DO FINANCIAL ASSISTANCES PROPERLY ADDRESS SMALL SCALE FISHERIES PROBLEMS?: THE CASE OF SMALL-SCALE FISHERIES OF THE NORTH COAST OF JAVA.

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ABSTRACT

One of the main obstacles faced by small-scale fisheries in developing country is lack of financial capabilities. In order to overcome such a constraint, government in developing country often provides subsidies and small loans in various forms to offset the difficulties in accessing financial markets. Small-scale fishery in northern coast of Java is such a typical fishery where heavy subsidies in forms of soft loans and small credits have double-edge swords effects to both resource and fishermen. Micro credits and other forms of small loans only address the short terms problems and provide partial solution to the overall fisheries problems in the area. This paper explores the experiences of small-scale fisheries in the northern coast of Java with respect to the impact of subsidies and small loans (micro credits) on their fishing activities as well as their livelihood. The paper also addresses how other non-conventional financial assistances address the poverty and fishing problems compared with government-driven assistances.

Keywords: Subsidy, Micro Credit, Small-scale fisheries, livelihood, regression analysis, eficiency analysis.

Introduction

Fisheries play an important role in economic development especially in coastal areas. Fisheries not only serve as source of income earnings but also absorb surplus of labor in coastal area and becomes the only source of cheap protein for coastal population. Developing fisheries sector is important not only from the macro perspective but also from micro perspective. From macro perspective, fisheries contribute significantly to national well-being, therefore efforts must be exerted to increase the role of fisheries in national economy. From micro perspective developing fisheries sector not only benefits coastal population but also increase regional competitiveness based on natural resources.

Fisheries development in developing countries however, faces an enormous challenge, especially in terms of financing capacity. On national scale, government budget is not sufficient to develop such a huge fisheries system. Similarly on regional scale private investor as well as local government cannot meet the demand for financial requirement to develop fisheries sector. At firm level, local fishermen are very much dependent upon local financier as well banking to finance their fishing operation.

To overcome such a constraint, government in developing countries often intervene the fisheries through providing subsidies, especially for small scale fisheries. Nevertheless, there is growing recognize that this type of intervention might exacerbate excessive fishing capacity (Munro and Sumaila, 2002); FAO, 1998; Milazo, 1998; FAO, 2000). Milazo (1998) for example, noted that subsidy in fisheries eventually will reduce operating costs, increase profits, but in the end will stimulate further escalation of effort and compounding over exploitation and over capacity. Similarly Hempel and Pauly (2002) found that revenue enhancing subsidies proved to be deceiving, since even the fishery resources are declining, the analysis perceived that they are making profits.

Subsidies not only lead to escalating fishing effort, but it will also reduce fish availability in the long term. In the case of Indonesian fisheries, there are several studies which support this argument. Bailey (1990) and Mc Elroy (1990) for example, noted that subsidy programs in the form of motorization of the Java Sea fisheries have lead to decreasing of long term catch per unit effort during period of 1980-1990's. Mc Elroy (1990) found that the numbers of effort (measures in trip) of the pelagic fisheries in Pekalongan was escalating. Fishers had to go fishing further imposing extra costs of fishing which hampered the objective of subsidy. Similar findings were found in Lombok, West Nusa Tenggara, where unsustainable credit assistance provided by foreign NGOs such as HIVOS and GIZ had created sticky dependence on foreign assistance, yet they have no long term impact on production and income of fishermen (Kroeber, 1991).

Various studies which attempt to assess on subsidies are voluminous. Most of these studies, however were focusing the impact on fishing productivity, and very few on the assessment on its efficiency. This study attempts to link these two factors together. It also incorporate the assessment of different type of financial assistance provides by private institutions such a*s venture capital*. This private institution was overlooked by various studies, especially in the North Coast Java Fisheries. Therefore, it is expected that this study would provide a better picture on the impact of subsidies in fisheries in Indonesia.

Method

This study was carried out into four steps. Firstly qualitative approach was used to assess implementation regarding *venture capital* and micro credit in Indonesia and how it is applied to fisheries. This also includes qualitative approach in assessing economic performances of average fishing vessels of those who receive financial assistance and those who do not. Secondly, a quantitative approached by means of regression equation was used to assess the effect of subsidy (*venture capital* and micro credit) on productivity in comparison with those fishermen who do not get financial assistance. Thirdly, efficiency analysis was carried out using frontier analysis (Banxia®), to analyze the impact of subsidy to the efficiency of fishing. In the final part policy implication of this analysis was spelled out.

Quantitative assessment based on regression analysis was carried out as the following. It is assumed that fisher's productivity, revenue, rent and return of investment (ROI) is function of several technical and economic variables. The technical variables were approximated by technical aspects of fishing vessel such gross tonnage and length of trip, while socio-economic variables include income, education, age, and experience. The role of financial assistance such as

low interest rate from venture capital and other micro credit from government banking was captured using dummy variable, i.e., D=1 if fisherman received financial source from venture capital and government banking, D=0 otherwise. Therefore, the general function of this model is written as:

$$y = f(edu, age, \exp, GT, trip, Dummy) \quad \textbf{(Eq.1)}$$

Models of both linear and non-linear were tested. However, the non-linear model has advantage over the linear one in terms of coefficient interpretation. The non-linear model can be specified in the logarithmic form to capture the elasticity factor i.e; percentage of change in independent variable affects percentage in dependent variable. The model then is written as:

$$\ln(y)=\alpha_0+\alpha_1\ln(edu)+\alpha_2\ln(age)+\alpha_3\ln(exp)+\alpha_4\ln(trip)+\alpha_5\ln(GT)...\alpha_n D+\varepsilon \quad \textbf{(Eq.2)}$$

Elasticity is determined by the change in dependent variable with respect to change in independent variable. For example elasticity of productivity of fishing with respect to gross tonnage is:

$$\frac{\partial \ln(y)}{\partial \ln GT} = \frac{\partial y}{\partial GT}\frac{GT}{y} \quad \textbf{(Eq.3)}$$

Quantitative assessment was also carried out to assess the level of economic efficiencies among fisheries (both who receives subsidy and who do not). In so doing, an efficiency analysis using frontier analysis (Banxia®)/Data Envelopment Analysis (DEA) was carried out. DEA is a Linear Programming based technique for evaluating the relative efficiency of Decision Making Units (DMU's). DEA approach (Charnes et al, 1978), is used to estimate efficiency scores of the DMU (vessels data) based on CCR model. CCR model is applied because it is more suitable then BCC (variable return to scale) model, and most studies in finance institution were based on the input oriented constant return to scale model (Charnes et al, 1978 in Nawaz, 2008). If the DMU j has some inputs $x_{i,j}$ and outputs y_k, a relative efficiency measure is defined by:

$$Efficiency = \frac{\sum_k u_k y_k}{\sum_i v_i x_{i,j}} \quad \textbf{(Eq. 4)}$$

where *u* and *v* are weights parameter for input x and output y, respectively. The optimization problem for the equation is:

$$\max \theta_0 = \frac{\sum_k u_k y_{k,jo}}{\sum_i v_i x_{i,jo}} \le 1$$

$$\text{subject to } \frac{\sum_k u_k y_{k,j}}{\sum_i v_i x_{i,j}} \le 1 \ \forall_j$$

$$u_k, v_i \ge 0 \quad \textbf{(Eq. 5)}$$

Description of studies

This study was carried out using cross-sectional data of small-scale fishermen in the Northern Coast of Central Java. Two fishing locations in the region were chosen namely Pekalongan and Tegal (Figure 1). These small scale fishermen are those who fish for small-pelagic fish using gill nets and scope nets (*Payang*). Both of these coastal areas are subject to various financial assistances both from government initiatives as well as private and individual financiers. Three groups of fishers were selected as samples. The first group is control a group namely the fishermen who do not receive any financial assistance or in another word, funding their own fishing operation and capitals investment using their own financial sources. The second group is those fishers who receive financial support from the government through micro-credit schemes channeled though *Bank Rakyat Indonesia* or People Bank of Indonesia, one of government banking institutions who has formal authority to channel micro credits for small and medium enterprises such as fisheries sector. The third group is fishers who receive financial support from non-government institution, either through private enterprise or individuals. In this case fishers who receive micro-credit from *venture capital* were chosen. The Central Java *Modal Ventura* is one of ventures capital private institutions which channels funding from various sources. Even though their core of business is channeling financial support for agricultural and industrial sectors, recently some of ventures companies such as the one in the northern coast of central Java has involved in providing financial support for fishermen in Tegal area. Earlier study by Manaf (2010) has indicated the role of this ventures capital on the fishing productivity in Tegal fishing area. This fishing area was chosen for analysis of this study.

Figure 1. Study area

In order to capture the effect of financial on fishing productivities, socio economic as well as technical variables were selected. These include catch per trip, age of fishers, years of experience, Gross tonnage (GT), income per year, and number of family dependence. The descriptive statistics of these variables are listed in Table 1.

Table 1. Descriptive statistics of socio-economic variables

Variables	Non Recipient				Micro-Credit Recipient				Ventura Recipient			
	Mean	Min	Max	SD	Mean	Min	Max	SD	Mean	Min	Max	SD
Catch/trip (kg)	8,302.0	24.8	29,166.7	7,648.4	73.5	45.0	110.0	25.0	13,580.5	6,680.0	19,916.7	4,718.9
Age	43.2	16	75	11.2	49.5	35.0	70.0	11.1	39.6	35.0	50.0	5.0
Education	7.6	2	12	2.9	7.1	6.0	9.0	1.5	8.1	6.0	15.0	3.8
Experiences	21.5	2	41	7.2	6.9	1.0	20.0	5.5	22.6	10.0	34.0	7.6
GT	15	5	24	7.9	9.5	5.0	12.0	2.5	23.6	22.0	25.0	1.1
Income/year (million)	281.2	11.7	1,074.4	270.2	64.3	31.1	108.0	23.6	485.1	320.9	691.9	133.4
Number of Family dependence	3.1	0.0	8.0	2.0	3.7	2.0	5.0	0.9	2.7	1.0	4.0	1.0
Rent	136.8	0.1	621.4	173.1	28.1	4.3	57.6	18.4	318.9	0.8	890.3	274.2
ROI	46.6	0.6	258.7	45.9	27.1	6.1	45.5	14.3	123.8	0.1	332.3	110.6
Credit Amount (Million)					8.0	3.5	20	5.0	103.6	75.0	150.0	33.6

Result and Discussion

A regression analysis based on equation (Eq 2) was run for 71 samples. The regression was analyzed using a various different dependent variables. These include catch per trip, revenue, returns on investment as well as economic rents. The explanatory variables are gross tonnage, experience of fishers in fishing, years of education, number of trip and dummy variable (D=1 if fishers receive financial assistance or micro credit D=0 otherwise), two types of regressions were tested, one is for linear model and the other is for logistic model. The following Table presents general (overall) model for the purpose of model comparison.

Tabel 2. Comparison Result overall model

Variables	Model 1		Model 2		Model 3		Model 4	
	Y = Catch		Y = Revenue		Y = Rent		Y = ROI	
	Linear	Log	Linear	Log	Linear	Log	Linear	Log
Constanta	93.15	2.80	569.40	6.74	22.20	1.19	(129.48)	2.73
GT	3.65	0.53	21.74	0.77 ***	11.29	1.33	6.35	0.22
Trip	(0.44)*	(0.46)**	(3.22)**	(0.71)***	(0.22)	(0.66)	0.31	(0.21)
Exp	0.15	(0.16)	15.48 **	0.21	3.73	(0.41)	0.76	(0.16)
Age	(0.20)	0.45 *	(7.79)**	(0.29)	(1.98)	0.70	1.03	0.43
Edu	1.92	0.29 *	11.99	0.06	(3.02)	(0.04)	(1.69)	(0.26)
Dummy	1.09	0.35 **	(4.70)	(0.09)	19.61	0.25	34.89 *	0.64
R^2	72.80	84.00	82.90	96.10	41.50	63.90	31.40	10.20
R^2 (adj)	70.30	82.50	81.30	95.70	36.00	60.60	25.00	1.80
D_W	1.21	1.92	1.44	1.89	1.46	1.71	1.55	1.66

Note: * α = 10 % ** α = 5 *** α = 1 %

As can be seen from above result, model with revenue as dependent variable performs better than those with production, economic rent and Return of Investment (ROI). Model with revenue as dependent variable has R^2=96.1% and R^2-adj=95.8%. It indicates that variation in revenue 96% can be explained in the technology and socio-economic variables, including financial assistance. On the other hand, model with production as dependent variable, even though perform seemingly well, has only R^2=84%, it means that those explanatory variables only account for 84% variation on productivity.

As can be seen from Table 2, models with catch and revenue as dependent variables show better goodness of fit as indicated with higher R^2 and R^2-adjusted. These two models were then taken to be refined further by eliminating insignificant variables. i.e. experience and years of age of fishers. After removing these variables, the logarithmic model for two different dependent variables are as follow.

Tabel 3. Step wise analysis result

Dependent Variable	**Log Model**
Production	ln Prod (Y)ton=1.97 + 0.696 lnGT - 0.360 ln Trip + 0.317 Ln Age + (0.329) (0.157) (0.257) 0.329 Ln Edu + 0.433 Dummy-Credit** (0.169) (0.14) R^2=83.5% R-adj=82.2% DW=1.77
Revenue	ln Revenue (Y) Rp Million=7.07+0.758 ln GT**-0.715 ln Trip*** + (0.24) (0.118) 0.201ln Exp* – 0.320 ln Age – 0.084 Dummy_credit (0.073) (0.18) (0.111) R^2=96.1% R-adj=95.8% DW=1.87

Note: * α = 10 % ** α = 5 *** α = 1 %

If we take a look closely at financial assistance variable (i.e micro credit) it shows that this variable has significant t-statistic under model with Y=production (or ln production to be more precise). This variable has level of significance at 95% with coefficient of 0.43. This means that those who receive credit on average, their production will be 0.43 higher than those who do not receive credit.

If the dependent variable is total revenue/year (in log term), variable micro credits, however, has no significant impact on revenue. The sign of coefficient is also negative, indicating the opposite effect between the two variables. The different effect between these two models perhaps can be justified from the fact that revenue of fishermen is subject to fluctuation in catch rather than in fixed capital, while financial assistance might induce directly through fixed capital, therefore will affect productivity. This result is similar to study by Afrin et al. (2008) in Bangladesh aid, where micro credits have positive contribution in capital of fishing activities, therefore, in the long run will boost productivity. Nevertheless, it does not automatically increase in revenue since many factors will influence the revenue of fishery.

This hypothesis can be confirmed from the result of regression analysis revenue as dependent variable. In this model, three variables give positive impact on revenue, i.e. gross tonnage and experience with coefficient 0.76 and 0.2 respectively. Gross tonnage have higher significant t-value with P-value of 0.002 (significant at 95%), while experience have t-statistic of 2.75 (95%) significant.

The model also reveals that number of trip has negative coefficient indicating that the more trips the fishers do, the less they receive in terms of revenue. This is due to the fact that the share of variable cost in trip is relatively high, so that with more trips, more costs will be paid so that reducing the revenue received by fishermen. The logarithmic form can be interpreted as elasticity, so coefficient 0.76 for GT for example indicates that 1% increase in gross tonnage will contribute to 0.76% increase in revenue.

These mixed results of the effect of subsidies on fishing, are not surprising, as fishing is considered to be an industry with high degree of uncertainty. Moreover Schoor (2005), noted that the effect of subsidies is hard to measure, since it takes on a wide variety of form. These include vessel/gear modernization, landing and processing infrastructure, fuel subsidies and many other things. The outcomes of some of these policies on sustainability of small-scale fisheries have not been well studied, and need further investigation. Perhaps subsidies might be effective to achieve specific objective such as increasing income through reduction of input prices and provision of infrastructure (Mabowonku, 1990).

In order to capture the effect of credits (micro government banking and venture capital) in socio-economic variables, a similar regression technique was carried out. The level of credit is measured by the amount of money the fishers received from financial assistance. This model differs with the previous one that uses credit as dummy variable. The regression was tested using various dependent variables, i.e, production, revenue, rent and return on investment (ROI), however only model with revenue as dependent variable which gives better R^2 and R^2=adj. The equation can be written as the following:

ln Revenue=3.05+0.453 ln GT-0.035 ln trip+0.804 ln credit***-0.648 ln age+0.695 ln edu
0.656 0.412 0.225 0.868 0.620

R^2=87.1 R-adj=81.7 DW=1.82 **(Eq. 6)**

From Eq.6, it can be inferred that the level of credit has significant impact on revenue as indicated by P-value (0.004) and t-statistics (3.57). Since the regression is in the form of logarithmic, it can be inferred that one percent increase in the amount of money the fisher receives will affect 0.8% increase in revenue. In another word, 1 Million Rupiahs (US$ 110) injected in fishing capital, will likely to induce 800,000 Rupiahs (US$ 89 in revenue).

In order to determine whether fishers who receive subsidies (micro credits) would be more efficient in terms of using their inputs compared to those who do not receive credits, an efficiency analysis using Frontier (Banxia) was carried out. The units of analysis are fishers, while inputs are measured by GT and Trip, and output is measured in production (ton). The result on analysis is depicted in the following Table 4.

Table 4. Efficiency Frontier Analysis Result

DMU	Efficiency Score (%)	Total Potential Improvement		
		GT (%)	Trip (%)	Production (%)
Non Recipient	4.11-100	-43.75	-56.25	0
Ventura Capital	53.97-100	-45.26	-54.74	0
Micro Credit government Banking	43.09-100	-50.00	-50.00	0

Efficiency scores in Table 4 are listed in ranges instead of average. Looking closely at Table 4, one can conclude that fishers who receive credits (both in terms of micro credits from local government Bank and from Venture capital) tend to have cluster of efficient score near full efficient, while fishers who do not receive credits, their score varies from 4.11 to 100. The distribution of efficiency score among these three groups is depicted in Figure 2.

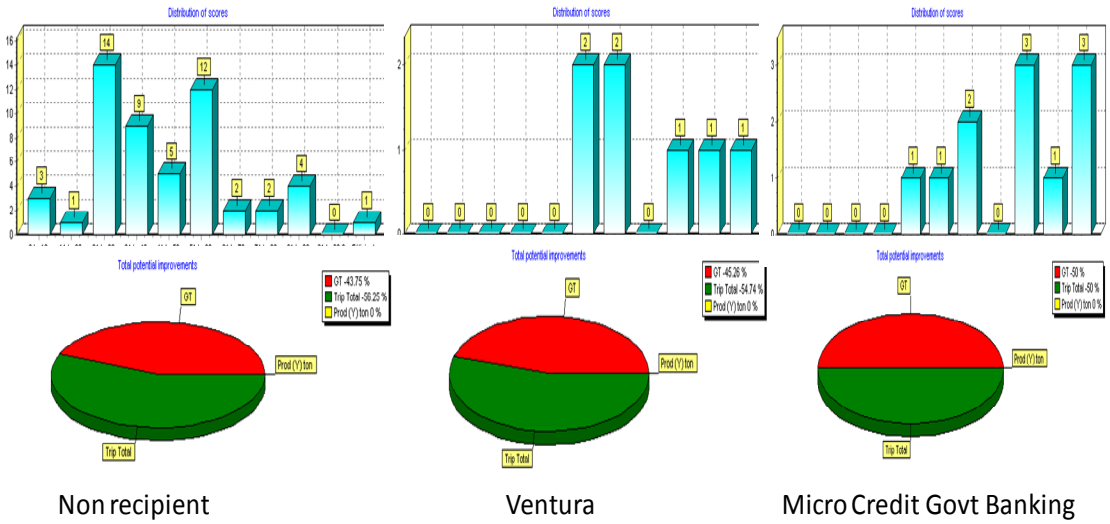


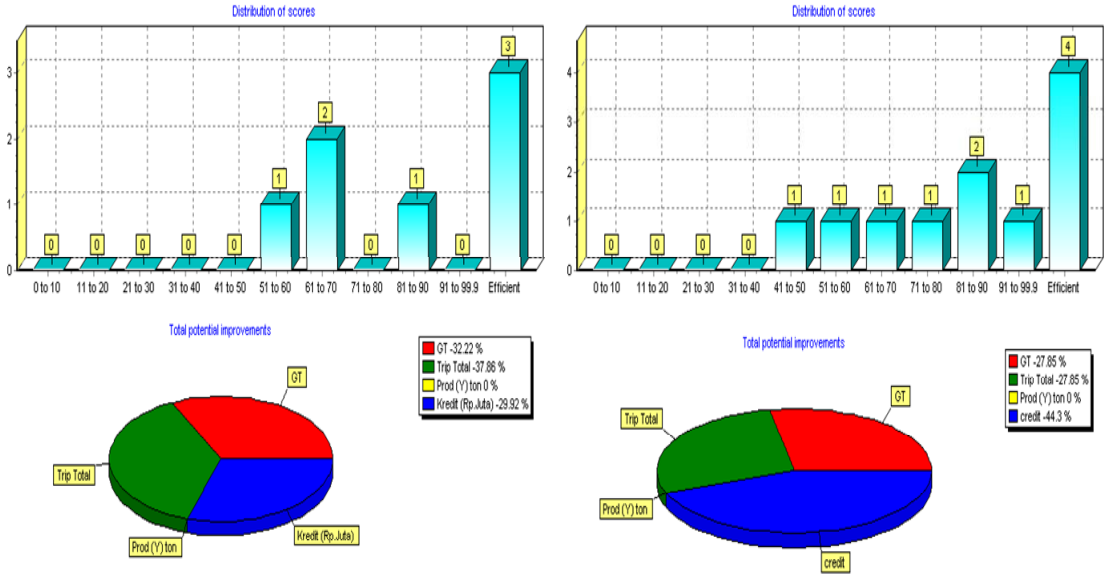
Figure 2. Distribution of efficiency scores among the groups

In order to achieve fully efficient utilization of inputs, reduction in both the size of GT and the number of trips could achieve such a goal. Nevertheless, there are no significant differences in terms of reduction of GT and trip. The percentage of reduction of GT is on the magnitude of 44-50% for all groups. Similarly the magnitude of trip reduction is around 50-60% for all groups. Fishers who receive micro credit, however, call for bigger share of reduction in GT but smaller share of trip in order to achieve fully efficient utilization of inputs. This result again cannot strongly be implied that financial assistance would lead to better utilization of fisheries inputs and increase in catch. These results conform to previous studies on the Java Sea fisheries by Squares et al (2003) who found that excess capacity and overfishing are serious problems faced by the Java Sea Fisheries. Therefore, subsidies, in any forms, will likely induce more harm than cure to the fisheries. As shown by this study, both recipients of financial assistance and regular fishers who do not receive financial assistance are not significantly affected by subsidies. Both groups call for significant reduction in inputs used such gross tonnage which indicates excess capacity in the fisheries.

If we take a look into the DEA analysis for the recipient only (Table 4 and Figure 3), using credit as an input, we can see that for the Ventura credit recipient, the optimal amount of credit to fulfill the efficiency is around 72.6 Million Rupiahs/recipient or US$ 8000 (-29.92% from the average credit) to 150 Million Rupiahs (US$ 16500). For the micro credit, the optimal amount of credit should be around 4.3 million Rupiahs/recipient or US$ 490 (-44.3% from the average credit) to 7.0 million Rupiahs (US$770). Credits smaller than those ranges will not sufficient to lift up the industries into more profitable fishing and therefore more economically efficient because it will not cover the cost of fishing. On the contrary, if the credit scheme is too high, it will add up to the cost of trip with the risk of decreasing yield per unit of effort.

Table 5. Efficiency Frontier Analysis Result with credit as an input

DMU	Efficiency Score	Total Potential Improvement			
		GT (%)	Trip (%)	Production (%)	Credit
Ventura	58.64-100	-32.22	-37.86	0	-29.92
Micro credit	45.32-100	-27.85	-27.85	0	-44.3



DEA with credit Ventura

DEA with micro credit Govt Banking

Figure 3. DEA Analysis for credit recipient with credit as an input

Concluding Remarks

Small-scale fisheries of the North Coast of Java are constrained by financial capital. Nevertheless to solve this problem by means of subsidies has not always lead to improvement in their socio-economic condition. This study shows that subsidy in the form of low interest rate micro credits or financial assistance through different institutional such as *ventura capital* and direct financial assistance through government banking, may have little impacts on the economic performance in the fisheries, but this is subject to choice of the models and variables. It also shows that subsidy in the short term might be efficient but in the long term may be not. This study reinforces other findings of ineffectiveness of direct subsidies to combat poverty in fisheries in the long term. The government should pay more attention to divert their subsidies into fishing infrastructure, improving access to markets and to increase capacity building of fishermen and fisheries institutions. Subsidies in terms of lower interest rate is only short term panacea giving only short term relieve to the fisheries problems. The long term impact would be double jeopardy both in terms of overcapacity and stock declining. Subsidies given to the fisheries which already experience excess capacity and overfishing will also unlikely results in better management of the fisheries. In fact, it will put more pressure on resources and in turn will negate the objective of subsidy provision itself. Perhaps it is worth noting that government intervention in terms of subsidies could also be directed to providing alternative employment opportunity outside

fisheries sector so that it could generate employment multiplier on other sector of economies in coastal areas.

Other policy implication that can be drawn upon from the study is that financial institutions such as micro banking and other non-banking institution have to take into account distinct characteristics with regard to lending money for fisheries business. The banks and financial institutions have to revise their criteria requirements for the eligibility of credit recipients since fishing may not be compatible with requirements that Banks and other financial institutions call for. These issues have been raised by fisher organization for quiet long time, nevertheless, response from the government and financial institutions, is still lacking.

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