Integrated Marine and Fisheries Center and priority for product intensification in East Sumba, Indonesia

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Abstract. The main composition of fishery's economy in Indonesia is small-scale fishery who rely on traditional capture fisheries management, likewise in East Sumba Regency. However, from the potential side, East Sumba waters have great resources besides capture fisheries. Thus, research is conducted to identify strategic products existing in East Sumba, Indonesia, and to calculate the level of economic impact for the regional economy and labour absorption. The method used in this research is a qualitative descriptive method using multiplier effect analysis and business feasibility analysis. The results of the study show that seaweed, capture fisheries, freshwater farming, salt, artemia, and tourism have the potential as economic prime-mover of small-scale fishery in East Sumba. Seaweed has the highest business feasibility, followed by capture fisheries, and freshwater farming as a third. Meanwhile, salt, artemia cultivation and marine tourism have lower business feasibility and still need further development in the trial phase. With the addition of a formal management institutional mechanism called the Integrated Marine and Fisheries Center (IMFC) by the government all of these resources can be managed integrally and efficiently, with high quality and acceleration so that the regional economy can be leveraged including the welfare of the small-scale fishers.

Keywords: East Sumba; Indonesia; IMFC; marine product's intensification; SDGs.

1. Introduction

The Integrated Marine and Fisheries Center (IMFC) in East Sumba Regency is the new economy accelerator in eastern Indonesia [1]. IMFC is part of the National Priority Program [2] and in line with the mission of the Ministry of Maritime and Fisheries (MoMaF), namely "sovereignty", "sustainability" (of fisheries resources) and "prosperity". Conceptually, IMFC consists of four main components, namely: 1) development of infrastructure; 2) institutional development; 3) development of marine and fisheries business; and 4) sustainable marine and fisheries resources management [3].

East Sumba Regency was designated as one of the priority locations for fisheries development from a total of 20 IMFC in Indonesia. This IMFC has the potential to be a gateway for the export of fishery

products and has the potential as a centre for marine development in East Nusa Tenggara Province which is expected to be the backbone of the National Fish Logistics System [4] and part of fishery industrialization [5]. IMFC is a regional-based marine and fisheries development concept with an area management approach and system with the principles of integration, efficiency, quality and high acceleration. East Sumba Regency is designated as a location for marine and fishery centres because it is very by predetermined criteria, which are border areas and have small outer islands and have flagship commodities in the marine and fisheries sector [6], as well as the support and commitment from local governments.

Indonesia has a wealth of ocean resources, 17,504 islands and coastline as long as 99,093 kilometres and is surrounded by two oceans, namely the Indian Ocean and the Pacific Ocean to make Indonesia a country with an abundance of marine resources in the area of 3,2547,483 km^2 of territorial waters and 2.7 million waters in the Exclusive Economic Zone [7]. However, the contribution of fisheries is relatively small for national GDP because it has only reached 30% in contribution. This figure is relatively small compared to other countries. Countries such as Japan, South Korea and Vietnam can contribute between 48-57% from fisheries even though the waters are smaller than Indonesia [8]. Fishery production until 2018 shows where the total fishery production reached 33,53 tons with details: 9.45 tons of capture fisheries and 24.08 tons of aquaculture with a total export value of 5.0 billion dollars [9].

The low achievement in the fisheries sector above is estimated by the MoMaF due to the low inter-island connectivity so that the distribution of fishery products is uneven in Indonesia and there is no integrated fisheries centre to manage marine products as high-value commodities [10]. In addition to these two issues, it is also estimated that the absence of commodity preferences based on priorities provided by fisheries development regulators causes the utilization of marine resources to be done randomly and capture anything without a clear business plan nor appropriate technology.

To answers the gap, a study is conducted at one of the Integrated Marine and Fishery Centres in East Sumba that was initiated by the Ministry of Marine Affairs and Fisheries in as part of an acceleration program for the fishing industry. This study aims to identify the fishery's priority commodities to become the flagship of the fisheries sector after the construction of the IMFC and how the feasibility of fisheries commodities in the IMFC scheme can encourage regional economic development and create employment.

2. Location of study and methodology

2.1. Location
The location of the study is in East Sumba Regency, East Nusa Tenggara Province, Indonesia. Geographically, East Sumba Regency is located between 119°45' - 120°52' Longitude and 9°16' - 10°20' Latitude, with the boundaries as follows: North is bordered with the Sumba Strait; the south bordered with the Indian Ocean; the east is bordered with the Sawu Sea, and in the west bordered with Central Sumba Regency. The East Sumba mainland area is spread over one main island (Sumba Island) and three smaller islands namely Prai Salura Island, Mengkudu Island and the uninhabited Nuha Island.

2.2. Methodology
There are two sources of informations, primary anr secondary. Primary data obtained through interviews using in-depth interviews with stakeholders and fisheries actors in twenty-two districts in East Sumba. Secondary data obtained from official agencies according to the commodity being studied. Data processing is conducted by quantitative methods, namely feasibility analysis for each commodity and multiplier effects for flagship commodities and qualitative methods to analyze descriptive information. In detail, the research flow can be described in the following scheme:

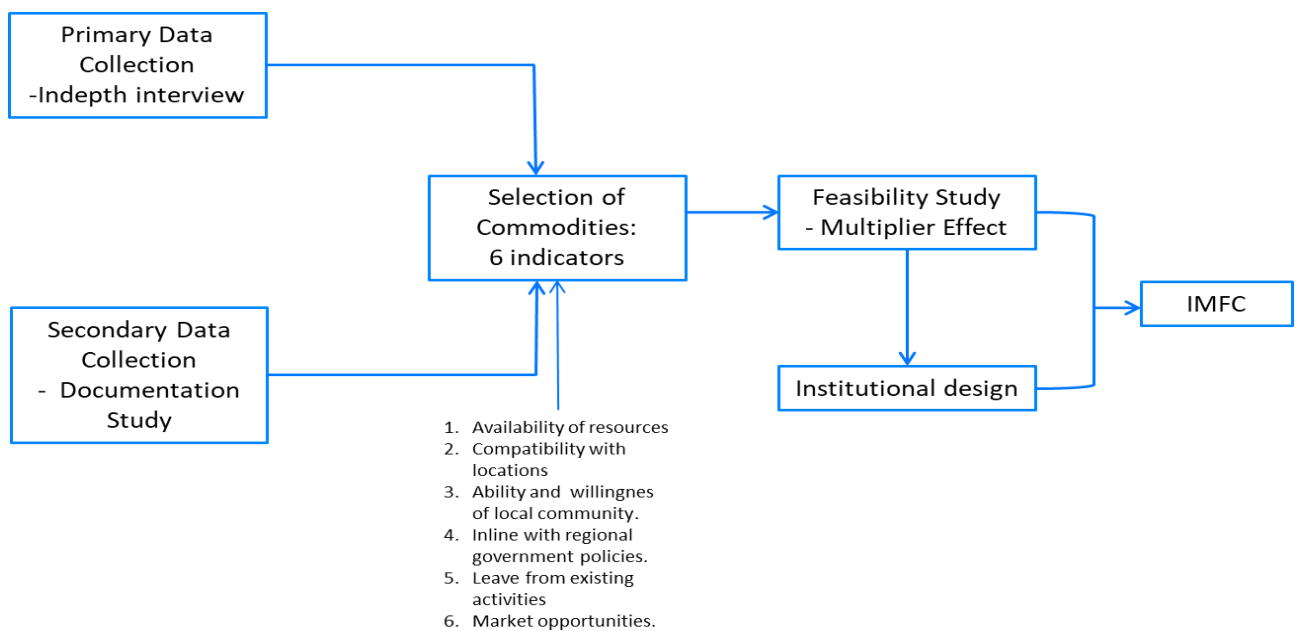**Figure 1.** Map of East Sumba Regency, East Nusa Tenggara Province.

Figure 2. Scheme of study.

The six indicators to select commodities were constructed through expert judgement after the focus group discussion in the location of study and involving various disciplines from the economy, fishery, port management, and coastal sociology. The indicators gave the limitation for field research among various resources on the coast of East Sumba. The primary data is collected from each sub-sector, there are 30 seaweed farmers, five salt farmers (including for artemia study), ten capture fishers, two groups of freshwater farmers and supported by data from officials and direct observation. These respondents considerably have the capacity and knowledge to give actual conditions of each sector.

3. Result of the Study

3.1. Seaweed
The province of East Nusa Tenggara ranked second in the supply for national demands on *Euschema cottonii* seaweed after South Sulawesi [11] and has a "sustainable" status (through RAPFISH analysis) on three factors: economy, intitution, and technology [12]. The location of seaweed cultivation is located on the Flores Islands, Timor, Rote, Sawu and Sumba using simple technology [13]. East

Sumba contributes 0.17% of NTT province's total production with a total of only 1,966,225 tons [14]. This number is closely related to the non-optimization of the existing farming area of 5,944.34 hectares, while seaweed farming area in East Sumba is only 352.9 hectares or around 5.94% is used. With the relatively rising price of seaweed, supported by institutional and technological factors, seaweed has a high prospect of sustainability [15]. Even so, with the same productivity level of 9.36 tons/hectare at this time, if the area of seaweed cultivation is expanded to 80% (4,775.47 hectares), it can produce 44,490 tons of seaweed. If the productivity of seaweed per hectare is increased at least doubled from the present (18.72 tons/hectares), then the optimum production of seaweed will be achieved within 13 years or in 2030. More details can be presented in the following figure:
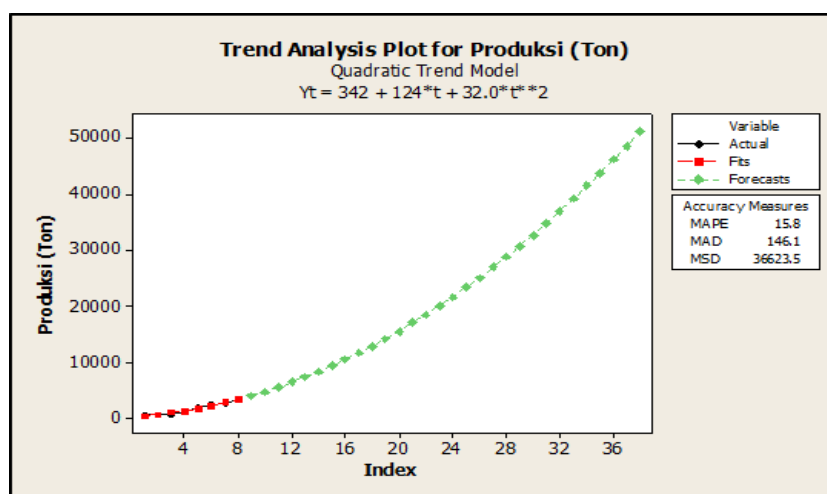

Figure 3. Trend Analysis of seaweed production of East Sumba.

The discount rate used refers to the Small Scale Enterprise Loan (KUR) interest rate, which is 13% per year. The cashflow analysis obtained NPV of Rp 20,308,466, IRR of 49.54%, Net B/C of 1.74, as presented in Table 1.

Table 1. Result of feasibility study on seaweed farming.

No	Item	Value
1	NPV (*Net Present Value*) (Rp)	20,308,466.00
2	IRR (*Internal Rate Return*) (%)	49.54
3	Net B/C (*ratio*)	1.74

3.2. Capture Fisheries

East Sumba Regency has the potential of marine fisheries which are part of Fishery Management Area (WPP) 573 of Indonesian waters and spatially suitable for pelagic as primary target compared to demersal [16] The potential of these marine fisheries can only be utilised around 32%, so there are still development opportunities, as shown in Table 2.

Table 2. Potential and the utilization of fish resource in East Sumba.

No.	Item	Value
1	MSY/Maximum Sustainability Yield (tons/year)	46,466
2	TAC/Total Allowable Catch (tons/year)	37,173
3	Production of capture fisheries year 2017 (tons)	9,108,80
4	Rate of utilization (%)	32
5	Potential for development (tons/year)	25.206

Source: Kepmen KP 47/2016 [17]

The catch of marine fishers in East Sumba Regency as a total has increased by about 1.98% per year. The increase of capture fisheries production occurred in the demersal fish group (0.51%) and reef fish (1,01%), while the fisheries production that experienced a decline in the production is from small pelagic fish groups (-0.36%), large pelagic fish (-0.34%) and squid (-0.89%) [14].

Table 3. Result of feasibility study on capture fisheries.

No.	Item	Nilai
1	*Net Present Value* (Rp billion)	8.211
2	*Net Benefit Cost* (*Ratio*)	3,11
3	*Internal Rate of Return* (%)	32.17

Based on the analysis results in the table above, it can be seen the NPV value of Rp.8,210,919,135,567, meaning that the current value of the benefits to be gained during the life of the project ten years in the future is Rp. 8,210,919,135,567. Net B/C value of 3.11 means that every one rupiah costs incurred will generate revenues/ benefits of 3.11 times from the costs incurred during the 10-year business life with an interest rate of 17%. The IRR figure is 32.17%, meaning that the business can provide a return or profit of 32.17% per year from all investments invested during the ten years of business. Analysis at this stage concludes that the development of capture fisheries business provides benefits in terms of NPV, IRR and Net B/C indicators so that it is feasible to be developed.

3.3. Freshwater Farming
The area of culture that can be utilized for freshwater aquaculture activities in 2016 in East Sumba Regency amounted to 448 hectares, and only 26 hectares are used or only 5.8%. The development of freshwater aquaculture activities in East Sumba Regency is due to several factors, including the increasing number of food stalls, restaurants and hotels in East Sumba. The high price of sea fish compared to cultivated freshwater fish also results in people who are far from coastal areas preferring to buy freshwater fish compared to sea fish. The number of households managing freshwater fishery businesses in 2016 in East Sumba Regency increased by 85.17% from the previous year. Freshwater fish production also continues to increase by 56.54% from 2012 to 2016 [14].

Table 4. Feasibility analysis of Freshwater Farming.

Item	Tilapia	Catfish	Carp
NPV (Rp)	218,943,078.00	361,798,461.00	305,312,311.00
B/C Ratio (*Ratio*)	2.98	2.05	6.18
IRR (%)	78.25	48.04	172.41

The results table above shows that the NPV or net benefits from the cultivation of tilapia, catfish and carp are at values> 0, which means it is feasible for the business. Net B/C Ratio value means that for every Rp. 1, spent in five years, it can generate a net profit of Rp. 2,98.00 for tilapia, Rp 2,05.00 in catfish, and Rp. 6,18.00 in carp. Meanwhile. IRR is a rate of return on business with an interest rate of 13%, carp is the most profitable commodity and is able to return loans, followed by tilapia and catfish.

3.4. Salt
Indonesia as beach country relies salt production from Java and Madura, with less dominant from Southeast Sulawesi, South Sulawesi, Central Sulawesi, West Nusa Tenggara and East Nusa Tenggara [18]. East Sumba Regency has excellent potential for the development of salt with its high water salinity. The salinity value obtained in the waters of East Sumba Regency ranged from 12-34 ppt (parts per thousand). The potential of salt ponds in East Sumba Regency reaches 1,111 Ha, but the salt production pond that has been managed until 2016 is only 70 hectares based on boiled salt, while the pond salt is only 19 hectares, means that the utilization of salt production is less than 15% of existing potential land. From the feasibility analysis of the salt business in East Sumba, the results are as shown

in Table 5. This business feasibility analysis consists of revenues, fixed costs, variable costs and business analysis.

Table 5. Result of feasibility study on boiled salt.

No.	Item	Value
1	*Net Present Value* (Rp)	13,641,611,33.00
2	*Net Benefit Cost* (*Ratio*)	3.60
3	*Internal Rate of Return* (%)	98.50

Based on cash flow analysis, the NPV value is 13,641,611 rupiah, indicating that the salt boiling business for five years provided a net profit after deducting a discount rate of 13%, giving a profit of 13,641,611 rupiah. Net B/C gained 3.60, which means that every 1 rupiah used for salt boiling for five years, a net profit of 3.60 rupiah will be obtained. IRR of 98.50% provides information that the business of boiling salt for five years provides a business return of 98.50%.Means that with a bank loan interest rate of 13% from Bank, this salt boiling business can return the loan and still be profitable. The high value of IRR is because the investment value is very small compared to the revenue obtained.

Despite feasible in business, there are challenges in developing this salt business in the aspect of market reach. So far, the salt market is only limited to Sumba Island and is not marketed outside the region. Besides that, salt business is still based on micro-scale business so that the forms of commercial business institution development have not yet been established in East Sumba.

3.5. Artemia in Salt Pond

Artemia salina or brine shrimp is about 12 mm length planktonic that important for aquaculture[19]. Products produced from the cultivation of artemia in salt ponds are Artemia cysts and biomass. Both artemia cyists and biomass are very important products in their use for fishery industry activities which are feed for shrimp juvenile or fish larvae from various aquaculture activities (both land and sea) [20]. There is currently no development of Artemia cultivation in East Sumba, but the existence of salt ponds is a potential that has not been optimally utilized.

At present, Indonesia has to import about 40 tons of artemia cyst with a value of around 56 billion rupiahs every year, with the average price per kg of imported artemia cysts being 1.4 million rupiah. So that the market of artemia cyst that is cultivated domestically is still wide open because the demand for artemia cyst is very high. Also, artemia cultivation activities that are integrated with salt ponds will increase the income of salt farmers because, in addition to receiving revenue from salt sales, farmers also receive income from the sale of artemia cysts and biomass. Besides that, with the integration of the artemia cultivation activities with salt ponds, the produced salt is more quality because they are physically cleaner.

In business feasibility, artemia cultivation can be said to be feasible if there is a more intense model of technology application and logistics distribution from and to Sumba Island through the existing "Sea Toll" (Marine Route). The following are the results of the feasibility analysis of the artemia business in salt ponds:

Table 6. Result of feasibility study on artemia in the salt pond.

No	Uraian	Value
1	*Net Present Value* (Rp)	522,267,552.00
2	NET B/C (*Ratio*)	6,66
3	*Internal Rate Return* (%)	185,17

Based on the analysis of cash flow cultivation of artemia, the NPV value obtained is Rp. 522,267,552 means that the artemia cultivation activity will get a net benefit of Rp. 522,267,552 over the life of the project, on the basis of the interest rate of 13% per year. Then based on the NPV value

obtained in scenario 1 is said to be feasible to proceed because the NPV value> zero. Meanwhile, the Net B/C value is 6.66. This shows that every 1 rupiah used for the artemia cultivation business for five years will receive a net profit of 6.66 rupiah. Therefore, the artemia cultivation business is declared feasible and profitable to be developed. Because the Net B/C value of 6.66 shows that each cost incurred in the amount of one rupiah will receive a net benefit of 6.66 rupiah for five years at an interest rate of 13% per year. The value of IRR in integrated artemia cultivation with salt ponds is 185.17%. The IRR value of 185.17 illustrates that the artemia cultivation business for five years gave a business return of 185.17%. With a bank loan interest rate of 13%, artemia cultivation activities can return loans and still be profitable.

3.6. Marine Tourism

Sumba Island has been designated as one of the fifty National Tourism Destinations (NTD) under the name NTD Sumba - Waikabubak and surrounding areas, so that it has been officially planned to become a national tourism development centre, as stated in Government Regulation of the Republic of Indonesia Number 50 the Year 2011 [21] In terms of attractions, Sumba Island has a comparative and competitive advantage. Potential tourist attractions in the East Regency consists of three types, namely cultural tourism, nature tourism, and culinary tourism. For nature tourism, marine-based tourism (maritime) is very potentialbut still considered idle compared to cultural attraction [22]. Much less, the provincial government of East Nusa Tenggara still consider Flores Island and Alor Island as primary marine tourism destination [23]. Whereas East Sumba Regency itself has three types of marine tourism objects, namely in the form of beaches, underwater tourism, and waters and small islands.
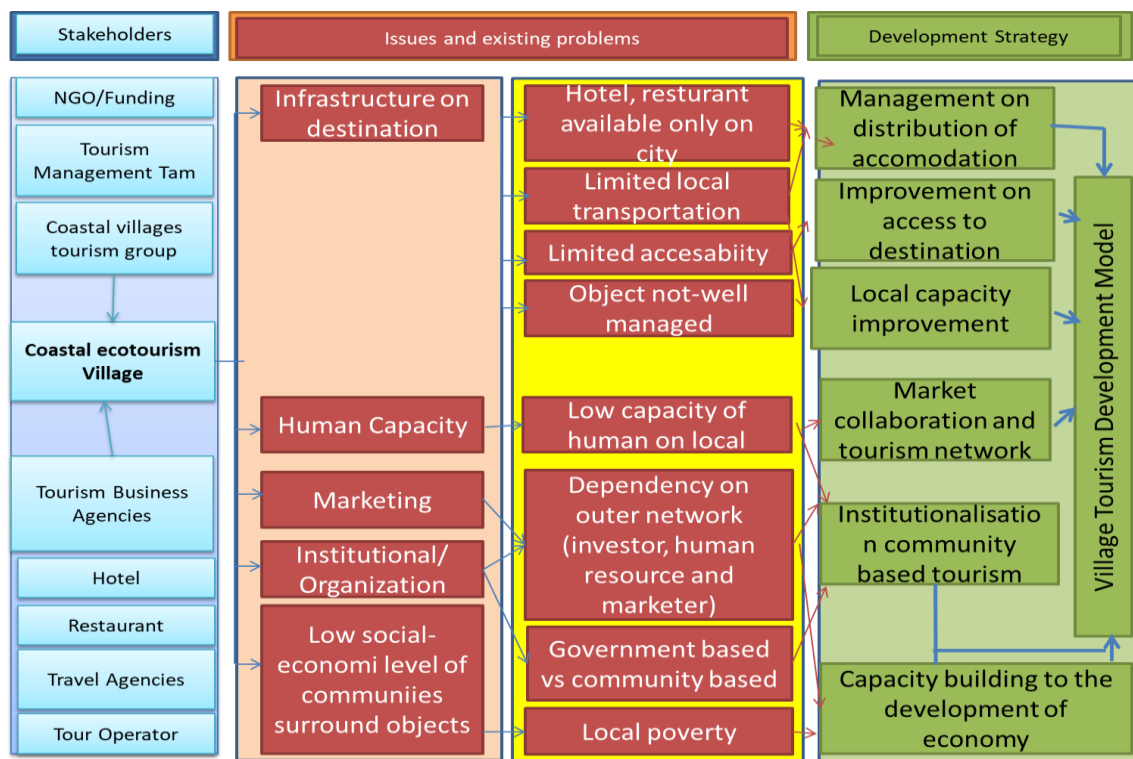

Figure 4. Design for the development of marine tourism in East Sumba.

The increase in the average tourist arrivals per year in East Sumba Regency from 2005 to 2016 amounted to 12.12%, which consisted of foreign tourists increased by 11.15% and domestic tourists increased by 14.10% [24]. Observing that the potential tourism object in East Sumba is a unique nature and culture, the development of marine tourism must be developed towards sustainable tourism with distinct characteristics, which according to Hartanto [25], are as follows: a) Sustainable tourism

contains the spirit of conservation, not exploitative and prevent the commercialization of nature and culture in East Sumba; b) Designed to be developed with the local community, where they are acting as the main actors in tourism activities; and c) Sustainable tourism grows naturally based on community, natural environment and socio-culture; the community must be an integral part of tourism activities, because the core of tourism activities is the community itself. In the context of East Sumba, the product and market development strategy can be based on the framework in Figure 4.

However, until this present, this potential has not been specifically developed and is still idle. Therefore, it is still needed a more in-depthstudy of the potential of marine tourism among the many tourism objects and attractions in East Sumba regency to ensure the sector able to give significant effect on economic growth [26].

4. Discussion: Multiplier effect of strategic flagship commodities

According to Arsyad [27] the determinant factor for regional economic growth is related the demand of goods and service from outside. The industrial growth which uses local resources and raws for export will create regional wealth and job creation. The economic impact also related to multiplier effect where the policy for the increasing number of employment will create the bigger multiplier effect [28]. The discussion related to the multiplier effect of developing strategic leading commodities for the economy of East Sumba Regency for present focused on strategic flagship commodities of seaweed and capture fisheries. Seaweed and capture fisheries have a multiplier effect on the regional economy both on economic growth and employment. The multiplier effect analysis uses McCann equation [29]. This equation uses two approaches to measure this multiplier effect, namely, the income approach and the labour approach. Data processing is performed by the OLS (Ordinary Least Square) method. Table 7 and Table 8 are multiplier effects analysis of seaweed cultivation and capture fisheries in East Sumba Regency.

Table 7. Multiplier Effect Analysis from the sector of seaweed farming.

Legend		Multiplier effect on economic growth sub-sector seaweed	Multiplier effect on employment on sb-sector seaweed
Model *multiplier effect*	=	$T = (2.49 \times 10^{12}) + 28.5\,B + e$	$T = (90.333,6) + 3.05\,C + e$
R^2	=	86.82 %	95.20 %
F_{count}	=	32.95 ($F_{sign} = 2.25 \times 10^{-3}$)	59.48 ($Fsign = 4.5 \times 10^{-3}$)
t_{count}	=	5.74 ($t_{sign} = 2.25 \times 10^{-3}$)	7.72 ($tsign = 4.5 \times 10^{-3}$)

Equations in Table 7 statistically shows that the multiplier effect model can be used because it already shows a high validity. In the economic growth model, a coefficient of B of 28.5 is obtained, which means that every 1 rupiah increase in the seaweed base sector will have an impact on increasing the regional economy of 28.5 rupiah. In the employment model, the obtained coefficient C value is 3.05, which means that every increase of 1 person seaweed base sector will have the effect of absorbing the workforce of East Sumba as many as three persons.

Table 8. Multiplier Effect analysis from the sector of capture fisheries.

Legend		Multiplier effect on economic growth sector of capture fisheries	Multiplier effect on employment from sector of capture fisheries
Model *multiplier effect*	=	$T = (1.51 \times 10^{12}) + 11.92\,D + e$	$T = (17730.84) + 29.17\,E + e$
R^2	=	95,20 %	77,48%
F_{count}	=	59.48 ($Fsign = 4.5 \times 10^{-3}$)	13.76 ($Fsign = 0.02$)
t_{count}	=	7.72 ($tsign = 4.5 \times 10^{-3}$)	3.71 ($tsign = 0.02$)

The equation in Table 8 statistically shows that the coefficient D value is 11.92 which means that every 1 rupiah increase in the base of the marine capture fisheries sector will have an impact on

increasing the regional economy by 11.92 rupiah. The coefficient value of E is 29.17, which means that every increase of 1 person in the marine capture fisheries sector will have the effect of absorbing the total workforce of the East Sumba region by 29 persons.

The selection of policies towards regional economic development can be based on two issues: First is the sensitivity to increasing regional economic income, and the second is sensitivity of the absorption of the workforce. Indicators β (B, C, D, E) show sensitivity, where seaweed increases total revenue, meanwhile capture fisheries absorb more labour in the area. As presented in the table above, the labour multiplier and revenue in seaweed and capture fisheries commodities are >1 where shows the ability of the two commodities to drive income growth and employment in East Sumba Regency.

5. Conclusion

The study indicating there are three most strategic product can be improved for the development of fishery in Sumba Timur and stimulate employment which is: seaweed farming, capture fisheries, and freshwater farming. Meanwhile, salt, artemia and marine tourism has a significant potential to be an prime economic mover of East Sumba but need more improvement and breakthrough on technological, institution, and market. For short term implementation, both seaweed farming and capture fisheries can be the most strategic commodity to generate economy through the operationalization of IMFC. Regarding the option development policy by the government, it depends on the financial ability of regional government to manage which priority to develop first or develop both sub-sector simultaneously.

Acknowledgement

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