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Simulation Of Household Economic Policy To Improve Small-Scale Fisherman's Income, Using Rural Rice-Fish Development Program In Donggala, Indonesia

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ABSTRACT:
The purpose of the study is to describe and analyze household economic policy to improve small-scale fisherman who become participants of rural rice-fish development program's income in Donggala, Sulawesi Tengah Province, Indonesia. The populations are small-scale fishermen that participate in rural rice-fish development program in Donggala. The samples are taken using multi stage sampling. Policy simulation is carried out based on valid SAS (Statistical Analysis System) analysis. There are two types of simulation, singular and multiple simulations. The purpose of singular simulation is to describe effect of the aide towards the fishermen's economic condition while multiple simulation aims at describing combinations of various singular simulations. The findings of the study show that based on the simulations types of household economic policy that increases the small-scale fishermen's income are increasing boat size, fishing frequency, husband's fishing workload and fuel as well as subsidy for gasoline, health, education, electricity, and fuel for non-fishing activities. It is expected government policy that provides fishing equipments and subsidy can improve small-scale fishermen's household more particularly their economic condition.
Keywords: *small-scale fishermen's household economic policy simulation*

1. INTRODUCTION

Marine potentials that consist of capture fisheries, aquaculture and marine biotechnology industry are tremendeous assets for national economic growth. However, the assets have yet been maximized. It is predicted that capture fisheries potentials are between 6,276 million tons per year with Total Allowable Catch (TAC) of 5,007 million tons or 80% of MSY (*Maximum Sustainable Yield*). The total catch has reached 3.5 million tons recently and therefore there are 1.5 million tons left every year. It is predicted that estimated value of all catching potentials is US$15.1 billions. Catching potential areas involve Malaka Strait, South China Sea, Java Sea, Makassar Strait and Flores, Banda Sea, Seram Sea and Tomini Bay, Sulawesi Sea and the Pacific Ocean, Arafura Sea and the Indian Ocean (Departement of Fisheries and Oceanography, 2003).

The total area of sea in Sulawesi Tengah Province is 193,923.75 kilometers and the catching potentials are214,108 tons/year that involves68,000 tons from Makassar Strait, 77,652 tons from Tomini Bay and 68,455 tons from Tolo Bay. Meanwhile, total Sulawesi Tengah Province coastline is 4,000 km. These are the reasons why Sulawesi Tengah Province has huge fishing potentials (Department of Fisheries and Oceanography of Sulawesi Tengah Province, 2012).

Fishery resource consists of fish, environment and man-made resources used to utilize the fishery resources. As the result, fishery resource management or utilization should involve management of fish resource, environment and human activities. Furthermore, it can be said that fishery resource management refers to management of human activities that take advantage of fish as the resources (Nikijuluw, 2002)

Fish resource utilization can be used as an indicator that measures development of a catching activity in particular body of water as well as a guidance for sustainable fishing management or one that does not cause damage to the environment. Sustainable production of fish is one of limited resources in making decision about optimum composition of one catching unit. Local fishing statistics refers to production of fish where volume of fish in each fish market most of the time becomes the basis (Alatas U, *et al*, 2014).It is predicted there are three causes why catching activities have yet been optimum. The first is lack of human resources, knowledge about fisheries and fishing technology. The second is discrepancy between fishery resources utilization between one area and another and the last is environmental damage that affects fishery resource such as mangrove, coral reef and sea grass as the habitats for fish and other marine organisms.

Development of catching business that has been and is going on currently emphasizes on increasing productivity of small-scale fishing. On the other hand, the underlying issues in small-scale fishing business are quality of human resources, aceess towards funding and facilities, technology and market as well as socio-cultural issues; these affect fishermen having low income. In order to overcome the issues, thorough, careful analysis is of necessities.

Small-scale fishermen's catching activities are dominated by small-scale enterpresies with basic technology, highly influenced by the season and production is limited to local consumption (Pancasasti, 2008). The small-scale fishermen work independently without hiring people other than their family members (Reswati, 1991). As the effect, in order to develop programs of which purpose is to improve small-scale fishermen's household welfare, an approach that takes their household decision-making pattern into account is very important (Purwanti P, 2010).

Government policy that empowers community economic has been implemented all over the country; but, unfortunately the implementation has yet been optimum and as the result the small-scale fishermen's households are still categorized as low-income household.As the effect, an analysis that functions as guidance for the society in order to be able to live independently without having dependency upon the government should be carried out. There are various government programs of which purpose is to improve production of small-scale fishermen, but the outcome has yet been maximum. Therefore, the study attempts at conducting simulation of economic policy of small-scale fishermen's households who become participants in rural rice-fish development program that is related to various consumption variables namely health, electricity and education subsidy.

Simulation is a pretty flexible tool to solve problems with a lot of and various dimensions. So, simulation is both imitation model and real system. Starting point of the modelling is to simplify a real system that only pays attention to several elements or main characteristics that has cause-effect relationship with the real system. Basic knowledge of simulation uses historical and projected data as the bases (Kosasi, 2002).

Based on Eriyanto (1999), simulation is an activity where observers can draw conclusions about characetristics of a system by analyzing model with similar characetristics/ behavior and cause-effect

relationship of the model is exactly the same as or similar to the real system. Furthermore, it can be said that the outcome of a simulation is generally in the form of information about performance of a system so that it has yet given cause-effect relationship as the result. Simulation tends to show statistical prediction and/or comparison from various alternatives to get optimum point rather than exact result.

In order to improve the small-scale fishermen's income, government policy that is able to improve household economic growth is necessary. Both household production and consumption are vital in order to make sure that the fishermen can make the ends meet.When they are unable to control their household economic condition, their houshold is categorized as poor and backward. Based on the aspects, the purpose of the study is to to describe and analyze household economic policy to improve small-scale fisherman who become participants of rural rice-fish development program's income in Donggala, Sulawesi Tengah Province, Indonesia.

2. METHODOLOGY

Scope and Setting of the Study

Scope of the study is analysis towards relationship between small-scale fishermen's household activities related to household economic activities that involves various factors and production, workload, income and spending in order to increase the fishermen's income. The bases of the simulation are result of the validation towards the model and statistical testing that can predict level of validity.

The setting of the study is Makassar Strait located in Donggala, Sulawesi Tengah Province. Multistage sampling is used as the method to decide the settng of the study. It is multi stage sampling method from regions to villages with sample drawing methods that have different stages too. Furthermore, the data collection techniques are interview and field observations to small-scale fishermen as active participants of catching activities. The interview is conducted based on series of questions (questionnaire) that has been prepared previously.

Simulation Analysis

The study uses simulation analysis method. Its purpose is to test and evaluate decision and policy in the past and make prediction about the future (Pyndick and Rubinfield, 1995; Muhammad, 2002). Simulation is needed to learn and analyze impacts of change in exogenous variables and endogenous variable. Singular simulation is carried out to analyze influence of production towards fishermen's income.

1. 25% increase of boat size
2. 25% increase of fishing frequency
3. 25% increase of fishing workload for husband
4. 25% increase of gasoline for fishing activities.

For multiple simulation, the following things can be conducted:

1. 25% fishing frequency and 25% fishing workload for husband;
2. 25% fishing frequency and 25% boat size;
3. 25% fishing frequency, 25% gasoline;
4. 25% fishing workload for husband, 25% boat size;
5. 25% fishing workload for husband, 25% gasoline;
6. 25% boat size, 25% gasoline.

Simulation for non-food subsidy is as follow:

1. 75% subsidy for health, education and electricity;
2. 75% subsidy for fuel used in non-fishing activities.

3. FINDINGS AND DISCUSSIONS

Singular Analysis towards Household Economic Policy of Small-Scale Fishermen

Household economic studies are frequently used to evaluate impacts of governmnet policy such as one related to providing fishing equipments and facilities as well as one related to effect of opening job vacancy towards production, workload, income and household spending. In order to get description about change in endogenous variables, basic simulation from the entire endogenous variables that has been through validation should previously be developed.

The result of basic simulation shows description of the fishermen's household who participates in the rural rice-fish development program. Simulation analysis is conducted to analyze the small-scale fishermen's

financial situation as the effect of economic change and government policy. In making decision for the fishermen's household, some simulations can be done. The simulation is described in Table 1 below.

Table 1. Simulation Result for Testing Correlation between Various Decisions towards Small Scale Fishermen's Household Economic

Variables	Basic Simulation	Percentage of Change towards Basic Simulation (%)			
		SIM 1	SIM 2	SIM 3	SIM 4
Production (kg)	208.60	9.44	5.99	3.02	5.80
Husband's non-fishing workload (HOK)	17.90	-8.02	-5.40	-3.18	4.09
Wife's non-fishing workload (HOK)	3.27	-4.40	-1.65	0.69	8.34
Fishing Income (Rp)	2,584,835.00	19.05	12.09	6.16	-13.19
Fishing Revenue (Rp)	5,213,918.00	9.45	5.99	3.05	5.83
Variable Cost (Rp)	2,629,082.00	0.00	0.00	0.00	24.52
Non-fishing Income (Rp)	1,627,938.00	-7.11	-4.64	-2.62	4.00
Household Income (Rp)	4,212,773.00	8.94	5.62	2.77	-6.54
Food Consumption (Rp)	2,452,062.00	9.78	6.15	3.03	-7.16
Non-food Consumption (Rp)	1,562,887.00	7.60	4.78	2.35	-5.56
Household Consumption (Rp)	4,014,948.00	8.93	5.62	2.76	-6.53

Source: Data Analysis (2015)
Notes:
SIM : Simulation
SIM 1 : 25% increase of fishing frequency
SIM 2 : 25% increase of fishing workload for husband
SIM 3 : 25% increase of boat size
SIM 4 : 25% increase of gasoline for fishing activities

Based on Table 1, 25% increase of fishing frequency (SIM 1) increases production (HT) of 9.44%,and increases fishing income of 19.05%. When fishing frequency increases, husabnd's non-fishing workload decreases by 8.02% and as the effect, non-fishing income also decreases by 7.11%. Overall, 25% increase in fishing frequency results in 9.78% increase in food consumption, 7.60% increase in non-food consumption and 8.93% increase in household consumption.

As many as 25% increase of husband's fishing workload (SIM 2) will increase production (HT) of 5.99%, and increases fishing income of 12.09%. When there is 25% increase in husband's fishing workload, husband's non-fishing workload decreases by 5.40%. Overall, 25% increase in husband's fishing workload results in 6.15% increase in food consumption, 4.78% increase in non-food consumption and 5.68% increase in household consumption.

As many as 25% increase of fishing boat size (SIM 3) will increase production (HT) by 3.02% and fishing income by 3.05%. Increasing boat size allows fishermen to have wider fishing ground and it decreases 3.18% of husband's non-fishing workload. Decrease in the husband's non-fishing workload results in 2.62% decrease in non-fishing income. Furthermore, 25% increase of fishing boat sixe will increase 6.16% of fishing income. Increasing boat size will have positive effects toward the fishermen's household since there is 2.77% increase in household income, 3.03% in food consumption, 2.35% of non-food consumption and 2.76% of household consumption.

As many as 25% increase of gasoline (SIM 4) will increase 24.52% of operating fee or variable fee. Increasing the amount of gasoline will expand the fishermen's fishing ground, increase production (HT) of 5.8% and income of 5.83%. Increasing gasoline will cause 24.52% increase of operating fee but overall, there is 6.54% decrease of household income, 7.16% decrease of food consumption, 5.56% of non-food consumption and 6.53% of household consumption.

Multiple Analysis towards Household Economic Policy of Small-Scale Fishermen

It is expected that the rural rice-fish development program fishermen's income. The goal of the program is to improve or change social economic condition of the fishermen. Table 2,3,4 and 5 describes the result of multiple analysis from several policies and decisions of which purpose is economic development; the analysis is in the form of percentage.

The multiple simulation aims at finding out to what extent the policy and decisions made by the small-scale fishermen about their household increases production. The multiple simulation is conducted by combining various variables simultaneously using the following indicators such as increasing fishing frequency, husband's fishing workload, boat size and amount of gasoline.

Table 2. 25% Increase of Fishing Frequency and 25% Increase of Husband's Fishing Workload

Variable	Basic Simulation	Simulation Scenario (25%)	Change (%)
Production (kg)	208.60	240.80	15.44
Husband's non-fishing workload (HOK)	17.90	15.65	-12.56
Wife's non-fishing workload (HOK)	3.27	2.97	-9.19
Fishing Income (Rp)	2,584,835.00	3,389,811.00	31.14
Fishing Revenue (Rp)	5,213,918.00	6,018,894.00	15.44
Variable Cost (Rp)	2,629,082.00	2,629,082.00	0.00
Non-fishing Income (Rp)	1,627,938.00	1,445,731.00	-11.19
Household Income (Rp)	4,212,773.00	4,835,542.00	14.78
Food Consumption (Rp)	2,452,062.00	2,848,547.00	16.17
Non-food Consumption (Rp)	1,562,887.00	1,759,067.00	12.55
Household Consumption (Rp)	4,014,948.00	4,607,614.00	14.76

As many as 25% increase of fishing frequency and 25% increase of husband's fishing workload will result in 15.44% increase in production, 31.14% increase in fishing income and 15.44% increase in revenue. Increasing husband's fishing workload also decreases husband's non fishing workload by 12.56% and wife's non fishing workload by 9.19% that results in 11.19% decrease in non-fishing income.

Combination between 25% increase in fishing frequency and 25% increase of husband's fishing workload, increases household income by 14.78%, food consumption by 16.17%, non-food consumption by 12.55% and household consumption by 14.76%. Based on the analysis in Table 3, operating fee does not change or 0%.

Table 3. 25% Increase of Fishing Frequency and 25% Increase of Boat Size

Variable	Basic Simulation	Simulation Scenario (25%)	Change (%)
Production (kg)	208.60	234.60	12.46
Husband's non-fishing workload (HOK)	17.90	16.05	-10.33
Wife's non-fishing workload (HOK)	3.27	3.04	-6.84
Fishing Income (Rp)	2,584,835.00	3,236,475.00	25.21
Fishing Revenue (Rp)	5,213,918.00	5,865,558.00	12.50
Variable Cost (Rp)	2,629,082.00	2,629,082.00	0.00
Non-fishing Income (Rp)	1,627,938.00	1,478,702.00	-9.17
Household Income (Rp)	4,212,773.00	4,715,177.00	11.93
Food Consumption (Rp)	2,452,062.00	2,771,917.00	13.04
Non-food Consumption (Rp)	1,562,887.00	1,721,152.00	10.13
Household Consumption (Rp)	4,014,948.00	4,493,069.00	11.91

Based on Table 3, 25% increase of fishing frequency and 25% increase of boat size result in 12.46% increase of production, 25.21% increase of fishing income and 12.50% increase of revenue. 25% increase in both fishing frequency and boat size, there is 11.93% increase in household income, 13.04% increase in food consumption, 10.13% increase in non-food consumption and 11.91% increase in household consumption. From Table 3, it can be seen that variable cost does not change or 0%.

Based on the result of simulations in Table 2 and 3, there is difference by increasing fishing frequency of 25% and husband's fishing workload by 25%; these increase production by 15.44%). On the other hand, 25% increase of fishing frequency and 25% increase of boat size can only cause 12.46% in production; so there is 3% discrepancy. Based on the simulation, it can be concluded that developing skills and capability will increase fishermen's production and income at the same time.

Multiple simulation is going to be conducted towards increase in fishing frequency and amount of gasoline. The simulation aims at finding out to what extent combination of the two variables increase the small-scale fishermen's production. The findings show that increasing amount of gasoline allows the fishermen to have wider fishing ground. Table 4 describes the result of simulation by increasing 25% of fishing frequency and 25% of gasoline.

Table 4. 25% Increase in Fishing Frequency and 25% Increase of Gasoline

Variable	Basic Simulation	Simulation Scenario (25%)	Change (%)
Production (kg)	208.60	240.40	15.24
Husband's non-fishing workload (HOK)	17.90	17.35	-3.07
Wife's non-fishing workload (HOK)	3.27	3.29	0.81
Fishing Income (Rp)	2,584,835.00	2,736,483.00	5.87
Fishing Revenue (Rp)	5,213,918.00	6,010,336.00	15.27
Variable Cost (Rp)	2,629,082.00	3,273,853.00	24.52
Non-fishing Income (Rp)	1,627,938.00	1,586,419.00	-2.55
Household Income (Rp)	4,212,773.00	4,322,902.00	2.61
Food Consumption (Rp)	2,452,062.00	2,522,176.00	2.86
Non-food Consumption (Rp)	1,562,887.00	1,597,586.00	2.22
Household Consumption (Rp)	4,014,948.00	4,119,762.00	2.61

Table 4 shows that 25% increase in fishing frequency and 25% increase in gasoline result in 15.24% increase in production, 5.87% increase in fishing income and 15.27% increase in revenue. They also increase variable cost by 24.52%.

Overall, combination of the simulation causes 2.61% increase in household income, 2.86% increase in food consumption, 2.22% increase in non-food consumption and 2.61% increase in household consumption. Change in the simulation does not give too much change towards the fishermen's household consumption. Based on Table 5, it can be seen that there is zero change (0%) in variable/operating cost.

Table 5. 25% Increase in Husband's Fishing Workload and 25% Increase in Boat Size

Variable	Basic Simulation	Simulation Scenario (25%)	Change (%)
Production (kg)	208.60	227.40	9.01
Husband's non-fishing workload (HOK)	17.90	16.52	-7.72
Wife's non-fishing workload (HOK)	3.27	3.13	-4.09
Fishing Income (Rp)	2,584,835.00	3,056,496.00	18.25
Fishing Revenue (Rp)	5,213,918.00	5,685,578.00	9.05
Variable Cost (Rp)	2,629,082.00	2,629,082.00	0.00
Non-fishing Income (Rp)	1,627,938.00	1,518,821.00	-6.70
Household Income (Rp)	4,212,773.00	4,575,316.00	8.61
Food Consumption (Rp)	2,452,062.00	2,682,875.00	9.41
Non-food Consumption (Rp)	1,562,887.00	1,677,096.00	7.31
Household Consumption (Rp)	4,014,948.00	4,359,971.00	8.59

Based on Table 5, 25% increase of husband's fishing workload and 25% increase of boat size results in 7.72% decrease of husband's non-fishing workload, 4.09% decrease in wife's non-fishing workload and 6.7% decrease of non-fishing income. The multiple simulation increases production by 9%, fishing income by 18,25%, revenue by 9% as well as zero change in variable/ operating fee (0%). 25% increase of husband's fishing workload and 25% of boat size simultaneously causes 8.61% increase in household income, 9.41% increase in food consumption, 7.31% increase in non-food consumption and 8.59% increase in household consumption.

The result of the simulation in Table 2, 3, 4 and 5 shows that increase in each variable may increase the fishermen's production by 10%. When the government provides subsidy for the small-scale fishermen in the form of fishing equipment and self-development programs for the fishermen, their household income and welfare are going to improve.

Analysis of Policy Simulation towards Non-Food Consumption Subsidy for Small-Scale Fishermen's Household

Besides subsidy that provides fishing equipment and facilities, the government also provide subsidy for health, education and electricity as described in Table 6.

Table 6. Simulation Result of 75% Subsidy for Health, Education and Electricity

Variable	Basic Simulation	Simulation Scenario (75%)	Change (%)
Production (kg)	208.60	259.30	24.30
Husband's non-fishing workload (HOK)	17.90	14.03	-21.61
Wife's non-fishing workload (HOK)	3.27	2.66	-18.74
Fishing Income (Rp)	2,584,835.00	4014103.00	55.29
Fishing Revenue (Rp)	5,213,918.00	6481993.00	24.32
Variable Cost (Rp)	2,629,082.00	2467890.00	-6.13
Non-fishing Income (Rp)	1,627,938.00	1835971.00	12.78
Household Income (Rp)	4,212,773.00	5850074.00	38.87
Food Consumption (Rp)	2,452,062.00	3303450.00	34.72
Non-food Consumption (Rp)	1,562,887.00	1984144.00	26.95
Household Consumption (Rp)	4,014,948.00	5287595.00	31.70

Based on the result of the simulation, non-food subsidy such as health, education and electricity results in 24.3% increase in production. However, husband's non-fishing workload decreases by 21.6%), wife's non-fishing workload decreases by 18.7% and variable fee decreases by 6.1% due to 25% of subsidy for gasoline. When need for gasoline increases, both husband's and wife's fishing workload increases and as the result there is no time left for non-fishing activities.

Base don Table 6, 75% subsidy for health, education and electricity results in 55.3% increase in fishing income, 24.3% increase in fishing revenue compared to 25% subsidy that can only result in 17.9% increase in fishing income and 5.8% increase in fishing revenue. It means non-fishing subsidy brings great, positive impacts towards economic situation of the small-scale fishermen.

As many as 75% subsidy for health, education and electricity has significant impact towards household income (38.8%) and non-fishing income (12.8%). On the other hand, there is an increase in food consumption (34.7%), non-food consumption (26.9%) and household consumption (31.7%). Even though subsidy brings positive impacts towards the fishermen's household, it also increases household consumption by 7.1% and non-fishing income by 12.8%. Basically, the subsidy aims at improving non-fishing household income.

Table 7. Simulation Result of 75% Fuel Subsidy for Non-Fishing Activities

Variable	Basic Simulation	Simulation Scenario (75%)	Change (%)
Production (kg)	208.60	259.30	24.30
Husband's non-fishing workload (HOK)	17.90	14.03	-21.63
Wife's non-fishing workload (HOK)	3.27	2.66	-18.74
Fishing Income (Rp)	2,584,835.00	4014103.00	55.29
Fishing Revenue (Rp)	5,213,918.00	6481993.00	24.32
Variable Cost (Rp)	2,629,082.00	2467890.00	-6.13
Non-fishing Income (Rp)	1,627,938.00	2150971.00	32.13
Household Income (Rp)	4,212,773.00	6165074.00	46.34
Food Consumption (Rp)	2,452,062.00	3503994.00	42.90
Non-food Consumption (Rp)	1,562,887.00	2083369.00	33.30
Household Consumption (Rp)	4,014,948.00	5587363.00	39.16

Based on Table 7, 75% of fuel subsidy for non-fishing activities has impact towards household income (46.34%) and non-fishing income (32.13%). On the other hand, there is simultaneous increase in food consumption (42.90%), non-food consumption (33.30%) and household consumption (39.16%). In conclusion, the subsidy brings positive effect towards the fishermen's household. There is 32.13% increase in non-fishing income. Basically, the subsidy aims at improving non-fishing household income.

It is expected that the subsidy increases the fishermen's household income and production input at the same time. Increasing production input will automatically increase the fishermen's production. According to Monintja (1987), developing fishing activities is generally conducted by increasing production and productivity of fishing business sector. The purpose is to increase both fishermen's and farmer's income, Gross Domestic Product (GDP), foreign exchange, public nutrition and job vacancy. Some aspects to be taken into account in developing fishery sector are biological, technical (technology), economic and socio-cultural aspects.

In order to develop sustainability in fisheries, the government should issue some policies to protect the fishing industry by owning the belief that sustainable fishing industry will promote not only economic sector but also social opportunity through healthy environment.Such policy will overcome issues related to internal aspects of fishing business so that inefficiency in production, over-investation, by-catch, over-discard can be overcome and potential conflicts between fishing armada can be eliminated (Alatas U, *et al*, 2014).

4. CONCLUSION AND SUGGESTION

Conclusion

Household economic policy in increasing small-scale fishermen who participate in the rural rice-fish development program in Donggala, Sulawesi Tengah Province can be carried out sing the following methods namely (1) increasing boat size, (2) increasing fishing frequency, (3) increasing husband's fishing workload, (4) increasing amount of gasoline for fishing. These aspects should be increased 25%. Besides that, 75% subsidy for health, education, electricity, gasoline for non-fishing activities should also be given.

Having been analyzed, the policy has positive impacts towards increasing the household income of the small-scale fishermen. 75% subsidy for health, education and electricity results in 38.8% increaase in the fishermen's household incomeand 75% fuel subsidy for non-fishing activities results in 46.34% increase in the income. In conclusion, the subsidy gives significant and positive impact towards the fishermen's economic condition. In addition, the subsidy basically aims at improving the fishermen's non-fishing household income.

Suggestion

The government should issue some regulations in the implementation of the policies of which aim is improving economic condition of the small-scale fishermen. The regional government should develop self-development programs for the fishermen or have partnership with other parties (university or non-government organization).University and NGOs can help the government in conducting self-development programs for the government so that each program the government established can improve and change economic pattern/ condition of the small-scale fishermen.

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