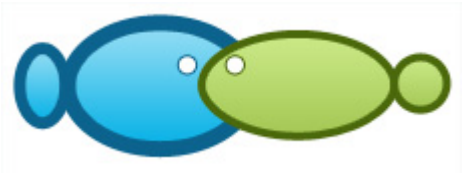

For sustainable revenue of fisheries sector in small islands: evidence of Maluku, Indonesia

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Abstract. Fisheries sector is the highest contributor for Maluku regional gross domestic product (GDP) and one of the largest contributor for national fish consumption and export behind South Sulawesi and just ahead of East Java. Despite of this achievement, wild-fish catch still has huge share on Maluku's fisheries production and this is problem since Minister of Marine Affairs and Fisheries of Indonesia has issued policy to prevent the use of trawl operation which can affect total catch and in 2015 Indoneisan government has revoked six major fishing companies and five of them were in Maluku. This study aimed to formulate a framework for local government to optimize the performance of fisheries sector in Maluku province in short run and long run. This research uses quarterly time series data from 2004-2013 by using Vector Auto Regression (VAR) method with its forecast features Impulse Response Factors (IRF) and Forecast Error Variance Decomposition (FEVD). Results of this research showed that in short period of time (for next 24 quarter) marine catch fisheries was the main contributor of fisheries sectors, but in long run, based on FEVD result, aquaculture sector emerged as the top contributor for fisheries sector whereas on the same period based on the result there was a sign of declining in trend from marine catch fisheries.

Key Words: revenue, fishery sector, Maluku, FEDV, IRF.

Introduction. As an archipelago country, Indonesia's geographical condition strongly supports the development of fishery activities. Indonesia has abundant fishery resources in both marine fishery and freshwater fishery, where 76% of Indonesia's surface area is sea-waters, in addition to the 5,500 rivers and lakes found throughout Indonesia (Indonesia Coordinating Investment Board 2011). In 2013, share of fisheries sector in nation Gross Domestic Products (GDP) was having promising growth (year on year comparison) from first quarter to third quarter with an average increase per quarter of 6.23%. Though, this positive growth on fisheries revenue by comparison to other sector and its potential in general fisheries sector still underachieve considering the Indonesia is martime state (Center of Data, Statistic and Information 2013).

Maluku Province is known as the 'Thousand Island Province'. Being surrounded mostly by water makes this province endowed by marine and fishery resources. The province whose waters cover 10 times the area of its land has 1.4 million population and constitutes only 0.6% of the total Indonesian population. Fisheries sector is one of few major sources for revenue for Maluku Province, according to Indonesia Coordinating Investment Board (2012) fisheries sector had almost 30% of total Maluku Province regional GDP. Fisheries sector is the biggest contributor for province regional GDP, but considering the total amount of potential sea resources that number should be higher. Since this province only relies on fisheries sector, then it is crucial to figure out how to improve this sector, despite being ranked on the second position at national level as respects in fish production. Fisheries productivity is determined by performance of marine catching fisheries and aquaculture. In catching fisheries number of boat with sufficient technologies plays a major role. Heryansyah et al (2013) indicated that catching ship/boat had significantly effect on productivity and, in general for the fisheries sector of East Aceh regency. Same result is showed by Salas and Charles (2007) who indicated that boat size, fisherman's experience and motor power had significant impact on fisheries productivity in Mexico. Based on statistics and empirical evidence, in 2013

Maluku only had 13.231 (2.14%) of total national number of fishing boats which was 618.320 whereas number of fishing company and household (SME) in Maluku in same year was 12.333 or 1.83% of total fishing company and SME in Indonesia (Statistic Indonesia 2013). Anderson et al (2015) used fisheries performance index (FPI) to investigate how development country are managing their fisheries sector by considering three factors which are the economic impact, environment sustainability and community effect. Previous studies have shown that use of the latest technology can increase the performance of fishery sector, as was pointed out by Jensen (2007), who affirmed that information technology coud also have a huge role in increasing the fisheries performance and fishermen welfare through interconnected cellphones of fishermen and distributors to elimination of waste, and near-perfect adherence to the Law of One Price. In addition, Aheto et al (2012) showed that types of fishing gears could also have significantly effect on fishing productivity, though overexploitation could decreased the economic return in long run.

On the other hand, there are other far more complicated factors for local government to look on in order to increase the performance of aquaculture sector, because as in other animal production sector, there are many factors that have to be taken into consideration in aquaculture such as land, freshwater, feed, and energy (Waite et al 2014). Though, aquaculture will provide solution for unemployment problem which is now one of the major problems Maluku Province is facing with. Based on report from FAO about the estimation of aquaculture can generate closed to 19 million on farm jobs in 2012, and 96% of which were located in Asia (FAO 2012). The number of households' aquaculture in Maluku province in 2013 was around 4043, previously reported as high as 5173 in 2009 and compare to number of aquaulture's households in Indonesia on 2013 was about 192.871 or just around 2%. Although, Anane-Taabeah et al (2011) showed that financial fund was the main problem for the growth of the aquaculture sector; it also requires proper knowledge to run this business.

Many reports and research have indicated that however still leading against aquaculture's total production, wild catch fishing has essentially stagnant (FAO 2012), in addition to this matter, Ministry of Marine Affairs and Fisheries of Indonesia has limited the use of trawl by fishermen operation and also in 2015 revoked six major fishing company and five of them were in Maluku, which will endangered total production and revenue of fisheries sector in Maluku in long run. While aquaculture, in contrast, has been expanding steadily for the last 25 years and saw its largest increase in 2010 (FAO 2012; Gjedrem et al 2012; Waite et al 2014). Considering there are no other natural resources in Maluku Province outside fisheries sector to become the backbone of revenue, then it is crucial to figure out ways to maximize and optimize this sector, therefore, this research focused on formulate priority for local government to optimize the performance of fisheries sector in Maluku province in short run and long run.

Material and Method. This study uses secondary quarterly time series data with 10 years of the period observation from 2004-2013, which collected from center of statistical board, Indonesia. This research was conducted from January to May 2015, with Maluku Province as its research object. Table 1 shows variables on this research divided into two categories, first, independent variables which are variables that have determination on fisheries productivity: number of catching ship, number of fishery household/company and number of household aquaculture. Second, dependent variables which were measured by total production of fisheries sector in Maluku Province. Analysis method of this research is Vector Auto Regression (VAR), with Forecast Error Variance Decomposition (FEVD) and Impulse Response Function (IRF) as one of tools of VAR to examine the trend from response on each shocks of those independent variables in short and long run to dependent variables.

Table 1

Research variables

No	*Variables*	*Definition*	*Symbol*
1	Regional GDP	Regional Gross Domestic Product of Maluku Province from 2004-2013	RGDP
2	Fisheries productivity	Log Natural total production of marine catch fisheries and aquaculture of Maluku Province	ln (FP)
3	Marine catching vessel	Number of registered catching ships/boats of this province	SS
4	Marine catching household/company	Number of fisheries company in Maluku Province	SC
5	Household aquaculture	Number of household aquaculture of this province	HA

Vector Auto Regression (VAR). The VAR models are natural tools for forecasting (Lütkepohl 2011). It often provides superior forecasts to those from univariate time series models and elaborate theory-based simultaneous equations models. Forecasts from VAR models are quite flexible because they can be made conditional on the potential future paths of specified variables in the model (Johansen 1995). With vector autoregressive models it is possible to approximate the actual process by arbitrarily choosing lagged variables. Thereby, one can form economic variables into a time series model without an explicit theoretical idea of the dynamic relations. VAR models themselves do not allow us to make statements about causal relationships. This holds especially when VAR models are only approximately adjusted to an unknown time series process, while a causal interpretation requires an underlying economic model. However, VAR models allow interpretations about the dynamic relationship between the indicated variables (Fuss 2007). In addition to data description and forecasting, the VAR model is also used for structural inference and policy analysis. In structural analysis, certain assumptions about the causal structure of the data under investigation are imposed, and the resulting causal impacts of unexpected shocks or innovations to specified variables on the variables in the model are summarized. These causal impacts are usually summarized with impulse response functions, VAR model of this research can be view in matrix below:

$$\begin{bmatrix} RGDP \\ \ln(FP) \\ SS \\ SC \\ HA \end{bmatrix} = \begin{bmatrix} a_0 \\ b_0 \\ c_0 \\ d_0 \\ e_0 \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{14} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{2s} \\ c_{31} & c_{32} & c_{33} & c_{34} & c_{3s} \\ d_{41} & d_{42} & d_{43} & d_{44} & d_{4s} \\ e_{s1} & e_{s2} & e_{s3} & e_{s4} & e_{ss} \end{bmatrix} \begin{bmatrix} RGDP \\ \ln(FP) \\ SS \\ SC \\ HA \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \\ e_{5t} \end{bmatrix} \quad (1)$$

Where:
RGDP = regional GDP of Maluku Province;
ln (FP) = log natural fisheries Productivity;
SS = number of catching ship;
SC = number of catching fisheries household/COMPANY in this region;
HA = number of households aquaculture in this region;
e = error;
a_{ij}; b_{ij}; c_{ij}; d_{ij}; e_{ij} are models matrix notation.

VAR model will be used when stationary data of the study are at the level; if the data are not stationary at the level but not co-integrated, then the VAR model of first difference will be used. When the data used in this study are not stationary at the level and co-integrated when rank cointegration (r) > 0 we use VECM (Vector Error Correction Model). VECM model is obtained as follows (Carrasco Gutierrez et al 2007):

$$\Delta y_t = \alpha\beta' y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-1} + \varepsilon_t \quad (2)$$

Where:
Δ = first difference operator;
$\alpha\beta'$ = $-\prod(1)$;
β = Vector cointegration r x 1;
α = Vector r adjusted r x 1;
Γ_i = $-\sum_{k=i+1}^{p} A_k$ for $j = 1, \ldots, p-1$.

Impulse Response Factor (IRF). The impulse response analysis is based upon the Wold theorem of moving average representation of a VAR(p)-process. It is used to investigate the dynamic interactions between the endogenous variables. The orthogonal impulse responses are derived from a Choleski decomposition of the error variance-covariance matrix: $\Sigma_u = PP^T$ with P being a lower triangular. The moving average representation can then be transformed to (Pfaff 2008):

$$y_t = \psi_0 \varepsilon_t + \psi_1 \varepsilon_{t-1} + \cdots, \quad (3)$$

with $\varepsilon_t = P^{-1} u_t$ and $\psi_t = \phi_i P$ for $i = 0, 1, 2, \ldots$ and $\psi_0 = P$. Incidentally, because the matrix P is lower triangular, it follows that only a shock in the first variable of a $VAP\,(p) -$ process does exert an influence on all the remaining ones and that the second and following variables cannot have a direct impact on y_{1t}. Therefore model on impact of determination factors to performance of fisheries in Maluku Province, can be seen as follows:

$$\ln(FP) = E_{t-n}(\ln(FP)_t) + z_{1i}\varepsilon_{it}^{SS} + z_{1i}\varepsilon_{it}^{SC} + z_{1i}\varepsilon_{it}^{HA} + \varepsilon_{it}^{\ln(FP)} \quad (4)$$

Where:
$\ln(FP)_t$ = fisheries productivity at t time;
SS_t = number of fishing boat at t time;
SC_t = number of catching fisheries household/company at t time;
HA_t = number of households aquaculture in this region at t time;
E_{t-n} = lag variable i in the previous period;
z_{ii} = variable restriction i on variable j;
$\varepsilon_{it}^{\ln(FP)}$ = variable j of vector orthogonal shocks;
i and j = variable (j aka i);
t = time period (quarterly);
n = lag distance.

Forecast Error Variance Decomposition (FEVD). This method is also based on a vector moving average model and orthogonal error terms. In contrast to impulse response, the task of variance decomposition is to achieve information about the forecast ability. The idea is, that even a perfect model involves ambiguity about the realization of $Y_{i,t}$, because the error terms associate uncertainty. According to the interactions between the equations, the uncertainty is transformed to all equations. The aim of the decomposition is to reduce the uncertainty in one equation to the variance of error terms in all equations. The corresponding VEC model is:

$$\Delta y_{1,t} = \alpha_1 (y_{2,t-1} - \beta y_{1,t-1}) + \varepsilon_{1,t} \quad (5)$$

$$\Delta y_{2,t} = \alpha_2 (y_{2,t-1} - \beta y_{1,t-1}) + \varepsilon_{2,t} \quad (6)$$

Where coefficient α_i measures the speed of adjustment of the *i-th* endogenous variable towards the equilibrium, $\varepsilon_{i,t}$ is forecast error, $\Delta y_{i,t}$ is first difference on dependent variable, β coefficient. In long run equilibrium, this term is zero. However, if y_1 and y_2 deviate from the long run equilibrium, the error correction term will be nonzero and each variable adjusts to partially restore the equilibrium relation.

Results and Discussion. In order to run this model, we need to carry out some tests to obtain an appropriate model, tests which include stationary test, optimal lag determination, and cointegration test.

Data stationarity test. The first step is checking the stationary for all the variables using Augmented Dicky Fuller (ADF) test. The purpose of this test is to make sure that every variable on the model is stationary, in order to prevent spurious result; the result of this test indicated that all variables are stationary in first difference (Table 2).

Table 2

Unit root test using Augmented Dicky-Fuller (ADF)

Variables	*Level*	*First difference*
Fisheries productivity	1.0000	0.0168*
Maluku regional GDP	0.9446	0.0000*
Marine catching vessel	0.5043	0.0032*
Marine catching households/companies	0.3458	0.0003*
Households aquaculture	0.8818	0.0001*

*) the variable is stationer at α = 1%.

Optimal lag determination. The second step is determining the optimal lag used in the estimation. However, we need to examine the model stability, so that the maximum lag will be obtained. Model on this research is stable in the first lag, therefore we do need check the Schwarz Information Criterion (SIC), as shown on Table 3.

Table 3

Lag selection

Lag	*Schwarz Information Criterion (SIC)*
0	48.02431
1	42.39564*
2	42.79291
3	43.39397
4	43.03979

* indicates lag order selected by the criterion.

Cointegration test. The cointegration test is applied because there are variables in the model that are not stationary in level, but stationary in first difference. It is possibly that there are cointegration among variables, or in other words, there are long run relationship among variables. We use Johansen cointegration test (Table 4).

Table 4

Cointegration test

Hypothesized no. of CE(s)	*Eigenvalue*	*Trace statistic*	*0.05 critical value*	*Prob.***
None*	0.557672	68.47724	47.85613	0.0002
At most 1*	0.477248	38.29617	29.79707	0.0042
At most 2	0.283587	14.29617	15.49471	0.0752

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level.

Based on the data stationary test (Table 2), data set for the fisheries performance model is not stationary at the level, but stationary at the first difference, on the optimum lag test (Table 3) showed that the optimum models are at the first lag and the models are stable whereas on Johansen Co-integration Test (Table 4), all three models have co-integration. As the result the suitable model to be used on the model of this research is Vector Error Correction Model (VECM), instead of normal VAR (Vector Auto Regression) model.

Empirical result. Before conducting the forecasting analysis on wild catch fishing and aquaculture in Maluku then first we need to run correlation test to check if there's a relationship among these variables (Table 5).

Table 5

Pearson correlation analysis result

	Marine vessel	*Marine catching companies*	*Households aquaculture*	*Fisheries production*	*Regional GDP*
Marine vessel	1				
Marine catching companies	0.9823**	1			
Households aquaculture	0.7518**	0.8391**	1		
Fisheries production	0.5128**	0.6125**	0.8700**	1	
Regional GDP	0.3703*	0.41935*	0.3998**	0.4666**	1

** Significant at 99%; * Significant at 95%.

Based on the correlation analysis of this empirical data, it shows that all determine factors of fisheries production has relationship with the production and Maluku regional GDP. As a result, there are connection among variables on this study. The relationship are between fisheries production and regional GDP with marine catching company. Likewise, fishing boat and traditional aquaculture. The result of correlation test is important to validate forecast analysis on this study because proven statistic–based that all variables on this study are connetced.

Impulse Response Factor (IRF). IRF measures the effect of a shock at a certain time to the endogenous variable innovation at that time and in the future. It is a one-period shock, which reverts to zero immediately. Figure 1 shows how fisheries production response to shock on fishing boat owned by every fisherman on this province and it indicates that shock on number of fishing boats will certainly increase performance of fisheries production in this province and gives permanent effect in long run.

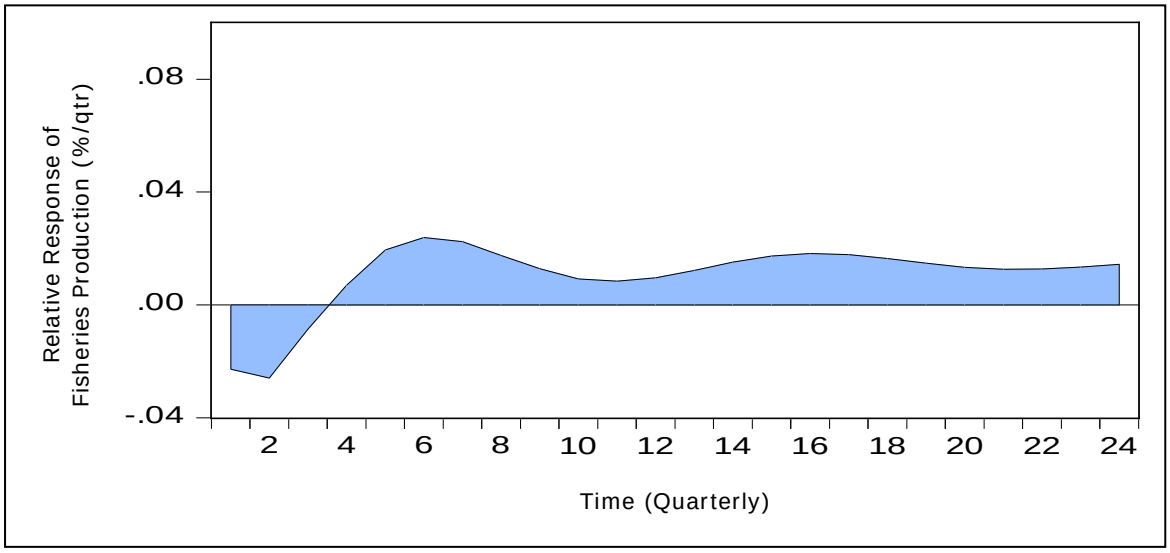

Figure 1. Response of fisheries production on shock on marine catching vessel.

Result on Figure 1, shows fisheries production performance had positive response on the shock on number of marine catching fisheries. The actual condition on this province is there are many catching boats runing their operation around Maluku Sea, but the number of catching vessel owned by local fishermen of this province compared to catching vessels owned by fishermen from other province not to mention number illegally operating in this area are still out of number which is 2.14% of national fishing fleets.

This situation becomes worsen with the fact that most of marine catching fleets have not be equipped with latest and efficient technology and well-trained human resources, which makes the productivity of fisheries sector of this province still underperformed, which caused the low multiplier effect to the local economy. Therefore, preventing the number of illegal fishing is the main goal for local government, at the same time have to focus on pushing the transition from traditional fishermen to become modern fishermen by increasing utilization of every technology available, Local government also need to increase the capabilities of fishermen by initiating courses and trainings in order to enhance fishermen abilities to increase efficiency and productivity.

The result also indicates that the exploration of marine resources in Maluku has not reach its maximum potential. Thus, addition of fishing boat will help to increase the productivity in fisheries sector. Moreover, the research from Petersen (2007) also stated that by training and vocational education will have positive effect on fishermen life standards in South Africa. Most of communities in coastal area are likely to have same problems which are: accessibility on education and support from local government. Those matters are crucial to suppress the gap between rural and coastal area, especially for fishermen to increase their knowledge about latest technique and technology on fisheries activity. Lovegrove & Morisson (2009) mention that access to sufficient education will enhance socio-sustainability of coastal communities in Asia-South Pacific Region.

Figure 2 shows how fisheries performance on production response to shock on number of fisheries company that been registered and it indicates that shock on number of fisheries household/company in this region will certainly increase fisheries production performance in this province. More people to run business on fisheries sector will have positively effect on productivity, which also means increasing revenue from fisheries sector through tax and, more importantly will create the multiplier effect. The more fishing company and/or SMEs (Small Medium Enterprises) means the more hiring and certainly the unemployment number will decrease since most fisheries company is more labor-oriented than capital-oriented.

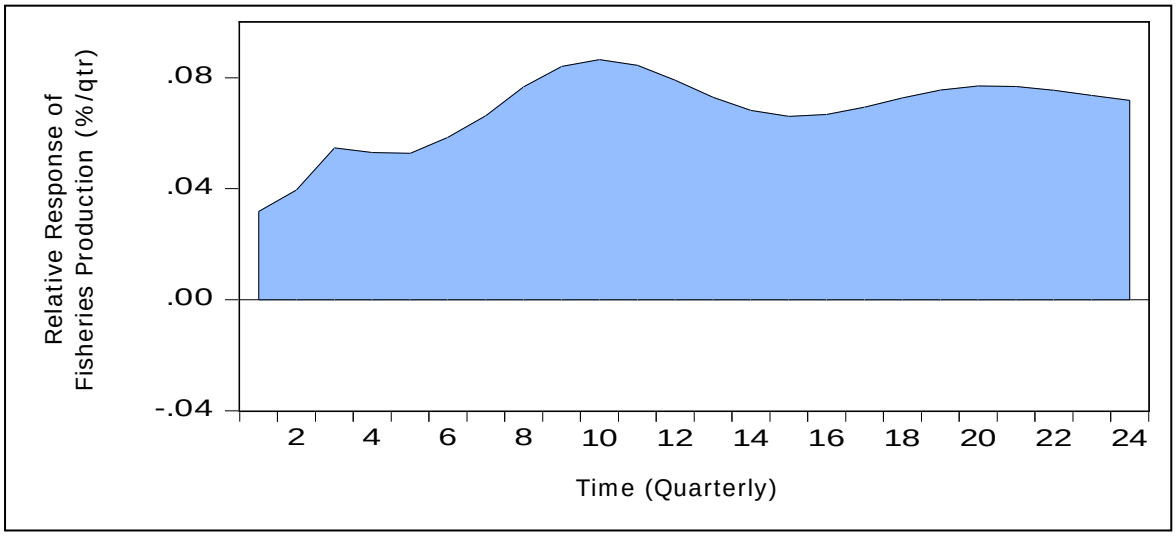

Figure 2. Response of fisheries production on shock of marine catching household/company.

Figure 3 shows how fisheries performance on production response to shock on number of households aquaculture that been registered and it indicates that shock on number of households aquaculture in this region is not quite strong to have an effect on fisheries production performance in this province but gives positive permanent effect in long run. There are research related to how aquaculture for freshwater, brackish water and seawater have grown rapidly around the world. FAO (2014) and Waite et al (2014) reiterated that aquaculture could boost income and employment, particularly in developing countries where most aquaculture growth will occur, although the development of aquaculture sector needs continuous supply on input, such as land, freshwater, feed, and energy, it also have to deal with inefficiency on management and lack of human capacity (Diana et al 2013). Maluku known as the best place for seaweed

and grouper culture, since 2004 to 2013 aquaculture in Maluku have risen rapidly but still lack of attention by its local government and it makes development of this sector stagnating. There is only one county in Maluku that puts more attention on developing aquaculture. In 2013, Southeast Maluku county had declared seaweed as their top commodity, but this good intention has not been followed by immediate and supportive government policy. Ironically, based on the latest report number of seaweed farmers have decreased gradually since 2013 (Teniwut & Kabalmay 2015).

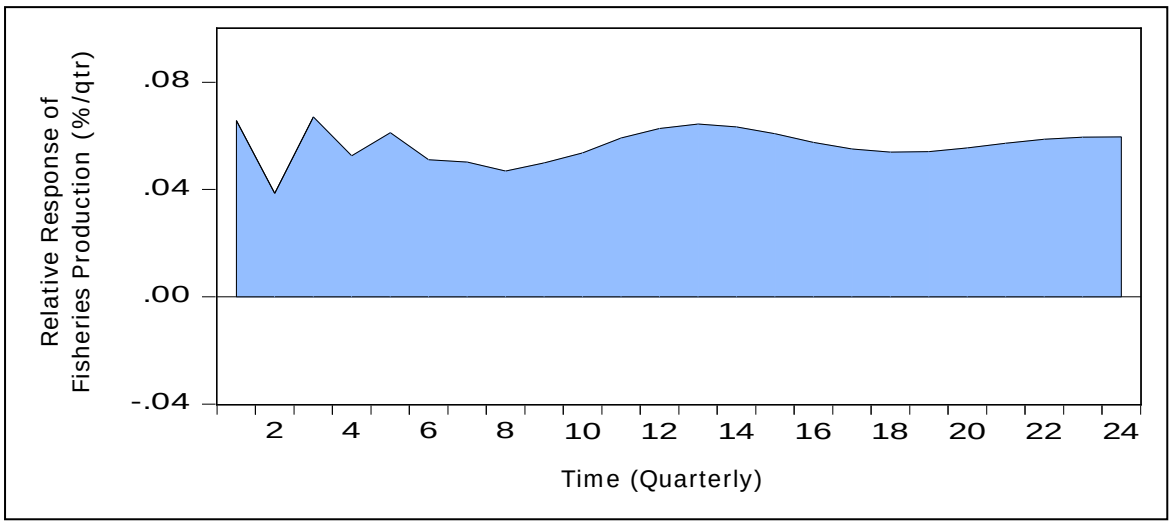

Figure 3. Response of fisheries production on shock on households aquaculture.

Result on Figure 4 show that fisheries production had a positive effect on province regional GDP. This result is obvious since Maluku Province, as a small islands-type really does not have other natural resources beside marine and fisheries. This finding is an evidence about the crucial role of fisheries sector on sustainable in revenue for Maluku, though, in Figure 4 have showed in long run Maluku's regional GDP is lower than in the short run. The risk of high future price (Ahsan & Roth 2010), landscape and amenity values, recreational and navigational use, and alienation of public space (Banta & Gibbs 2009) for aquaculture and ineffciency in management (Diana et al 2013), illegal fishing and over exploitation on wild fish catch are some of constrain factors that have to face by fisheries sector in long run. In order to deal with this matter, local governement need to take immediate action related to the enahncing the knowledge and capability of fishermen and farmers to increase their productivity.

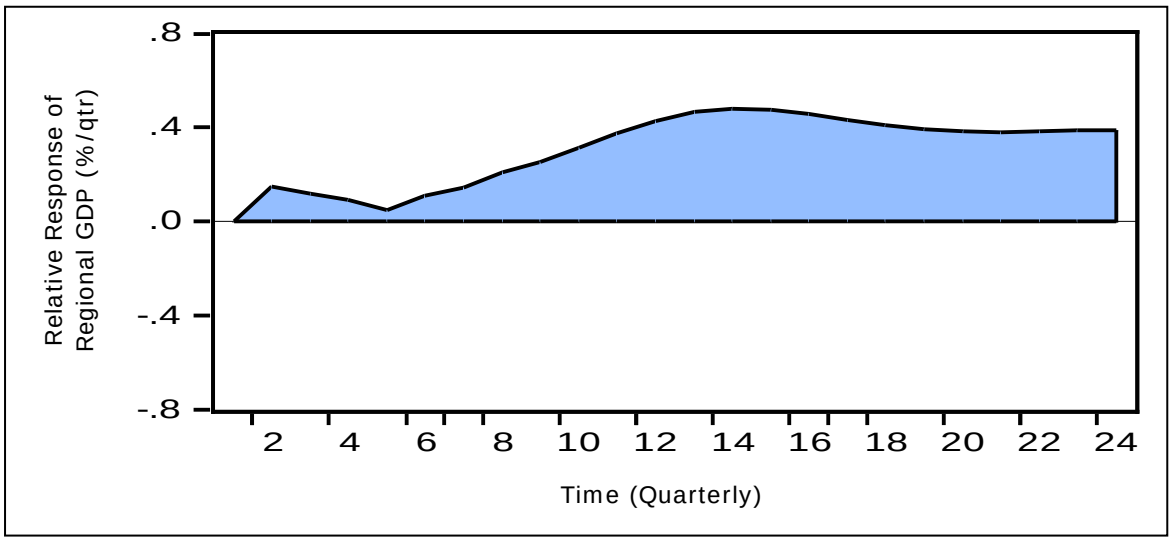

Figure 4. Response of regional GDP on shock fisheries production performance.

Forecast Error Variance Decomposition (FEVD). FEVD determines how much of the forecast error variance of each determine factors on Maluku's fisheries production and Regional GDP which can be explained by exogenous shocks, i.e. marine catching vessel, marine catching company/household and aquaculture household to the other variables in the certain period. In the long run, the variance of fisheries production was explained by household aquaculture for about 34%, meanwhile for variance of regional GDP was explained by fisheries production for 64% (Table 6). This result means that in long run, the role of marine catching fisheries will constantly decline and the role of aquaculture will increase.

As seafood supplies from wild sources mostly are fully exploited, this provides a substantial opportunity for aquaculture production to be competitive. Although, factors like high maintenance knowledge related matter, high cost access to fund sources related (Jagger & Pender 2001; Akpabio & Inyang 2007; FAO 2007) are often to be major constrain. Based on data from Statistic Indonesia, aquaculture have growth significantly since 2004 but its effect on total fisheries production of Maluku Province is still become non factor, in 2011 aquaculture only had 21% of total fisheries producution. Aquaculture is distinguished from other aquatic production by the degree of human intervention and control that is possible (Anderson 2002), this means knowledge and capability play major role on the success of this sector through inovation and accordingly essential for utilization of the rapid technology development that has fuelled the aquaculture production growth which has taken place since the early 1970s (Asche et al 2008).

Table 6

FVD of fisheries production and regional GDP

Variance decomposition of fisheries production					
Period	*Marine catching vessel*	*Marine catching company/household*	*Aquaculture household*	*Fisheries production*	*Regional GDP*
1	7.227786	3.231630	28.44015	61.10043	0.000000
4	4.943535	0.882472	12.53218	72.93965	8.702160
8	2.984473	3.165483	18.17379	58.79639	16.87986
16	4.505241	17.23799	29.31887	35.98607	12.95183
24	5.024104	21.30877	34.58522	27.37959	11.70232
Variance decomposition of regional GDP					
Period	*Marine catching vessel*	*Marine catching company/household*	*Aquaculture household*	*Fisheries production*	*Regional GDP*
1	1.358509	7.486890	1.603460	9.306078	80.24506
4	2.398400	17.30070	2.982958	20.72901	56.58893
8	1.992215	11.62716	4.808124	36.34397	45.22853
16	3.215129	4.178900	3.995934	61.17696	27.43308
24	3.311663	2.647178	3.685485	64.38096	25.97472

Results of this paper implied that in short run local government of this province can rely on marine catch fisheries by working together with education institution to optimize the revenue of fishermen by mapping sites that have higher economic value of fish and at the same time increase the protection in the area to prevent the illegal fishing. In long run, local government needs to build aquaculture sector based on the water characteristic of small islands and culture high value products like sea cucumber and seaweed by provide knowledge and technology in order to accelerate aquaculture sector of this province.

More approach that local government can get through to enhance fisheries productivity in particularly catching fisheries is to get involve in open up an accessibility for capital sources to local businessmen, by launch a bank that only focus on funding fisheries sector, because the access to capital becomes one of classical problems for almost every fisheries sector around the world especially in third world country or developing country so to speak. Another important factor which is related to post production from price to (potential) market of fisheries product related to the role of local government as regulator to protect the price of fisheries product by local fishermen and farmers against competitors, in particularly those from outside region by charge more

taxes on them and facilitate local fishermen and farmers to find potentional market (buyers) in Indonesia and abroad.

Conclusions. Result of this research indicates that amount of catching ship/boat and number of catching fisheries households/company have significant and positive effect on fishery production and also have a permanent effect in long run, but the number of household aquaculture doesn't have significant effect but has positive permanent effect in long run. Implications of these findings are government needs to focus on developing catching fishery sector to increase its total revenue. Therefore local government needs to take several approaches which are: enhancing the intensity of sea patrol to prevent illegal fishing; giving positive incentive to catching fisheries company such as tax allowance and price protection; and also giving subsidy on fuel. Local government can also increase research funding to create more effective technology of fish catching which can strengthen triangle networking between local government as regulator, fishermen (households/company) as core business and education institution as innovation agent, together side by side to make fisheries sector become real economic backbone of this province. Yet, this study has limitations, there are factors that have not been included on this study such as fishermen and farmer's access to the capital because studies shown that access to capital is one of the major constrain for fisheries sector to grow. In addition pro fisheries sector on strategic plan by governor and majors on each county in Maluku is also a variable that has to be considered on future research. Other factor that needs to be considered is bureaucracy, such as time elapse of administrative works which can lead to corruption and potential moral hazard. Future research can include those factors to enrich the scope on discussion and also be more thorough on analysis regarding knowledge and capability on the technical factors on fisheries sector.

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