.96	-4.65
The Upper South	33,361.13	+48.61
The Lower Southern Thailand coast	14,122.66	+20.29
The Lower Southern Andaman coast	17,443.81	+26.85
Total	106,066.18	+15.47

Source: Marine Shrimp Culture Research Institute, 2016

In Thailand, the past studied of Boonrit *et al*., (2011) who investigated the production factors affecting the efficiency of white shrimp (*Litopenaeus vannamei*) production by farmers in Ranot district of Songkhla province was conducted. However, there is a lack of a study in socio-economic factors affecting shrimp production, particularly, in the area which shrimp is important for farmer's livelihood, and the production is decreased. Socio-economic and environmental impact analysis of shrimp farming is an important aspect. While, shrimp industry is an important and potential sector for economic development in the country. Shrimp cultivation has an ecological impact in terms of salinity increase and loss of biodiversity (Mitro *et al*., 2014).

Interestingly, therefore, this study focused on the socio-economic factors affecting white shrimp production in the region which shrimp production has emerged as one important livelihood for farmers. As such, Chachoengsao province, a part of the eastern region of Thailand, is a selected as a study area. Chachoengsao province which has white shrimp farming about 19,382 Rai, accounting for 9.56 % of total white shrimp farming in the country (OAE, 2015). The result from this study is useful to encourage farmers to increase the amount of shrimp farming, as well as provide significant factors for relevant organizations or strategy makers to enhance shrimp production in Thailand.

Materials and methods

The study area

The study was carried out in Chachoengsao province, Thailand representing white shrimp farming in the centre of the region of the country. The white shrimp farming in this area accounted for about 19,382 Rai, or 9.56% of total white shrimp farming in the country (OAE, 2015).

Sampling and Sample size

White shrimp farmers in Pak Nam sub-district, Bang Khla district, Chachoengsao province was selected as the target population. There were 192 white shrimp farmers who registered with the Department of Fisheries in 2016. In order to determining sample size, this research was adopted from Boonchum and Boonsong (1992) when the finite population was at hundred, the appropriate sample size for estimating the proportion of a population is given by 10%-30%. Hence, in this study, 45 farmers were randomly selected by using about 20% of the total population as the study sample.

Data Collection and Data Analysis

Questionnaires were administered to 45 white shrimp farmers in Pak Nam sub-district, Bang Khla district, Chachoengsao province during the February to March 2015. Data were analysed using the Statistical Package for the Social Sciences (SPSS16). Descriptive statistics (frequency, percentage) were employed to explain the socio-economic characteristics of the farmers. Multiple linear regression model was employed to analyse factors influencing shrimp production in the study area.

The analytical regression model is expressed implicitly as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \mathcal{E}$$

Where,

Z_i = Quantity of shrimp produced (kilogram per rai)
β_0 = Constant term
β_k = Coefficient to be estimated
X_1 = Gender
X_2 = Age of farmer (years)

X_3 = Education level
X_4 = Marital status
X_5 = Household size
X_6 = Number of family labour
X_7 = Farm size (rai)
X_8 = Farming experience (years)
X_9 = Participate in training program
X_{10} = Sales channel
X_{11} = Selling price (baht)
ξ = independent error term

Results

Socio-economic characteristic of white shrimp farmers in the study area

The result of the socio-economic characteristic of the respondents is presented in Table 2. The majority of white shrimp farmers were male (64.4%). Almost half of the respondents were between 41-55 years old (46.5%). Similar to educational level, the majority of respondents completed in primary school (40.0%). More than half of them (57.8%) were married. Almost all of them (71.2%) had an average family member 3-5 people. Approximately, 40% of the respondents indicated that three family members were engaged in family white shrimp farming, and most of them (66.7%) cultivated white shrimp farming around1.5-10 rai or 0.24 – 1.6 hectares.

Regarding the experience in white shrimp farming, the result revealed that the almost of the respondents (44.4%) had an experience in the white shrimp farming about 5-15 years. Interestingly, most respondents (62.2%) never participated in the training programs concerning white shrimp farming. Almost half of the respondents had an average quantity of shrimp production at 1,000-3,000 kilogram per rai. After harvesting, more than half of them (55.6%) had sold white shrimp product at farm gate with an average price at 148.67 Thai baht per kilograms.

Table 2. Socio-economic characteristics of the shrimp farmers.

Characteristics	Frequency	Percentage
Gender		
Male	49	64.4
Female	16	35.6
Total	45	100
Age of farmer (Mean = 51.56 years)		
25-35	8	28.9
41-55	21	35.6
> 55	16	35.5
Total	45	100
Education level		
Primary school	18	40.0
Junior high school	10	22.2
Senior high school	9	20.0
Diploma/bachelor degree	8	17.8
Total	45	100
Marital Status		
Single	16	35.6
Married	26	57.8
Divorced	3	6.7
Total	45	100
Household size (Mean = 3 persons)		
< 3	11	24.5
3-5	32	71.2
> 5	2	4.3
Total	45	100
Number of family labour (Mean = 3 persons)		
1	4	8.9
2	8	17.8
3	18	40.0
4	13	28.9
5	2	4.4
Total	45	100
Farm size (Mean = 11.244 Rai)		
1.5-10	30	66.7
11-20	8	17.7
> 20	7	15.6
Total	45	100

Table 2. (cont.)

Characteristics	Frequency	Percentage
Year of farming experience (Mean = 21.22 years)		
5-15	20	44.4
16-25	15	33.4
> 25	10	22.2
Total	45	100
Participate in training program		
Never	17	37.8
At least 1 time	28	62.2
Total	45	100
Quantity of shrimp produced (Mean = 1,831.56 kilograms per rai)		
450-1,000	16	35.6
1,001-3,000	22	48.8
> 3,000	7	15.6
Total	45	100
Sales channel		
Farm	25	55.6
Shrimp raft	18	40.0
Market	2	4.4
Total	45	100
Selling price (Mean = 148.67 Thai baht)		
100-150	28	62.2
150-200	14	31.1
> 200	3	6.7
Total	45	100

Source: Survey data analysis, 2016

Factors influencing white shrimp production in Chachoengsao province, Thailand

Table 3 presents the result of socio-economic factors influencing white shrimp production in the study area. Multiple linear regression was employed to investigate factors affecting the quantity of vegetables produced per rai. The F-ratio (10.265) was significant at 1% implying goodness of fit of the model. The R^2 (0.774) indicated that 77.4% of the variation in the dependent variable (white shrimp production) can be explained by 11 independent variables includes: gender (X_1), age of shrimp farmer (X_2), education level (X_3), marital status (X_4), household size (X_5), number of family labour (X_6), farming farm size (X_7), experience (X_8), participate in training program (X_9), sales channel (X_{10}), and selling price (X_{11}).

The results in Table 3 revealed that six variables had positively significant influence on white shrimp production namely gender, age of farmer, household size, farm size, sales channel, and selling price, only one variable (the number

of family labour) had negatively significant influence on the white shrimp production. While, four independent variables namely marriage status, farming experience, educational level, and participated in training programs related to white shrimp farming did not have any significant influence to white shrimp production.

Table 3. Regression analysis revealed the factors influencing white shrimp production in Chachoengsao province, Thailand.

Variables	Coefficient	SE	t-stat	p-value
Constant	-5.442	1766.576	-3.981	.004
Gender (X_1)	.793	266.944	2.970	.006***
Age of farmer (X_2)	.060	28.609	2.092	.044**
Education level (X_3)	.288	204.428	1.406	.169
Marital status (X_4)	-.311	268.304	-1.159	.255
Household size (X_5)	.431	208.958	2.064	.047**
Number of family labour (X_6)	-.809	278.581	-2.904	.007***
Farm size (X_7)	.038	13.664	2.812	.008***
Year farming experience (X_8)	-.036	24.870	-1.444	.158
Participate in training program (X_9)	.379	245.189	1.544	.132
Sales channel (X_{10})	.476	222.753	2.136	.040**
Selling price (X_{11})	.020	3.563	5.687	.000***
R^2	.774			
Adjust R^2	.698			
F-ratio	10.265***			

***Significant at 1%, ** Significant at 5%
Source: Survey data analysis, 2016

Discussion

The majority of the white shrimp farming in the study area was small as indicated by farm size with an average cultural area during 1.5-10 rai or 0.2-1.6 hectares (ha). This was the typical characteristic of traditional shrimp farming which was small-scale marine farming in Thailand, with average culture areas during 0.16-1.6 ha. (Tookwinas, 1991).

The majority of white shrimp farmers in the study area were male. Additionally, the regression model investigating factors influencing white shrimp production in Chachoengsao province exhibited that gender was positively related to white shrimp production at 1% level of significance. This finding also indicated that shrimp farming in the study was performed mostly by males which was similar to the finding reported by Tokula and Ekwe (2006) and Sharmin *et al*. (2007) stated that male participations and involvement were dominant in shrimp farming.

In terms of age, the result presented that age of farmer was positively significant at 5% level to white shrimp production which was consistency with the statement made by Alauddin and Hamid (1996) indicating that the shrimp farming is generally classified into the traditional shrimp farming with older farmer, and the older farmers are more capable of taking proper decisions regarding farm management practices as they have many years of practical experience (Begum *et al*., 2015). As for the farm size, the result revealed that farm size had a positively significant relationship with white shrimp production technologies at 1% level of significance. This result could be explained by the fact that if farmers wish to increase their shrimp production, basically they should increase their cultured area. This result is confirmed by Rahman (2005) as cited in Begum *et al*. (2015) which point out that medium-sized farm produced the highest yield.

Similarly, the result of household size was positively significant to a white shrimp production at 5% significant level. This may imply that shrimp production was a major source of income for their family (Chanratchakool and Phillips, 2002). Likewise, increased in household size can lead to the increase in a white shrimp production. Nevertheless, the research result discovered that a number of family labour was negatively significant at 1% with the shrimp production. This may imply that shrimp farmers may ignore to include family labour into their production cost. Actually, the use of family member labour was included as a variable cost (Thongrak *et al*., 1996). For instance farms using more family labour may lead to decreased in shrimp production.

For sales channel and selling price, the result showed that both market-oriented variables were positively significant to a white shrimp production. As mentioned above, a white shrimp farming in the study area was an important source of family income, meaning that if farmers can sell their product at the higher price, they will obtain more income. Thus, an increase in selling price will lead to an increase in a white shrimp production. This finding was confirmed with the studied by Quagrainie (2015) pointing out that the selling price was the most significant variables for a white shrimp production. As for the sales channel, it demonstrated positively significant with a white shrimp production. This may be explained by the statement from Islam *et al*. (2011) that the good channel and available marketing services may be depending on the farm size and the quantity of a white shrimp production as well.

Conclusion

The main socio-economic characteristics of the white shrimp farmers in Pak Nam sub-district, Bang Khla district, Chachoengsao province were mostly male shrimp farmers. Almost half of them had an age rank between 41-55 years old, and completed primary school. Most of them cultivated white shrimp farming about 1.5-10 rai with an average experience in shrimp farming about 5-15 years. However, almost all of them never attained the training program with related to white shrimp farming. Almost half of the respondents had an average quantity of shrimp production at 1,000-3,000 kilogram per rai. More than half of them sold white shrimp product at farm gate with an average price at 148.67 Thai baht per kilograms which was lower than the average price of white shrimp as a whole (180 Thai baht per kilogram; OAE, 2016).

This study also examined the factors affecting the productivity of white shrimp production. The study revealed that gender, age of farmer, household size, farm size, sales channel and selling price were positively significant to the productivity of the white shrimp production, while the number of family labour presented negative relation to productivity. The most important variable in determining white shrimp production was the selling price of white shrimp produced. Therefore, the result from this study could provide insight information to relevant organizations to improve selling and pricing system of white shrimp farmers. Furthermore, white shrimp farmers had to pay intention to white shrimp markets in order to access and acquire more information or participated in a training program related to white shrimp production. Participation in a training program in various aspects of white shrimp marketing will be able to access to updated pricing information. In addition, policies should be developed and enhanced the productivity of white shrimp farmers through the provision of workshops or learning from best practices that farmers can obtain further knowledge from shrimp production trainings which would enable them to improve their productivity.

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