

Determinant factors of fishermen income and decision-making for providing welfare insurance: An application of multinomial logistic regression

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ABSTRACT

As a country surrounded by the ocean, Indonesia is categorized as a country that has marine potential. The fishermen communities' economy depends on ocean. However, the fishermen communities live below the poverty line and their average income is less than regional minimum wage. In conjunction with the issue, this study seeks to investigate the factors affecting the income of fishermen communities and right decision to fishermen in covering with welfare insurance in Cirebon, Indonesia. The quantitative study is designed using cross-sectional approach. The data collected by applying random sampling with open-ended questions and interview. A total of 100 fishermen's have participated in this study. The study used some factors in measuring the fishermen community income, namely coastal environment condition, fish catching technology and location, operational capital, climate (season) condition, fishermen's age, fishermen's education, and fishing experience. The data are analyzed using the multinomial logistic regression model by assisting the statistical software, i.e., SPSS-23. The results show that coastal environment condition, fish catching technology and location, operational capital, climate (season) condition, fishermen's age, fishermen's education, and fishing experience have significant effects on fishermen income. Interestingly, the factor of coastal environment condition and climate (season) condition have significant negative effects on fishermen income. In conclusion, this study identified that two important factors reduced the welfare level of fishermen (via income). Also, in line with that things, the right decision which can provide to support and assist the fishermen community was by providing the welfare insurance. It is purposely to give them the protection from various risks faced by fishermen.

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1. Introduction

Indonesia is a country which has been surrounded by ocean and it has become a country with considerable marine potential. It will be making the fishermen communities' life prosperous since their livelihood comes from the ocean. Unfortunately, the fisher communities' lives are often identical to the poverty (Noer, 2018; Rinaldi et al., 2019; Pranata, 2019). The recent level of fishermen's prosperity is still under the agrarian sector. Fishermen (especially for traditional fishermen) are grouped into the most improvised social group level over other groups in the agrarian sector (Purcell et al., 2016; Ghani et al., 2017; Firdaus, 2020; Prawiti & Dewi, 2020).

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As a consequence, the use of marine and coastal resources optimally will support the growth of local economy and gives high advantage to fishermen communities' prosperity (Adili & Antonia, 2017; Fatihudin, 2019). Still, seas and coastal areas are not the main priorities for the national economy growth and it is unable to give prosperity to communities. Hence, most of fishermen communities are still below the poverty line (King et al., 2018; Imam et al., 2018; Jönsson, 2019; Ernayani et al., 2020). Most of communities in coastal areas in Indonesia are fishermen from generation to generation. Their characteristics are dynamically constructed as surrounding resources, so they should keep moving from one location to others to get the optimal fish capture (Seara et al., 2016). Besides, the high business risk makes fishermen communities live in the stern natural atmosphere which is always in uncertainties in carrying out their business (Primyastanto, 2015; Biswal et al., 2017; Leasiwal, 2017; Rusmana et al., 2019; Putri & Wulandari, 2020; Lein & Setiawina, 2018).

Communities who work and earn money from as fishermen are the ones who do business activities through getting income from fishing. Fishermen are people who actively do their job in capturing fishes (Himes-Cornell & Kasperski, 2016). The prosperity level of fishermen is extremely determined by fish capture results. The quantity of fish capture reflects their income and this income is mostly used for family necessities (Huchim-Lara et al., 2016; Sutton & Rudd, 2016; Hoang et al., 2020). According to Salim (1999), factors affecting fishermen's income involve: capital, number of ships, number of employees, fishing mileage, and experiences. Henceforth, it is needed to investigate the factors affecting fishermen's income to learn which factors significantly affect fish capture results.

Several researchers have focused on identifying factors affecting fishermen's income, by involving some variables and methods. A study by Rinaldi et al. (2019) investigated the factors affecting fishermen's income in Sibolga City. They used some variables, namely asset ownerships, education levels, work hours, and work experiences. The research population were fishermen who used outboard motorboats under 5GT type with the fishing tool of net sticks. The data were collected using purposive sampling technique toward 90 fishermen through the open-ended questionnaire. The data were analyzed using the Cobb-Douglas production function. The result of their study found that the asset ownerships, education levels, work hours, and work experiences had significant effects on fishermen's income in Sibolga.

Further, Putri and Wulandari (2020) studied whether or not the fishermen's experiences, educations, and work hours influence the fishermen's income. The population were fishermen distributed from two regencies, namely Central Bangka and East Belitung with a total of 238 respondents. The study used the primary data and collected using the interview and self-administered questionnaire. The data were analyzed using a qualitative approach through path analysis. The result of their study showed that fishermen's experiences and work hours significantly affect the fisher's income while their education was insignificant.

Leasiwal (2017) investigated the fishermen communities' income condition in West Rurehe and West Serum Districts. He aimed to study whether the fishing experiences, education levels, fishing labor wages, and technologies affect fishermen's income level. The data were obtained through questionnaire and interview. The data were analyzed using qualitative descriptive and quantitative using panel data regression. The result reflected that factors of fishing experiences, fishing labor wages, and technologies absolutely affect the increase of fishermen's income while education levels do not.

In addition, Ridha (2017) carried out a study in coastal area of Idi Rayeuk District, aiming to identify whether or not the variable of capital, employees, experiences, fish prices, and fish catching numbers affect the fishermen's income. A total of 30 fishermen of outboard motorboats were collected by using the random sampling technique. The study was designed using quantitative approach and analyzed using multiple linear regression model. The result showed that only the variable of capital, fish prices, and fish capture numbers that partially effect on fishermen's income. Such studies have also been conducted by Depledge et al. (2017), Satumanatpan and Pollnac (2017), and Young et al. (2019). By the following previous elaboration, the current study tries to fulfill the gaps from previous studies by considering the factors that affect the fishermen income and right decision to fishermen in covering with welfare insurance in Cirebon, Indonesia.

2. Materials and Methods

This section presents the materials and methods used in this study. The materials explain about the object of the data and factors to be analyzed while the methods deal with models used in the study.

2.1 Material

The data were fishermen communities who earned money from capturing fishes in the area of Cirebon Indonesia. The data consisted of 100 samples, from the open sampling method through questionnaire and interview. From 100 respondents, the fishermen's income generally was differentiated into two categories, including $n_1=20$ or 20% respondents as category 1 who got the high income, and $n_0=80$ or 80% respondents as category 0, who get the medium to low incomes. Factors expectantly affecting the fishermen's income were 8 (eight) variables, including Coastal environment condition (X_1), Fish capture technology (X_2), Fish capture location (X_3), Operational capital (X_4), Climate (season) condition (X_5), Fishermen's

age (X_6), Fishermen's education (X_7), and Fishing experience (X_8). To the data, which will require normality test, as discussed below.

2.1.1 Definition of operational variables

Fishermen's income is the value received by fishermen from selling fish capture results as measured in the rupiah unit. Fishermen communities' income is dependent to the use of fishery resource potentials in the sea.

Coastal environment degradation is reflected by what happens to mangrove forests. It does not merely affect land shifting and shrinking but threatens the living life. The population of some kinds of fish potentially keeps decreasing due to the damage and disappearance of habitat.

Catching fish activities use traditional or modern fishing tool. Fish capture with a traditional technology will result in fewer number of capture result compared to the modern one.

Fish catching location is an area compatible for the fish habitat, naturally, known as the fish capture area. The condition needed for this area is that this area is possibly compatible for fish life and habitat and has a great amount of fish food.

Capital is included into the production factor. If there is no capital, fishermen have no ability to pay the operational fee or pay and buy tools they use. The amount of the operational cost affects the fishermen's total income. It is due to that the operational cost increases fish capture numbers.

Season considerably affects the fishermen's lives in the monsoon west and monsoon east seasons. The high wave due to the monsoon west and east will decrease the fishermen's income.

Age: people reaching the age of 15 and above are included to fishermen while the ones below the age of 15 are not, although they participate in fishing. People at the age of 15 is considered to be responsible to fulfill the fish capture target, so the income also increases.

Education, before becoming fishermen, they usually get or do not get formal educations such as elementary school, junior high school, senior high school.

Experience, a person is considered as a fisherman if he has reached the age from 15 to 30, a person above the age of 30 is considered as an experienced fisherman (*pawing*). It is also a category or classification to determine the fish capture number.

Further, we employ the normality test whereas the independent variable for the data value is fluctuated. The strong difference between data values affects bias in the analysis so that it would not reflect the real situation. The normality test was conducted using the statistical software of SPSS 23. After conducting the normality test, the data were used in the estimation analysis of logistic regression model (Sidi et al., 2017.b; 2018; Sukono et al., 2018.a; Taslim et al., 2020.a; 2020.b).

2.2 Method

2.2.1 Logistic regression model

The logistic regression was a part of the regression model analysis often used to estimate probabilities of an event by matching the data in the logit function of logistic curves. This method was a general linear model used in the binomial regression. As in the general regression model, this method used some predictor variables in terms of numeric and category (Sukono et al., 2014; Sidi et al., 2018).

2.2.2. Multinomial Logistic Regression Model

In conducting the data analysis in which the response variable was nominal, the study used a method developed from the logistic regression model, namely the nominal logistic regression model while the response variable in terms of ordinal used the ordinal logistic regression model (Sukono et al., 2014; Sidi et al., 2017.b). Multinomial logistic regression model (nominal and ordinal) is an approach used to describe the relationship between some predictor variables X and a multinomial response variable (polytomous). The nominal logistic regression model is used when there is no order between the response categories analyzed. One category is selected to be a reference category. The multinomial logistic regression model is generally represented in the following equation.

$$P(Y = j|x) = \pi_j(x) = \frac{\exp[g_j(x)]}{\sum_{k=0}^{r-1} \exp[g_k(x)]} = \frac{\exp(\beta_{j0} + \beta_{j1}x_1 + \beta_{j2}x_2 + \dots + \beta_{jp}x_p)}{\sum_{k=0}^{r-1} \exp(\beta_{k0} + \beta_{k1}x_1 + \beta_{k2}x_2 + \dots + \beta_{kp}x_p)}, \quad (1)$$

where $P(Y = j|x)$: the conditional probability from the response variable Y for the j category on the vector x , $j = 0, 1, \dots, r-1$; $\pi_j(x)$: the logistic regression model for the response variable Y for the j category; $g_j(x)$: the model logit for the j category; x_m : the value of the m explanatory, $m = 1, 2, 3, \dots, p$; β_{jm} : the coefficient parameter estimators. Where, the vector $\tilde{\beta}_0 = 0$, so $g_0(x) = 0$; $\tilde{\beta}_0$: the parameter coefficient of logit model for the response variable Y to the 0 category ($\beta_{00}, \beta_{01}, \dots, \beta_{0p}$) (Sukono et al., 2014; Sidi et al., 2018).

For the response variable with r category, it is able to form $r-1$ equation of the logit model, where each equation forms the binary logistic regression consisting of a group of category toward reference, as shown in the following equation.

$$g_{r-1}(x) = \ln \frac{P(Y = r-1|x)}{P(Y = 0|x)} = \ln \left(\frac{\pi_{r-1}(x)}{\pi_0(x)} \right) = \beta_{(r-1)0} + \beta_{(r-1)1}x_1 + \dots + \beta_{(r-1)p}x_p. \quad (2)$$

In general, the steps conducted in the multinomial logistic regression model analysis include: (1) estimating parameter coefficients for the multinomial logistic regression; (2) conducting tests on parameter coefficients to simultaneously know the compatibility multinomial logistic regression model estimators; (3) conducting tests on parameter coefficients to partially know predictor variables mostly affecting the multinomial logistic regression model; (4) conducting the interpretation on the ratio of trend value based on multinomial logistic regression model estimators (Sukono et al., 2014; Sidi et al., 2017.b).

2.2.3 Coefficient parameter estimator

In the coefficient parameter estimators of logistic regression model, the expected values between response variables are not linear and have not similar variation so the coefficient parameter estimator $\tilde{\beta}$ can be obtained through the Maximum Likelihood Estimation. The function of conditional Likelihood for the data sample as many as n observation is stated as the following,

$$l(B) = \prod_{i=1}^n \left[\pi_0(x_i)^{y_{0i}} \pi_1(x_i)^{y_{1i}} \pi_2(x_i)^{y_{2i}} \dots \pi_{r-1}(x_i)^{y_{(r-1)i}} \right]. \quad (3)$$

If the left and right sides of Eq. (3) are taken the natural algorithm, the log Likelihood function it is obtained as follows,

$$L(\beta) = \ln[l(\beta)]$$

$$L(\beta) = \ln \left[\prod_{i=1}^n \left[\pi_0(x_i)^{y_{0i}} \pi_1(x_i)^{y_{1i}} \pi_2(x_i)^{y_{2i}} \dots \pi_{r-1}(x_i)^{y_{(r-1)i}} \right] \right]. \quad (4)$$

To get the $\tilde{\beta}$ estimator value that is able to maximize into $L(\beta)$, we need to the first and second derivatives respect to function $L(\beta)$. β value can be determined using the Newton- Rapson iteration method (Sukono et al., 2017.a; 2017.b; Sirait et al., 2020).

2.2.4 Testing parameter

Testing parameter simultaneously; Testing coefficient parameters was simultaneously conducted to test the role of predictor variables in multinomial logistic regression model estimators simultaneously toward the response variable. Testing the hypotheses were reflected in the followings.

H_0 : $\beta_{j1} = \beta_{j2} = \dots = \beta_{jp} = 0$, means that there is no influence of predictor variables toward the response variable.

H_1 : there is minimally one $\beta_{jm} \neq 0$, which means there is at least one predictor variable affecting the response variable, $m = 1, 2, \dots, p$, with the testing statistic as represented below,

$$G = -2 \ln \left[\frac{l_0}{l_k} \right]. \quad (5)$$

H_0 will be rejected in α the significance level if the statistic value of $G > X^2_{(v;a)}$ or p -value $< \alpha$. If H_0 is rejected, the predictor variables simultaneously or wholly affect the response variable (Sukono et al., 2018.b; 2019.c).

Testing parameter individually; Testing coefficient parameters was partially conducted to individually test each role of predictor variables in the model. Testing variables was conducted after using the Wald statistics. The hypotheses used were in the followings,

$H_0 : \beta_{jm} = 0$, indicates that there is no influence of the m predictor variable toward the variable response of the j category.

$H_1 : \beta_{jm} \neq 0$, indicates that there is influence of the m predictor variable toward the variable response of the j category.

$$j = 0, 1, 2, \dots, r-1; \quad m = 1, 2, \dots, p$$

The statistic of Wald test is as follows,

$$W = \left[\frac{\hat{\beta}_{jm}}{Se(\hat{\beta}_{jm})} \right]^2. \quad (6)$$

A hypothesis of H_0 is rejected if the statistic $W > X^2_{(1;\alpha)}$ or p -value $< \alpha$. If a hypothesis of H_0 is rejected, the coefficient parameter estimator of β_{jm} significantly affects the response variable (Sukono et al., 2014; 2019.b). Hosmer and Lemeshow test is known as a test of logistic regression models fit to the data. Statistic test of Hosmer & Lemeshow is follows,

$$\hat{C} = \sum_{k=1}^g \frac{(O_k - n_k \bar{\pi}_k)}{n_k \bar{\pi}_k (1 - \bar{\pi}_k)} \quad \text{or } P_Value = \Pr(\hat{C}) \quad (7)$$

where $O_k = \sum_{j=1}^{n_k} Y_j$ and $\bar{\pi}_k = \sum_{j=1}^{n_k} (m_j \bar{\pi}_j / n_k)$.

The hypotheses are as follows:

H_0 : There is no difference between the results of observations with the model used;

H_1 : There is a difference between the results of observations with the model used.

Hosmer & Lemeshow follow the Chi-Square distribution with degrees of freedom $df = (g - 2)$, with a general $g = 10$.

Test criteria used were: Rejecting a hypothesis of H_0 if statistic value $\hat{C} > \chi^2_{(1-\alpha)(g)}$, otherwise accepting hypothesis of

H_0 when $\hat{C} \leq \chi^2_{(1-\alpha)(g)}$ where α the significance level is established (Sukono et al., 2014; 2019.a).

R-Square; Hosmer and Lemeshow, the determination value of R^2 in logistic regression model analysis showed strong relationships between independence variables and dependence variables. Statistic of R^2 can be determined using the formula as follow:

$$R^2 = 1 - \exp \left[- \left(\frac{L^2}{N} \right) \right], \quad (8)$$

where L is the value of the log likelihood of the model, and N is the number of data. If the determination value of $R^2 \rightarrow 1$, then the relationship between the independent variable and the independent variable is strong. Conversely, if the determination value of $R^2 \rightarrow 0$, then relationship is weak (Sukono et al., 2014; Sidi et al., 2017.a).

3. Results

The data were analyzed as described in section 2.1. For multivariate analysis, before the data is used to further analysis normality test is necessary. The purpose of normality test in multivariate analysis is to know whether distribution of the data (following or close to) is normally distributed. Normality test of data is performed using SPSS version 23. Once the data are normally distributed, then this data is used to estimate parameters of binary logistic models. The coefficient parameter estimators of the binary logistic regression is conducted to determine vector of $\hat{\beta} = (\hat{\beta}_0, \hat{\beta}_1, \dots, \hat{\beta}_8)$ coefficient, which can maximize log probability function in the Eq. (4). The estimation is carried out using SPSS software version 17.0. The result of parameter estimates, and standard error values of each parameter estimate are represented in Table 1.

There is a need to conduct a test for the significance to coefficient parameter estimators in which predictor variables relatively affect the response variable of $\pi(X)$. The null hypothesis testing used is $H_0: \hat{\beta}_0 = \hat{\beta}_1 = \dots = \hat{\beta}_8 = 0$ against the alternative hypothesis $H_1: \exists \hat{\beta}_0 \neq \hat{\beta}_1 \neq \dots \neq \hat{\beta}_k \neq 0$ ($k = 0, 1, \dots, 8$). Testing the significance is simultaneously carried out using statistic of Log Likelihood G test referring to Eq. (5). The calculation uses SPSS software version 23 and results in the statistic value of Log Likelihood ratio yields $\hat{G} = -27.01226348994915$. It is clear that the statistic \hat{G} asymptotically distribute chi-squares (χ^2) with eight degrees of freedom, i.e. $df = 8$. When the significant level is determined $\alpha = 0.05$, from the table of chi-square is obtained $\chi^2_{(1-0.05)(8)} = 2.7326$. Since the statistic value of $\hat{G} > \chi^2_{(1-0.05)(8)}$, then the hypothesis H_0 is rejected, it indicates that $\hat{\beta} = (\hat{\beta}_0, \hat{\beta}_1, \dots, \hat{\beta}_8)$ coefficient is significant to simultaneously affect the response variable $\pi(X)$.

The \hat{Z} statistic is asymptotically normal distributed, so if the significance level is determined $\alpha = 0.05$, the \hat{Z} statistic are obtained $Z_{\frac{1}{2}(0.05)} = -0.27$ and $Z_{\frac{1}{2}(1-0.05)} = 0.27$. While the \hat{Z} statistic is in the interval $-0.27 \leq \hat{Z} \leq 0.27$, then the hypothesis H_0 is accepted, else the hypothesis H_0 is rejected.

Table 1
Coefficient Parameter and Standard Error Estimators

Coefficient Parameter of Variables (X_i)	Estimator of Parameter ($\hat{\beta}_i$)	Standard Error $SE(\hat{\beta}_i)$	Ratio (\hat{Z}) $\frac{\hat{\beta}_i}{SE(\hat{\beta}_i)}$	Significance
Constant	-1.9807175	0.635	-3,11924016	Significance
Coastal environment condition (X_1)	-1.05250123	1.067	-0.98641165	Significance
Fish capture technology (X_2)	2.05312435	1.978	1.03797995	Significance
Fish capture location (X_3)	0.76586961	0.617	1.24279757	Significance
Operational capital (X_4)	0.92524281	0.574	1.61192127	Significance
Climate (season) condition (X_5)	-2.12394297	3.205	-0.66269672	Significance
Fishermen's age (X_6)	0.44294572	0.382	1.15954377	Significance
Fishermen's education (X_7)	0.08972099	0.072	1.24612486	Significance
Fishing experience (X_8)	0.74122571	2.541	0.29211220	Significance

Log Likelihood Statistic = - 27.01226348994915

Based on the \hat{Z} statistics in Table 1, all coefficient parameter estimators are significant. It indicates that coefficient parameter estimators affect fishermen's income. After conducting log Likelihood ratio and Wald tests, Hosmer & Lemeshow test is carried out. Hosmer & Lemeshow test is to analyze the compatibility of logistic regression model estimators with the real data. The hypotheses of Hosmer & Lemeshow are the follows.

H_0 : There is no difference between the observations with the estimators of the model.

H_1 : There is a difference between the observations with the model estimators.

Testing Hosmer & Lemeshow statistic is conducted using the Eq. (7). Test can also be performed using the statistical of P_Value , the test criteria is rejected H_0 if P_Value is less than the significance level of α . In this test, P_Value is 0.293. If the significance level is determined as $\alpha = 0.05$, then obviously P_Value is greater than the significance level of α . Therefore, the hypothesis H_0 is accepted, which means "there is no difference between the observations with the logistic regression model estimator".

Next step, to measure how strong the relation between predictor and response variables can be determined by the coefficient of determination R^2 . The coefficient of determination R^2 is calculated using the Eq. (8). The result indicates the coefficient of determination $R^2 = 0.99957323$, obtained from the logistic regression model estimators, portraying that the relationship between predictor variables: Coastal environment condition (X_1), Fish capture technology (X_2), Fish capture location (X_3), Operational capital (X_4), Climate (season) condition (X_5), Fishermen's age (X_6), Fishermen education (X_7), and Fishing experience (X_8), with the response variable of $\pi(X)$ is very strong.

Consequently, based on the result of coefficient parameter estimators given in the Table 1 with referring to Eq. (2), the logistic regression model estimators are stated in the following equation.

$$\hat{g}_{r-1}(x) = \ln \left(\frac{\pi_{r-1}(x)}{\pi_0(x)} \right) = \quad (9)$$

$$-1.9807175 - 1.05250123 X_1 + 2.05312435 X_2 + 0.76586961 X_3 + 0.92524281 X_4$$

$$- 2.12394297 X_5 + 0.44294572 X_6 + 0.08972099 X_7 + 0.74122571 X_8 .$$

Based on the Eq. (9), the discussion section is described in the followings.

4. Discussion

Considering the analysis result presented in Table 1, the eight factors (variables) analyzed both simultaneously and partially are significant in affecting the response variable (fishermen communities' income). There are six factors positively affecting the income, including Fish capture technology ($X_2 = 2.05312435$), Fish capture location ($X_3 = 0.76586961$), Operational capital ($X_4 = 0.92524281$), Fishermen's age ($X_6 = 0.44294572$), Fisherman's Education ($X_7 = 0.08972099$), and Fishing experience ($X_8 = 0.74122571$). One of these factors, fish capture technology factor, has the highest coefficient parameter estimator with the value of 2.05312435. It shows that this factor has the highest influence on the fishermen's income. When this factor is increased, it will significantly increase the fishermen's income. Still, the influences of other factors also need to be considered. The coefficient parameter estimator of education is equal 0.08972099 which is considered as the lowest one. It implies that it has a little influence on the increase of fishermen's income, especially traditional fishermen (Srikanthan, 2013; Squires & Wiber, 2018).

Meanwhile, there are two factors negatively affect the income: Coastal environment condition $X_1 = -1.05250123$ and Climate (season) condition ($X_5 = -2.12394297$). These negative influence show that the increase of a unit of estimator will decrease the income. The climate (season) condition factor has the highest coefficient parameter estimator (-2.12394297), indicating that the more the climate (season) condition makes the high wave, the fewer the fishermen are able to go fishing, so they lose their incomes. Another negative factor is coastal environment condition with coefficient parameter estimator of (-1.05250123) which reflects that the more the environment degradation condition, the more the fish habitat gets damaged (i.e. the damage of coral reefs, abrasion, sedimentation, and so forth), so fishes will move out from one location to another. This condition results in the decrease (disappearance) of fish colonies (Udbye, 2014; Yang, 2017; Sambuo et al., 2018).

Indonesia is an archipelago country surrounding by seas reaching 5.8 million kilometer and become a country with the biggest marine area in the world, with the coastal line of 95.181 kilometer. The natural resource potentials containing in Indonesian marine territory should have given the prosperity to Indonesian people, especially coastal communities. In the irony, the poverty of coastal communities remains high with poverty headcount index (PHI) of 32.4%. This number is obtained from the general image of fishermen communities' income in the coastal area of Gebang District, Cirebon Regency with the average income per day between IDR. 75,000 – 150,000 or IDR. 1,000,000 – 3,000,000 in a month. The minimum Regency Wage (UMK) in Cirebon in 2020 is IDR. 2,196,416. Therefore, there are many fishermen with monthly income under the UMK. Indeed, there are many factors obstructing fishermen communities' prosperity, and investigation is needed (Noer, 2018; Firdaus, 2020). Regarding the Protection and Empowerment of Fish Cultivator and Salt Farmer, a program of Insurance Premium Assistance for Fishermen (BPAN) has been implemented. It becomes one of the government's priority programs through Ministry of Marine Affairs and Fisheries (KKP), that is also in line with *Nawacita* number five, namely increasing Indonesian human life quality. BPAN aims to guarantee the better fishermen activities in fish capturing so the fishermen's rights and responsibilities become clear and their fish capture activities will be protected. The advantages include fishermen's peace and comfort and the increase of fishermen's awareness to continue using the insurance individually (Supriatna et al., 2018; Sidi et al., 2019). Evidently, the result of investigating factors affecting fishermen communities' income is necessary for the information supply chain for the government and related institutions, so the insurance programs for fishermen can be carried out effectively and efficiently. This could happen by applying supply chain management principles, the information cycle and policy products, starting from the condition happening in fishermen communities to the government, marine authorities, and insurance enterprises. This can be re-used by fishermen communities and managed in the integrated way (Chase et al., 2007; Valverde, 2014; Njegomir & Rihter, 2017).

5. Conclusion

This paper concluded that there are eight factors investigated on affecting fishermen's income, particularly fishermen communities in the area of Cirebon Indonesia. The eight factors analyzed both simultaneously and partially are significant to fishermen's income. The logistic regression model estimators used in this analysis yields the coefficient of determination $R^2=0.99957323$, indicating that the relationship between predictor variables (factors) and the response variable (fishermen's income) is extremely strong, so the logistic regression model is reasonable to be used in this investigation. Eight factors identified are certainly useful for the government and related institutions as the information supply chain in relation to insurance risk management for fishermen communities, particularly those who live in the coastal areas, Cirebon Indonesia.

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