

## Article

# Makassar Strait Area Development in Indonesia Based on the Marine Economy Sector

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**Abstract:** The new capital city of Indonesia, Nusantara, having moved from Jakarta on Java Island to Kalimantan, is now officially located in the interregional area of the Makassar Strait. This area is expected to develop as the engine of the Indonesian economy, while various economic infrastructures are still very limited. The Makassar Strait area covers East Kalimantan, South Kalimantan, South Sulawesi, West Sulawesi and Central Sulawesi. These provinces have significant marine resource commodities and make a relatively significant economic contribution to the Indonesian economy as a whole. Using the data of the 2016 Inter-Regional Input-Output (IRIO) table which was updated in January 2021, this study aims to analyze the main sectors and inter-provincial linkages between each sector in the region. The results show that each province has a different main sector of economic development, which leads to different strategies based on their quadrants. Furthermore, the goal of provincial development as the new engine of the Indonesian economy is based on the assumption that the marine sector is on an industrial scale.

**Keywords:** IRIO; IKN Nusantara; IRIO; inter-sector linkage; marine economy; strategy



**Citation:** Gani, Irwan, Auliansyah Auliansyah, Emmilya Umma Aziza Gaffar, Muliati Muliati, Yesi Aprianti, Revy Fadly Robby Rachmadi, and Nadia Indri Agustina. 2022. Makassar Strait Area Development in Indonesia Based on the Marine Economy Sector. *Economies* 10: 195. <https://doi.org/10.3390/economies10080195>

Academic Editor: Andrea Appolloni

Received: 21 June 2022

Accepted: 29 July 2022

Published: 12 August 2022

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## 1. Introduction

The decision of the Government of Indonesia to relocate the state capital from DKI Jakarta to East Kalimantan is expected to have a positive impact on the development of regions in Makassar Strait. Based on the projection report, the relocation process will increase population and investment in Makassar Strait, therefore it will generate a new market for marine economic activities. In accordance with the circumstances, it is necessary to provide the needs of the development of this new city, as well as increase the productivity of marine sectors of its surrounding area.

Indonesia is considered one of the countries in Southeast Asia with a robust economy. It is ranked 10 globally and is the only country in Southeast Asia that is a part of the G20, an intergovernmental forum comprising 19 countries and the European Union (Raak 2014; World Bank 2021). Indonesia is an archipelagic country bordered by the Pacific Ocean in the north and the Indian Ocean in the south. Approximately 80% of the area is marine, and is comprised of 17,504 islands and 99,093 km of coastline. The marine environment contains a variety of flora and fauna that form various ecosystems such as mangrove ecosystems, seagrass beds, coral reefs, and estuaries. These conditions could be the reason why around 57% (equivalent to 327) of the 514 district/city-level areas are located on the coast (PUSDATIN-KKP 2018). Thus, various economic activities related to coastal and marine industrial outputs have been found there. Therefore, the marine sector is one of the important sectors in ensuring the livelihood of Indonesian citizens.

The development of Indonesian natural resources in the marine sector has been established in formal regulations on how to manage the marine sector based spatial planning,

including zoning in marine spatial planning, coastal and small islands, and marine areas. In the case marine areas, the regulation produces a zonation of national strategic areas, certain national strategic areas, and inter-regional zone zoning plans. Since 2020, the Makassar Strait interregional zoning plan was been approved and implemented by Presidential Regulation Number 83 in 2020. The area covers five provinces, including South Kalimantan, East Kalimantan, South Sulawesi, Central Sulawesi, and West Sulawesi.

Economic acceleration in the interregional zonation of the Makassar Strait has been improved through a policy on the development of the maritime sector. Each province has different characteristics. For example, East Kalimantan is a province with high income from oil, gas and coal resources that are mostly mined in coastal areas. The contribution of these resources to the Gross Regional Domestic Product (GDP) reaches 40% to 50% (Susilowati et al. 2017; World Bank 2009) annually. South Kalimantan relies on coal and lignite mining. Its contribution to the GDP is 19–26% (Rozie et al. 2019). South Sulawesi, West Sulawesi and Central Sulawesi rely on agriculture, nickel mining and biodiversity resources, which differ from those Kalimantan provinces because they are located in the Wallacea (Evans and Millott 2020; Japan International Cooperation Agency 2008). Despite having different natural resources and regional characteristics, these provinces use the Makassar Strait zones for economic activities such as fishing, aquaculture, marine tourism, and maritime transportation.

The Makassar Strait plays an essential role in connecting the provinces in Kalimantan Island (East and South Kalimantan) and the provinces in Sulawesi Island (South, West, and Central Sulawesi), especially to utilize marine resources. Nevertheless, there is limited information about what the key factors are in the economic sectors regarding marine resource utilization for each province. Furthermore, understanding the interaction of each sector and its contribution to improving the economy sectors of those provinces is critical in order to successfully achieve the goals outlined in Indonesian Presidential Regulation Number 83 of 2021.

Various studies have been carried out in the territory of Indonesia to analyze the key factors for the economic sectors in other provinces. Renur et al. (2019) analyzed the contribution of the marine economy to the development of Maluku Province. Amin et al. (2020) measured inter-sector linkages, the impact of output multipliers, income, and labor in the marine sector of North Maluku Province. Meanwhile, Sapanli et al. (2019) analyzed the marine economy's structure in Indonesia, while Nurkholis et al. (2016) analyzed the contribution of the marine sector to the economy. However, those studies used input-output table as the main source so that they cannot show the inter linkage of marine economic sector among provinces. It only provides information of linkage among sectors within a region. In contrast, Hirawan and Nurkholis (2007) evaluated changes in the economy's structure by analyzing the development of inter-sectoral and inter-regional relations in Indonesia using the Interregional Input-Output (IRIO) model between provinces.

Some of the previously mentioned studies mostly used similar methods as we do in this paper. However, none of them have focused their study on analyzing critical sectors and inter-provincial inter-sector linkages in the marine economy in Indonesia. Based on this, we would like the paper to contribute to filling the research gap, especially the marine economy of provinces in the Makassar Strait area. The growing interest in provinces in both Kalimantan and Sulawesi island is driven by the change in East Kalimantan status as the new location of the Capital of the State of Indonesia. In terms of interaction with provinces in surrounding areas, both East and South Kalimantan have shown significant dependency on unrenewable natural resources. As part of the objectives of the paper, we would like to provide insight and then shifting into renewable/sustainable natural resources such as the marine economy.

This paper is organized as follows: Section 1 contains the rationale and objectives of the paper; Section 2 reviews the literature of the study of sectoral interlinkage in economy; Section 3 contains the data and methodology used to solve research problems; Section 4

consists of the results obtained in the analysis process; the Section 5 contains the discussion; and Section 6 concludes the discussion.

## 2. Literature Review

Establishing the interlinkage among sectors in economy has become a major interest in research in development economics. One of the ways to measure the linkage is by utilizing Input Output Tables (IOt), and Inter-Regional Input Output Tables (IRIO) as the extended tools to analyse the issues. The main difference between these two is that IRIO could show the interaction and shifting of goods and services in terms of regional trading as well as spillover to or into connected regions. Input-Output (I-O) analysis is a technique has been widely used to reflect the interaction of sectors in a region, and divides the economy into two parts to demonstrate direct and indirect interdependencies among sectors. IO table is a tool to measure the utilization of goods and services in every sector of the economy. This table can be utilized to describe the structure of economy which consist of the output and value added of each industry, as well as supply and demand side of an economy. One of the advantage of IO model is its capability to measure the interlinkage among sectors, both forward linkage and backward linkage. In terms of forward linkage, it could be interpreted as a power of dispersion index whilst the backward linkage can be seen as a sensitivity of dispersion index (Kul Gelal 2021). Based on these indices, sectors in the economy can be classified into four categories, i.e., (1) Quadrant I: sectors that both exert strong influence on all industries and are most affected by external economic/non economic movement; (2) Quadrant II: sectors with weak influence on other industries but that are embodied with high sensitivity; (3) Quadrant III: weak sectors both in influence and sensitivity; and Quadrant IV: sectors with a strong influence on other industries but weak impact/sensitivity on other industries.

Research on the economic impact of sectors using IO analysis in Indonesia and world-wide has abundantly available, however those who are specifically analyse on fishery are quite limited (Jun et al. 2022; Meersman et al. 2022; Noori et al. 2021; Shu et al. 2022; Tian et al. 2022; Vukić et al. 2021). We follow the assumptions and drawbacks of IO analysis from Miernyk (1966) and Szyrmer (1992), while Luhur provide an overview of I-O model application in the economics of fisheries in South Korea and Indonesia (Lee and Yoo 2014; Luhur et al. 2014). The fishery sector in the South Korean economy affected by the subsidy policies on non-taxable oil for fishery industries due to the increase of oil price. The finding implies that transport industries play a crucial role in fishery sectors, specifically capture fishery and aquaculture. In line with the previous finding, the study also found the effect of fishery sectors on employment due to its intensiveness of labor. The paper suggest the government to improve the productivity of this sector by promoting fishing villages tourism, support the educational training for farmer and their successor, fishery experts, and aquatic engineers. Furthermore, the paper recommends to regulate the fishery sectors with regard to fishery investment and pricing policy based on the Leontief price model. The study carried out by Luhur et al., using Indonesian updated IRIO table 2005, has found that Indonesian fishery sectors tend to have high linkage, both forward and backward, among industries in the economy. The study also found that by cluster of regions, fishery sectors were dominated by provinces in the middle part of Indonesia such as Java and Bali, as well as Sumatera, which is an indication of inefficiency in channeling the distribution. The latest related research in a similar field was conducted in China and showed that fishery has low influence as a final primary production industry, while as a secondary sector it has strong influence but a weak induction effect. In this case the writer suggested that there is a need of government intervention to stimulate the consumption of the aquatic product, as well as promoting stronger demand in higher value added product. At the study period it was known that fishery sectors experienced stagnation regardless of the production values due to the negative impact of implementation of a specific government regulation with regard to fisheries. Another study related to the importance of the fishery sector, specifically recreational fishing, and was conducted by Zhao et al. Using I-O as an analytical tool, the

study found that even though the effect on socioeconomics is small compared to other industrialized countries, this recreational fishery has promoted job creation in China. This sub-sector of a fishery has been proven to have a stronger employment inducing effect than of other primary industries such as agriculture, forestry, and fisheries (Wang and Wang 2021; Zhao et al. 2022).

### 3. Methodology

Analysis of key sectors in the marine economy using Indonesia’s Inter-Regional Input-Output (IRIO) Table is based on domestic transactions on producer prices by 34 provinces and 52 industries in 2016 (update January 2021). This IRIO table is published by the Central Statistics Agency (BPS) through four stages of preparation, namely: (1) compiling the Supply and Use Table (SUT) table for 34 provinces (34 × 52), (2) compiling the IO table for 34 provinces (52 × 52), (3) survey of inter-island/provincial trade and (4) IRIO table for 34 provinces (52 × 52) (Badan Pusat Statistik 2021). The research was conducted in 2021 and covered five provinces in the Makassar Strait Interregional Zoning Area, namely South Kalimantan, East Kalimantan, South Sulawesi, Central Sulawesi, and West Sulawesi. The analysis stage is described as follows.

#### 3.1. Processing IRIO Data

The first stage carried out in this research is the procurement of IRIO data through the Indonesian Central Statistics Agency. To provide an overview of the data obtained, a matrix is made as presented in Table 1. From the matrix presented, a fundamental equation can be drawn up consisting of 34 provinces and 52 economic sectors, which is adopted from (Hirawan and Nurkholis 2007):

$$X_i^{Aceh} = \sum_{j=1}^{52} z_{ij}^{11} + \dots + \sum_{j=1}^{52} z_{ij}^{134} + Y_i^1$$

and so on until:

$$X_i^{Papua} = \sum_{j=1}^{52} z_{ij}^{341} + \dots + \sum_{j=1}^{52} z_{ij}^{3434} + Y_i^{34}$$

where: X is the quantity of output and Y is the quantity of final demand

**Table 1.** Indonesia’s Inter-Regional Input-Output Table Matrix based on domestic transactions on the basis of producer prices by 34 provinces and 52 industries in 2016.

Province			1. Aceh			..			34. Papua		
Province	Sector	Code	I-01	..	I-52	I-01	..	I-52	I-01	..	I-52
1. Aceh	Food Crops Agriculture	I-01	Z <sub>11</sub> <sup>11</sup>	..	Z <sub>152</sub> <sup>11</sup>	..	..	..	Z <sub>11</sub> <sup>134</sup>	..	Z <sub>154</sub> <sup>134</sup>
	..	..	..	..	..	..	..	..	..	..	..
	Other Services	I-52	Z <sub>521</sub> <sup>11</sup>	..	Z <sub>5252</sub> <sup>11</sup>	..	..	..	Z <sub>521</sub> <sup>134</sup>	..	Z <sub>5252</sub> <sup>134</sup>
..	Food Crops Agriculture	I-01	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..
	Other Services	I-52	..	..	..	..	..	..	..	..	..
34. Papua	Food Crops Agriculture	I-01	Z <sub>11</sub> <sup>341</sup>	..	Z <sub>152</sub> <sup>341</sup>	..	..	..	Z <sub>11</sub> <sup>3434</sup>	..	Z <sub>152</sub> <sup>3434</sup>
	..	..	..	..	..	..	..	..	..	..	..
	Other Services	I-52	Z <sub>521</sub> <sup>341</sup>	..	Z <sub>5252</sub> <sup>341</sup>	..	..	..	Z <sub>152</sub> <sup>3434</sup>	..	Z <sub>5252</sub> <sup>3434</sup>

Once the data is processed, to answer the first goals, the key sectors need to be analysed through backward and forward linkage analysis to answer the first goal. This relationship shows how vital the marine sector is as a sector that requires input from other sectors (backwards). Meanwhile, future linkages show the role of the marine sector in offering the

output needed by other sectors (Morrissey and Cummins 2016). Therefore, the backward and forward linkage model can be written as follows and adopted from Kwak et al. (2005); Wang and Wang (2019):

$$\text{Backward linkage } (\lambda_i) = \sum_{j=1}^n b_{ij} / \left( \frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n b_{ij} \right)$$

where  $\lambda_i$  is the denotation of the backward linkage impact, which is the number of column vectors of the Leontif inverse matrix, and the mean of the Leontif inverse matrix

$$\text{Forward linkage } (\delta_j) = \sum_{i=1}^n b_{ij} / \left( \frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n b_{ij} \right)$$

where  $\delta_j$  is the denotation of the forward linkage impact, and the total number of row vectors of the Leontief inverse matrix. After the backward and forward linkages are known, the final demand structure can also be analyzed. Final demand shows the activity of selling goods and services produced by the economic sector that is directly used. The final demand equation can be written as follows:

$$F_i = \sum_{j=1}^{52} F_{ij}$$

where,  $F_i$  is the final demand of sector- $i$  and  $F_{ij}$  is the number of output of sector- $i$  used as input by sector- $j$ .

### 3.2. Aggregating Analysis Results

After the data is analyzed the results of the analysis are aggregated into seven marine economic sectors (Colgan 2004, 2013, 2016; Ebarvia 2016). Each sector are then detailed in to sub-sectors based on the classification of Dewan Kelautan Indonesia. The complete marine economic sector and sub-sector are presented in Table 2.

**Table 2.** Marine Sector and Sub-sector.

Sector	Code	Sub Sector
Fishery	I-07	Fishery
Oil and Gas and Non-Oil Mining	I-08	Oil Mining, Geothermal Gas
	I-09	Coal and Lignite Mining
Marine Industry	I-12	Coal Industry and Oil and Gas Refinery
	I-13	Food and Beverage Industry
	I-19	Chemical, Pharmaceutical and Traditional Medicine Industry
	I-21	Non-Metal Mineral Industry
	I-25	Transport Equipment Industry
	I-27	Other Processing Industries, Machinery and Equipment Repair and Installation Services
	I-29	Gas Procurement and Ice Production
	I-30	Water Supply, Waste Management, Waste and Recycling
Marine Building	I-31	Construction
Water transportation	I-36	Sea Freight
	I-37	River Lake and Crossing Transportation
Maritime Tourism	I-40	Accommodation Provision
	I-41	Food and Drink Preparation
Marine Services	I-33	Wholesale and Retail Trade, Not Cars and Motorcycles
	I-48	Company Services
	I-50	Education Services



## 4. Results

### 4.1. Backward and Forward Linkages of the Marine Economic Sector

Backward and forward linkages conceive the size of the linkages between the upstream and downstream sectors. Backward linkages are links to raw materials (input providers), while forward linkages are outputs or sales of output/production goods (Hirawan and Nurkholis 2007). (Resosudarmo et al. 2008) stated that if the backward and forward linkage index is greater than one when added together, the sector can be determined to be a critical sector. Meanwhile, the sector is forward-oriented if the forward sector is more significant than one while the backward linkage is less than 1. If the opposite occurs, it means that the sector is backwards-oriented. If the same sector is less than 1, then the sector is included as a critical sector.

The analysis results (Table 3) show that East Kalimantan Province is the most dominant province in terms of key sectors compared to other provinces in the region. To be more detailed with the analysis results explained by sub-sector, the sub-sectors referred to have been presented in Table 2. The key sectors of the marine economy of East Kalimantan Province consist of six sub-sectors, including (1) coal and lignite mining, (2) the food and beverage industry, (3) chemical, pharmaceutical and traditional medicine industries, (4) construction, (5) wholesale and retail trade of non-cars and motorcycles, and (6) company services. South Kalimantan consist of two sub-sectors i.e., (1) food and beverage, and (2) construction industry. South Sulawesi Province consist of two sub-sectors i.e., (1) food and beverage, and (2) the non-metal mineral industry. Central Sulawesi consist of two sub-sectors i.e., (1) food and beverage, and (2) construction industry. West Sulawesi Province, has only one key sector, namely the food and beverage industry. In general, the sub-sectors with a forward linkage greater than the backward linkage can be interpreted as the sub-sector being very sensitive in accepting the influence of economic growth, for example, the key sector of coal and lignite mining in East Kalimantan Province. As if there is an increase of 1 unit of output in other key sub-sectors, the output in the coal and lignite mining sub-sector was 7.7683 units, which is the same with other key sub-sectors in the region.

In Table 3, some sub-sectors are forward-oriented or sensitive to other sectors. The most prominent examples are the oil, gas and geothermal mining sub-sector and coal industry and oil and gas refinery sub-sector. The oil, gas and geothermal mining sub-sector has a backward linkage index of 0.7981 and a forward linkage index of 5.7202, and the coal industry and oil and gas refining sub-sector have a backward linkage index of 0.9252 and a forward linkage index of 10, 2372. It implies that the output of these sub-sectors is oriented towards the sale of finished products (Hirawan and Nurkholis 2007), in other words these sub-sectors act as inputs for other sector within the regions and other provinces (Morrissey and Cummins 2016).

Adopted from (Amin et al. 2020), the backward and forward linkage index of the marine economic sub-sectors of the provinces in the Makassar Strait inter-regional area are grouped into four groups, namely: (1) leading, (2) developing, (3) potential and (4) under-developed. The grouping of each sub-sector can be seen in Figure 1. Based on the grouping results, the leading marine economic sub-sectors in Kalimantan Island (South Kalimantan and East Kalimantan) are higher than Sulawesi Island (South Sulawesi, Central Sulawesi and West Sulawesi). The results of grouping into quadrants are in line with the critical sub-sectors presented in Table 3.

**Table 3.** Index of backward and forward linkages of the marine sector by province in the region.

Sector	Code	Sub-Sector	South Kalimantan		East Kalimantan		South Sulawesi		Central Sulawesi		West Sulawesi	
			Backward	Forward	Backward	Forward	Backward	Forward	Backward	Forward	Backward	Forward
<b>Fishery</b>	I-07	Fishery	0.7910	0.8527	0.8195	0.7990	0.7332	1.1095	0.6742	0.8910	0.6742	0.8695
<b>Oil and Gas and Non-Oil Mining</b>	I-08	Oil, Gas & Geothermal Mining	0.7454	0.6759	0.7981	5.7202	0.7516	0.7814	0.6134	1.0314	0.6134	0.6134
	I-09	Coal and Lignite Mining	0.9631	1.1643	1.0046	7.7683	0.7670	0.6180	0.6134	0.6134	0.6134	0.6134
<b>Marine Industry</b>	I-12	Coal Industry and Oil and Gas Refinery	0.6134	0.6134	0.9252	10.2372	0.6134	0.6134	0.6134	0.6757	0.6134	0.6134
	I-13	Food and Beverage Industry	1.1733	1.6929	1.3419	1.5178	1.1306	2.7923	1.3683	1.2998	1.3683	1.3692
	I-19	Chemical, Pharmaceutical and Traditional Medicine Industry	1.2742	0.7158	1.1200	6.3057	1.0512	0.7348	1.0707	0.6432	1.0707	0.6136
	I-21	Non-Metal Mineral Industry	1.1403	0.8991	1.1784	0.6687	1.1026	2.1687	1.1596	0.8489	1.1596	0.6648
	I-25	Transport Equipment Industry	1.0244	0.6332	1.1201	0.7445	0.9752	0.6232	1.0733	0.6211	1.0733	0.6139
	I-27	Other Processing Industries, Machinery and Equipment Repair and Installation Services	1.0936	0.6255	1.1588	0.7548	1.1852	0.8328	0.9470	0.6211	0.9470	0.6409
	I-29	Gas Procurement and Ice Production	0.8931	0.6153	0.9835	0.6147	0.9655	0.6239	1.1889	0.6260	1.1889	0.6229
	I-30	Water Supply, Waste Management, Waste and Recycling	1.1445	0.6762	1.1146	0.6211	0.9475	0.6293	0.9772	0.6736	0.9772	0.8975
<b>Marine Building</b>	I-31	Construction	1.1774	1.4241	1.1227	1.3725	1.1780	0.7479	1.2596	1.0005	1.2596	0.7587
<b>Water transportation</b>	I-36	Sea Freight	1.1555	0.8274	1.1408	0.8546	1.1418	0.9191	1.2331	0.6841	1.2331	0.6630
	I-37	River Lake and Crossing Transportation	0.9664	0.6560	1.1822	0.7904	1.0422	0.6562	1.0225	0.6205	1.0225	0.6424
<b>Maritime Tourism</b>	I-40	Accommodation Provision	0.9949	0.6687	1.0349	0.6786	0.9334	0.6928	0.9955	0.6576	0.9955	0.6298
	I-41	Food and Drink Preparation	1.1877	0.7348	1.2492	0.8377	1.1616	0.8207	1.1345	0.7850	1.1345	0.6708
<b>Marine Services</b>	I-33	Wholesale and Retail Trade, Not Cars and Motorcycles	0.8906	1.6315	1.0095	1.8824	0.8454	3.0002	0.8788	1.7649	0.8788	1.7317
	I-48	Company Services	0.9921	1.2441	1.0596	1.1577	0.9744	1.1490	1.0363	0.7672	1.0363	0.7920
	I-50	Education Services	0.8944	0.6344	0.9744	0.6691	0.9223	0.6568	0.9063	0.6466	0.9063	0.6400

Source: Results of data processing (2021).

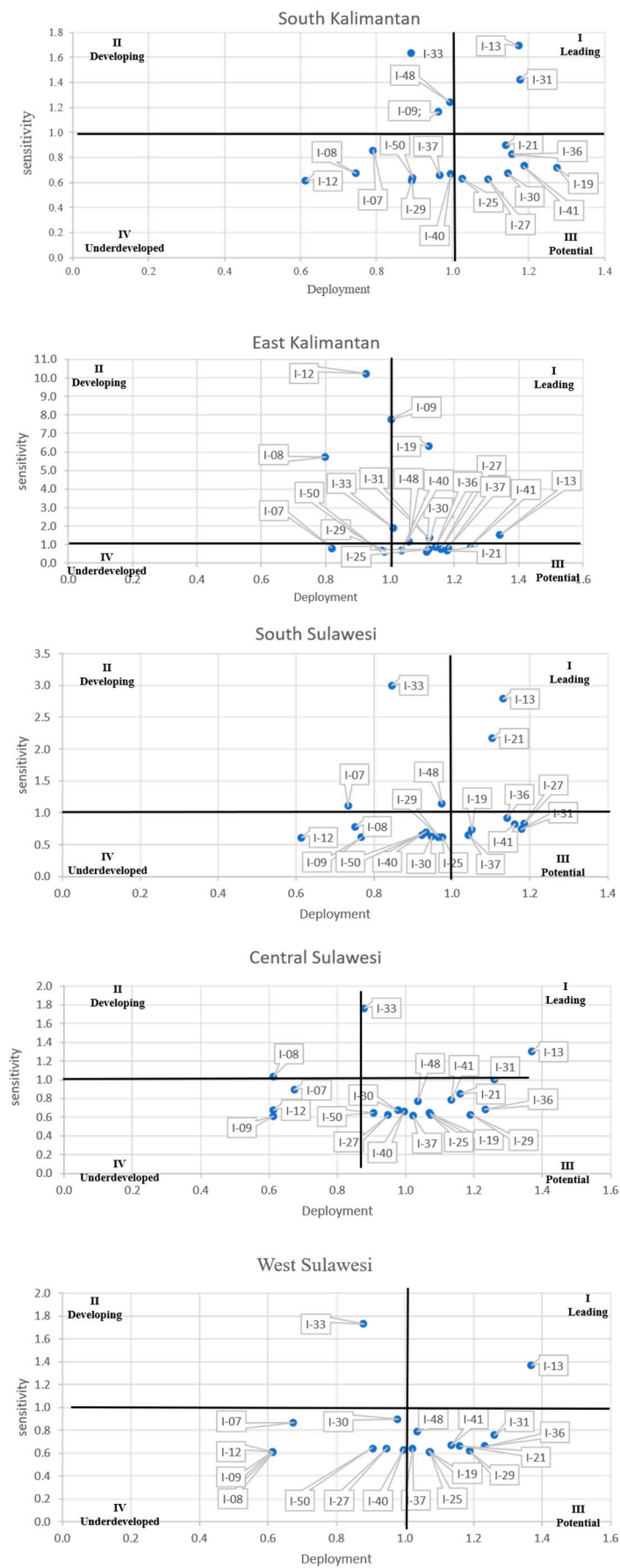


Figure 1. Grouping of Marine Economy Sub-sectors by Province. Source: author’s calculation.



Based on Figure 1, the South Kalimantan quadrant has two leading sub-sectors (food and beverage industry and construction), three developing sub-sectors (coal and lignite mining, wholesale and retail trade, not cars and motorcycles, and corporate services). In addition, seven potential sub-sectors (chemical industry, pharmaceuticals and traditional medicine, non-metallic mineral industry, transportation equipment industry, other processing industries, repair and installation of machinery and equipment, water supply, waste management, waste and recycling, sea transportation, and provision of food and drink). Furthermore, the other seven sub-sectors fall into underdeveloped quadrant.

The East Kalimantan quadrant has six leading sub-sectors (coal and lignite mining, the food and beverage industry, chemical industry, pharmaceuticals and traditional medicine, construction, wholesale and retail trade, not cars and motorcycles and company services), two developing sub-sectors (oil mining, geothermal gas, and coal industry and oil and gas refinery), eight potential sectors (non-metal mineral industry, transport equipment industry, other processing industries, machinery and equipment repair and installation services, water supply, waste management, waste and recycling, sea freight, river lake and crossing transportation, accommodation provision, and food and drink preparation), and three underdeveloped sub-sectors.

South Sulawesi quadrant has two leading sub-sectors (food and beverage industry, and non-metal minerals industry), three developing sub-sectors (fishery, wholesale and retail trade, not cars and motorcycles, and company services), six potential sub-sectors (chemical, pharmaceutical and traditional medicine industry, other processing industries, machinery and equipment repair and installation services, construction, sea freight, river lake and crossing transportation, and food and drink preparation) and eight underdeveloped sub-sector.

The Central Sulawesi quadrant has two leading sub-sectors (food and beverage industry and construction). Furthermore, instead of cars and motorcycles, two developing sub-sectors (oil, gas and geothermal mining, and wholesale and retail trade). It also has eight potential sub-sectors (chemical, pharmaceutical and traditional medicine industry, non-metal mineral industry, transport equipment industry, gas procurement and ice production, sea freight, river lake and crossing transportation, food and drink preparation, and company services) and seven underdeveloped sub-sectors.

Finally, West Sulawesi quadrant, one leading sub-sector (food and beverage industry), one developing sub-sector (wholesale trade, non-car and motorcycle retail), nine potential sub-sectors (chemical, pharmaceutical and traditional medicine industry, non-metal mineral industry, transport equipment industry, gas procurement and ice production, construction, sea freight, river lake and crossing transportation, food and drink preparation, and company services) and eight underdeveloped sub-sectors. Detail position of each sub-sector in the quadrants visualized in Figure 1.

The results of the analysis are reinforced by the existing oil and gas resources in the offshore and coastal areas of the Makassar Strait in the East Kalimantan area, where oil and gas mining results are processed at the Refinery Unit V Balikpapan, there are 16 oil and gas products produced by Pertamina RU V including (1) premium, (2) kerosene, (3) diesel, (4) avtur, (5) pertamax, (6) pertalite, (7) pertamina DEX, (8) Marine Gas Oil 5 (MGO-05), (9) Industrial Diesel Oil (IDO), (10) Liquefied Petroleum Gas (LPG), (11) OBM Smooth Fluid 05 (SF-05), (12) Low Aromatic White Spirit 05 (LAWS-05), (13) Net Bottom Fractionator (NBF), (14) Low Sulfur Fuel Oil Viscosity 1250 (LSFO V-1250), (15) naphtha, and (16) Low Sulfur Waxy Residue (LSWR); these products supply 26% of the total needs of all of Indonesia, and the products are sold through the business unit of PT Pertamina ([PT Pertamina \(Persero\) Refinery Unit V Balikpapan \(2016\)](#)). This condition is also reinforced by PT Badak NGL, which produces liquefied natural gas (LNG) and liquefied petroleum gas (LPG) and has been established since 1973 and has a refinery in Bontang City, East Kalimantan. Furthermore, coal products are transported to various parts of Indonesia for power generation and become an export commodity to various countries.

Examining Table 3 and Figure 1, East Kalimantan Province has the most marine economic sub-sectors; South Kalimantan, South Sulawesi and Central Sulawesi each have

two leading sub-sectors. West Sulawesi province is a province with one leading sub-sector. Although there are differences in each sub-sector grouping, it can be seen that there are similarities in the five provinces in the region; namely, the food and beverage industry sub-sector is the leading sub-sector in all provinces. When comparing this with the results of research conducted by (Resosudarmo et al. 2008) using the IRIO table data in 2005, although it is not specific to the marine sector but relevant for comparison, no shift in key/seeded sub-sectors was found. Provinces observed in Kalimantan island has prominent role in the industry mainly on three sub-sectors i.e., oil mining, geothermal gas, coal industry and oil and gas refinery, and food and beverage industry. Whilst in Sulawesi island the leading sub-sectors is food and beverage industry. This is the same as on the island of Sulawesi, occupied by the leading sub-sector of food and beverage processing until now.

#### *4.2. Structure and Inter-Sectoral Linkages between Provinces to Final Demand for Marine Economic Sector*

Based on the analysis results, the total value of domestic transactions of demand for goods and services in the marine economic sector in the Makassar Strait interregional area reached IDR 467 trillion. South Sulawesi Province contributed the most to this value; the contribution value reached IDR 208 trillion or the equivalent of 45% of the total value, then East Kalimantan Province contributed 30% or the equivalent of IDR 138 trillion and then South Kalimantan Province 14% (IDR 64 trillion), Central Sulawesi 9% (IDR 40 trillion) and West Sulawesi 3% (IDR 15 trillion). The structure and linkages between sectors between provinces to the final demand for goods and services in the marine economic sector of each province are presented and explained by column and can be seen in Table 4.

##### *4.2.1. South Kalimantan Province*

The total final demand for South Kalimantan Province has reached IDR 64 trillion. Of this total 94.2% came from the use of products from inside the region, 3.6% used imported inputs from East Kalimantan, and 2.1% came from Central Sulawesi Province. Furthermore, in Table 3, almost all marine economic sectors in each province contribute to the total final demand in South Kalimantan. However, the percentage of its contribution value is not as significant as those in East Kalimantan and Central Sulawesi. In monetary term the contribution is ranged between millions to billion Rupiahs. For example, South Sulawesi contribution to the economy of South Kalimantan originated from marine building sector is Rp. 509 million, whilst marine tourism sector has reached IDR 9.2 billion. Moreover, there are three sub-sectors that do not have significant contribution i.e., oil, gas & geothermal mining, fishery, and coal and lignite mining.

##### *4.2.2. East Kalimantan Province*

Although the total value of the final demand for East Kalimantan is not the largest, based on the calculation this province is the most independent among all. The reason is that 98.3% of its output is used as input to produce other outputs. In the marine economy sector, the main contributors to the total final demand were the marine construction sector which reached 54.4%, the marine industry at 16.9%, marine tourism at 5.7%, fisheries at 3.3% and marine transportation at 0.9%. The highest contribution to the development of marine economic sector in East Kalimantan are mostly come from the province of Sulawesi Island, namely Central Sulawesi, at 1%, South Sulawesi and West Sulawesi, each with 0.3%, while South Kalimantan was at 0.1%. Similar to the province mentioned earlier almost all marine economic sectors in all provinces in the region observed has various contribution to the development of the marine sector in East Kalimantan. For example, in monetary term, East Kalimantan has received one million Rupiahs for marine buildings from South Sulawesi, and one trillion Rupiah from the marine Industry sector from Central Sulawesi.

**Table 4.** Structure of Final Demand for Goods and Services by Province in the Makassar Strait Interregional Area (IDR million).

Province	Marine Sector	South Kalimantan		East Kalimantan		South Sulawesi		Central Sulawesi		West Sulawesi	
		Final Request	%	Final Request	%	Final Request	%	Final Request	%	Final Request	%
South Kalimantan	Fishery	3,822,466	5.9	18	0.0	-	-	-	-	-	0.0
	Oil and Gas and Non-Oil Mining	73,522	0.1	0	0.0	0	0.0	0	0.0	0	0.0
	Marine Industry	14,190,246	22.0	25,978	0.0	552	0.0	136,787	0.3	0	0.0
	Marine Building	22,005,146	34.2	1	0.0	759	0.0	1714	0.0	6	0.0
	Water transportation	1,229,659	1.9	21,580	0.0	14,956	0.0	23,166	0.1	1390	0.0
	Maritime Tourism	5,714,691	8.9	10,414	0.0	6920	0.0	4365	0.0	1097	0.0
	Marine Services	13,661,534	21.2	29,213	0.0	1247	0.0	19,568	0.0	898	0.0
East Kalimantan	Fishery	192,456	0.3	4,587,741	3.3	1	0.0	590	0.0	-	0.0
	Oil and Gas and Non-Oil Mining	3207	0.0	1,491,479	1.1	123	0.0	22	0.0	2	0.0
	Marine Industry	1,888,629	2.9	23,454,989	16.9	1,748,859	0.8	463,033	1.1	228,242	1.5
	Marine Building	1706	0.0	75,551,180	54.4	1646	0.0	3667	0.0	17	0.0
	Water transportation	17,896	0.0	1,184,954	0.9	38,979	0.0	43,172	0.1	4480	0.0
	Maritime Tourism	18,759	0.0	7,975,965	5.7	13,617	0.0	17,355	0.0	4455	0.0
	Marine Services	194,455	0.3	22,331,313	16.1	276,954	0.1	44,666	0.1	15,664	0.1
South Sulawesi	Fishery	-	0.0	6,807	0.0	79	0.0	1,864,915	4.6	136,734	0.9
	Oil and Gas and Non-Oil Mining	-	0.0	-	0.0	-	-	-	-	-	0.0
	Marine Industry	555	0.0	422,979	0.3	13,678	0.0	5,099,117	12.5	376,934	2.5
	Marine Building	509	0.0	1	0.0	486	0.0	24,695,460	60.5	4	0.0
	Water transportation	1561	0.0	17,714	0.0	2859	0.0	1,535,350	3.8	15,650	0.1
	Maritime Tourism	9894	0.0	15,505	0.0	3927	0.0	830,609	2.0	16,747	0.1
	Marine Services	4651	0.0	8693	0.0	4606	0.0	3,216,991	7.9	8411	0.1
Central Sulawesi	Fishery	9890	0.0	169	0.0	12,233,193	5.9	742	0.0	14,044	0.1
	Oil and Gas and Non-Oil Mining	1131	0.0	-	0.0	12,787	0.0	0	0.0	0	0.0
	Marine Industry	1,088,751	1.7	1,062,169	0.8	30,362,942	14.6	425,695	1.0	792,196	5.2
	Marine Building	58,955	0.1	65	0.0	101,895,455	49.0	127,060	0.3	474	0.0
	Water transportation	9,332	0.0	22,881	0.0	1,728,701	0.8	38,181	0.1	12,354	0.1
	Maritime Tourism	52,620	0.1	93,075	0.1	13,162,099	6.3	54,844	0.1	13,585	0.1
	Marine Services	160,532	0.2	245,565	0.2	45,186,307	21.7	652,420	1.6	220,136	1.4
West Sulawesi	Fishery	-	0.0	104,230	0.1	1,093,288	0.5	457,007	1.1	1,453,886	9.6
	Oil and Gas and Non-Oil Mining	-	0.0	-	0.0	-	-	-	-	-	0.0
	Marine Industry	1671	0.0	196,628	0.1	10	0.0	841,844	2.1	2,066,077	13.6
	Marine Building	11	0.0	0	0.0	4929	0.0	23	0.0	5,352,331	35.2
	Water transportation	587	0.0	1675	0.0	8936	0.0	6,889	0.0	130,727	0.9
	Maritime Tourism	494	0.0	873	0.0	760	0.0	327	0.0	521,577	3.4
	Marine Services	20,078	0.0	64,412	0.0	202,973	0.1	189,606	0.5	3,824,080	25.1
Total		64,435,619	100	138,928,266	100	208,022,628	100	40,795,185	100	15,212,200	100

Source: Data Analysis Results (2021).

#### 4.2.3. South Sulawesi Province

South Sulawesi has the most significant contribution to the total final demand in the region. Its total final demand has reached IDR 208 trillion, or the equivalent to 45%. However, based on the analysis results South Sulawesi is highly dependent on the Province of Central Sulawesi due to 98.3% of the inputs for goods or services in South Sulawesi are originated from Central Sulawesi. The remaining input is originated from East Kalimantan (1%) and West Sulawesi (0.6%). Regardless the number of rupiah, almost all sectors of the marine economy in provinces in the region contribute to the total final demand in South Sulawesi. As an example, the fisheries sector in East Kalimantan has contributed as much as IDR 1 million, whilst at the same sector it reached IDR 1.09 trillion in West Sulawesi.

#### 4.2.4. Central Sulawesi Province

The contribution of Central Sulawesi Province to the total final demand in the region has reached IDR 40 trillion, equivalent to 9% of the total final demand. It is interesting to find that there is high interdependency between Central Sulawesi and South Sulawesi. Based on the data it is known that Central Sulawesi has an enormous contribution in providing inputs for South Sulawesi. In the same position, Central Sulawesi is highly depending on the output from South Sulawesi as much as 91.3%, whilst the use of its own output in the province' economy is counted only for 3.2%. Similar to other provinces, almost all marine economic sectors in the province contribute to the marine economic sector in Central Sulawesi.

#### 4.2.5. West Sulawesi Province

West Sulawesi is the youngest province in the region which originated from the division of South Sulawesi. The contribution of West Sulawesi to the total final demand in this area has reached IDR 15 trillion and equivalent to 3% of the total final demand. Even though it has a minor contribution to the rest of the region, the final demand used in this province comes from within its territory as much as 87.7%, while 6.9% from Central Sulawesi, 3.6% from South Sulawesi, and 1.7% from East Kalimantan. Regardless the small contribution, like other provinces, almost all marine economic sectors in each province contribute to the marine economic sector in West Sulawesi. A complete description of the inter-provincial inter-sectoral linkages is presented in Table 4, and an illustration of the linkages can be seen in Figure 2.

#### 4.3. Policy for the Development of the Makassar Strait Area in Relationship with the National Development Plant

Law Number 17 of 2007 regarding the National Long Term Development Plan (RPJPN) of 2005–2025 has stated that one of the long terms missions is to make Indonesia grow as an independent, advanced, solid archipelagic country, based on national interests. Within two consecutive medium terms of planning, the marine sector has become one of central issue in national development of Indonesia. Marine sectors has estimated valued of IDR 2046 trillion [Lauder and Lauder \(2016\)](#), or equivalent to USD 171 million (exchange rate IDR to USD = IDR 12,000) in 2013. This value derived from fisheries IDR 380 trillion, coastal area IDR 670 trillion, biotechnology IDR 480 trillion, marine tourism IDR 24 trillion, crude oil IDR 252 trillion, and sea transportation IDR 240 trillion ([Prihartono 2015](#)).

A new milestone in developing Indonesia's marine sector began in the first leadership period of President Jokowi-Kalla (2014–2019). In his inauguration speech, the seventh president said, "it is time for us to return to the sea, again to make the sea the strength of the nation and state of Indonesia, so that Indonesia can become the world's maritime axis", then in his speech at the 2014 East Asian Summit, Jokowi stated five pillars of maritime axis development, namely: (1) building maritime culture, (2) maintaining and managing marine resources, (3) developing maritime infrastructure and connectivity, (4) strengthening maritime diplomacy, and (5) building maritime defense forces ([Badan Perencanaan Pembangunan Nasional 2016](#)). In order to achieve these goals, various efforts have been

made by the government. Specifically, in the Makassar Strait interregional area, priority development programs have been identified, which can be seen in Table 5.

As a support for regional development, currently Indonesian government has built supporting infrastructure and facilities such as ports connecting Sulawesi and Kalimantan. Some of predominant ports in the area of the Makassar Strait are located in Pantoloan (Central Sulawesi), Belang – Belang Port (West Sulawesi), Kariangau and Palaran Port in East Kalimantan (Prihartono 2015). In Makassar Strait inter-regional area, each province has completed drafting regional regulations regarding the Zoning Plan for Coastal Zone and Small Islands (RZWP3K). This zoning regulation is the implementation of Law Number 1 2014 about Management of Coastal Areas and Small Islands. This law regulates marine areas up to a radius of 12 miles and is valid for 20 years and can be reviewed every five years, and the review can be carried out more than once. In general, each RZWP3K has three spatial allocations: (1) A general use area, (2) Conservation areas, and (3) Sea lanes. The use of public areas is regulated under certain condition such as capture fisheries, aquaculture, mining, and tourism activities. Conservation areas include coastal conservation areas and small islands, which include efforts to protect marine ecosystems, biota, mammals, maritime archaeology, and sunken ships. Sea lanes include community shipping lanes, cargo shipping lanes, underwater pipelines, underwater cables, and marine organisms' highways. All of the regulation and policies and targets have been set for the marine economic sector as part of the long terms planning that aimed to increase its productivity.

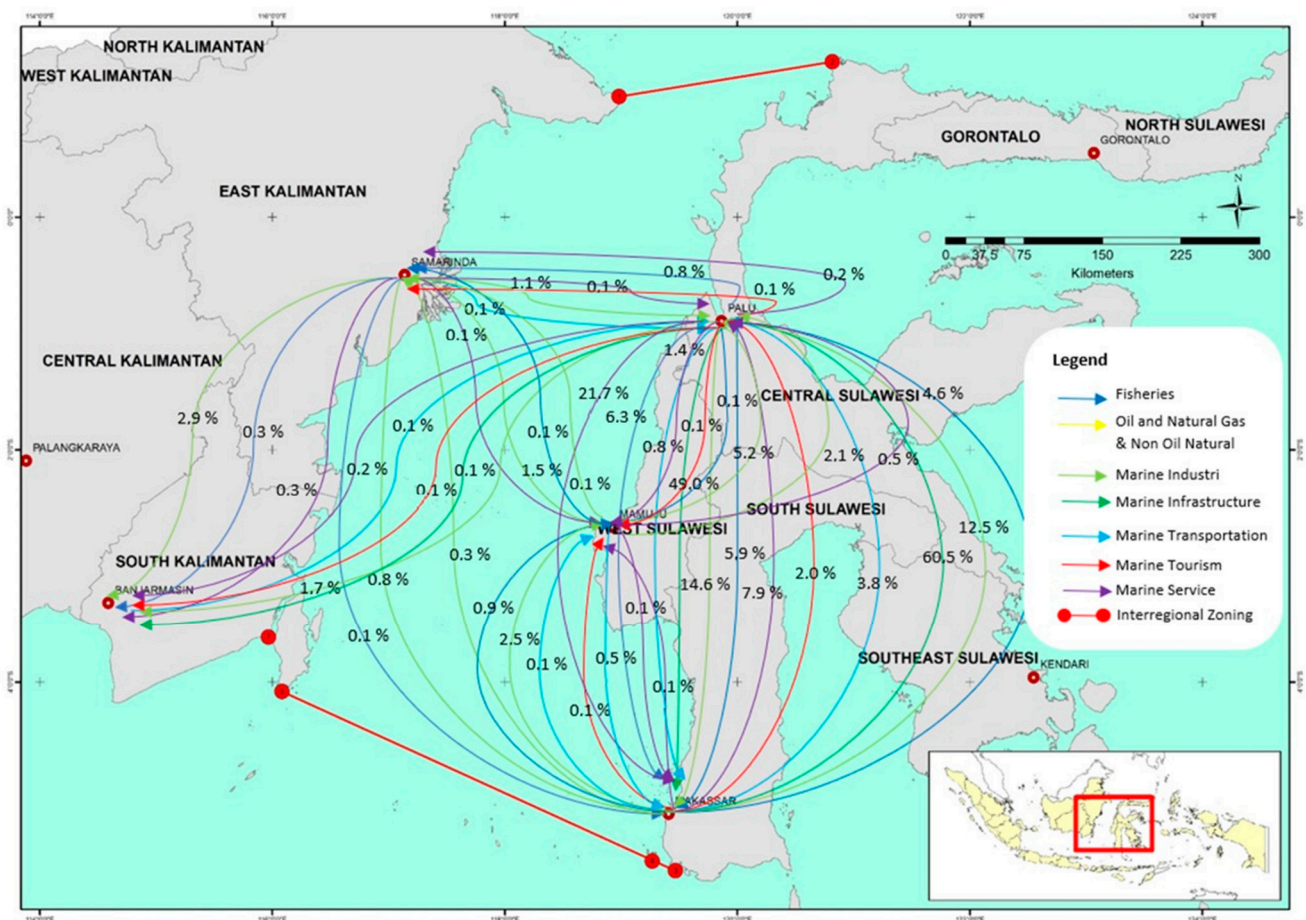


Figure 2. Interlinkage of sectors in Makassar Strait area. Source: author’s calculation.



**Table 5.** Priority programs in the next five years.

No.	Province	Leading Sector	Strategic Area Development	Strategic Priority Projects for Marine Sector	Economic Growth Rate Target (%) in 2024	Target Poverty Rate (%) in 2024	Target Open Unemployment Rate (%) in 2024
1	South Kalimantan	Palm oil, rubber, coal, oil and gas earth, capture fisheries, and aquaculture	Industrial Estate (KI) Batu Licin, KI Jorong, Pelaihari Harbor	Construction of Integrated Main Port Network: Kijing Port	6	2.80	3.10
2	East Kalimantan	palm oil, rubber, pepper, nutmeg, clove, coconut, capture fisheries, oil and gas and coal cultivation fisheries;	Maloy Batuta Special Economic Zone (SEZ) Trans Kalimantan, Derawan-Berau Natural Tourism Destination Area; Tanah Kuning Harbor, the State Capital Region,	(a) Revitalization of Balikpapan Oil Refinery and (b) Construction of New Refinery Bontang;	8.50	3.35	5.10
3	South Sulawesi	cocoa, coffee, pepper, nutmeg, cloves, coconut, sugar cane, nickel, coal, oil and gas, salt, capture fisheries and cultivation;	processing industry (downstream) natural resources (agriculture, plantations, base metals, and maritime) KI Takalar, Priority Tourism Destinations Toraja-Makassar-Selayar, Development of Makassar port trade center,	Makassar Integrated Main Port Network Development,	8.40	5.68	4.20
4	Central Sulawesi	cocoa, pepper, nutmeg, cloves, coffee, coconut, nickel, iron ore, coal, oil and gas, and capture fisheries and cultivation	processing industry (downstream) natural resources (agriculture, plantations, base metals, and maritime) KI Palu, Port Reconstruction wani,	-	8.60	11.45	2.40
5	West Sulawesi	coffee, cocoa, coconut, oil palm and fisheries catch and cultivate	-	-	8.70	4.85	2

Source: Attachment to the Presidential Regulation of the Republic of Indonesia concerning the 2020–2024 (2020) National Medium-Term Development Plan.



## 5. Discussion

As shown in Table 5 each province has characterized in leading sectors in the plantation, mining and marine sectors, in which every province in the islands have different leading sectors of one to another. This condition can be beneficial if it is managed thoroughly by the governance so that it can support the development of IKN Nusantara as the new state capital of Indonesia. Regardless the need to review and evaluate the targets set due to the negative impact of COVID-19 on the economy, it has been gradually handled and the economic activity has almost returned to normal. Based on the results of the IRIO analysis, the input bases in the area consist of renewable natural resources and non-renewable natural resources. The process of utilizing, extracting, and distributing these two types of natural resources has the potential to generate negative externalities and pressures on the ecosystem. Taking coal mining as an example, Indonesia's coal products contribute 7.9% to total world production, meaning that Indonesia has critical a role in increasing global warming because coal products are used as a source of power generation. Other effects that need to be taken into account is environmental damage due to tree cutting and land clearing activities, which result the changes in landscape, health problems, sedimentation, and flooding (Ives 2015; Afkarina et al. 2019). Moreover, there should be an implementation of existing regulation that promote the shift of non-renewable resources to renewable resources.

Based on the presidential regulation paper number 8 year 2020, oil and gas mining activities are obliged to be located in coastal and marine areas. Rigs are spread across various oil and gas blocks in the Makassar Strait and are connected by underwater pipelines. This situation will lead to environmental problems and has potential economic issues due to its intersection with capture fisheries activities, aquaculture, fish resource migration areas and coastal and marine conservation areas. Some of negative externalities have been occurred in 2018 such as oil pipeline leaks has caused calamities such as fires in the sea surface due to the oil spill has raised the death toll of human and other living thing. Other negative impact for the environment is that mangrove, seagrass, coral ecosystems, and other organism are damaged (Ahyadi et al. 2021). Another challenge for this area is the position of the Makassar Strait in the Indonesian Archipelagic Sea Lane II (ALKI-II). This position may cause the higher risk of pollution due to marine activities around the archipelagic sea lanes (Buntoro 2012).

The ratification of Law number 3 of 2022 concerning the movement of State Capital from DKI Jakarta to East Kalimantan Province will occupies 256,142 ha of land and 68,189 ha of sea water. The area is officially named IKN Nusantara and is led by the head of the ministerial-level authority. The construction of IKN Nusantara phase one will begin in the period 2022 to 2024; at this stage basic infrastructure will be built such as roads, dams, state palaces, office areas for ministries/agencies and housing for employees. This activity will be followed by an increase in the population in the area. Population growth starts from IKN construction workers, and will then will be followed by civil servants and military personnel when IKN Nusantara starts operating. Therefore, IKN will trigger an increase in the need for food and energy so that cooperation between the provinces in the Makassar Strait area and the IKN authority is a must.

The results of the analysis in this study can be used as a reference in determining the priority scale to meet basic needs in terms of provision of food and energy in IKN Nusantara. Based on the analysis, the general strategy imposed by each of the regions in Makassar Strait should be in line with the comparative advantage concept. This concept proposed that each province should consider their strengths and opportunities by maximizing sectors/sub sectors, as well as carefully handle the threat and weakness of sectors/sub sectors in the relevant quadrants. Sectors that are located in quadrant I should pay attention to their dependencies on non-renewable resources, which relies on strategic activities/regulation to gradually reduce its dependencies. Moreover, the fulfillment of needs in the sub-sector in quadrant IV (Under-Developed) category is carried out by an import strategy based on the objective of cost efficiency (see Figure 1). However, the strategy would yield

the optimum results only when each of the marine sector is integrated of one to another and in the level of industrial scale. The regional development strategy in the Makassar Strait area in quadrant I is to optimize the food and beverage industry sector with an aggressive growth policy strategy. The strategy proposed in quadrant II is a diversification strategy and applicable for the wholesale and retail trade sectors. In quadrant III we found the food and beverage industry as a potential sub-sector should impose strategies that allowed this sector to generate added value for its product. The last quadrant (quadrant IV) consists of two sectors which are education service and coal and lignite mining. These sectors are considered as the weak sectors due to their nature i.e., education is mostly based on subsidies from the government, and coal and lignite mining is a sector with negative externalities.

As an implication of the findings, we recommend to focus on sectors in quadrant I as passive aggressive strategy. The population of East Kalimantan as the result of the relocation of capital city of Indonesia is projected to reach 1.7–1.9 million in 2045 (Law on State Capital 3 Number 2022). This escalation of population, at the beginning, will consist of civil servants, military personnel, construction workers, in-migration of family members, and so on. Furthermore, the mass migration to IKN will followed and require the fulfilment of basic services such as food, energy, and other supporting infrastructure. In this regard, there is a need for the government to stimulate the marine sectors as one of the resources of food supply for the IKN area. As the result IKN area will play role as ‘the motor’ to increase the productivity of marine sector in regions in Makassar Strait Area. Moreover, the dynamic of population and the economic activities will eventually lead to the shift of non-renewable natural resource into the renewable one.

## 6. Conclusions

The use of inter-regional input-output (IRIO) data and analysis models has succeeded in drawing and identifying the critical sectors of the marine economy in each province. Based on the analysis results, East Kalimantan Province is the one with the highest number of leading sub-sectors compared to other four provinces. The leading sub sectors of the marine economy of East Kalimantan are coal and lignite mining, the food and beverage industry, chemical industry, pharmaceuticals and traditional medicine, construction, wholesale and retail trade, not cars and motorcycles and company services. In There are two leading sectors in South Kalimantan i.e., food and beverage industry and construction industry. Similar to South Kalimantan, South Sulawesi dan Central Sulawesi also have two leading sub-sectors. The two sub-sectors of South Sulawesi are food and beverage industry, and non-metal minerals industry, whilst Central Sulawesi consist of food and beverage, and construction industry. Moreover, West Sulawesi has only one leading sub-sector, namely the food and beverage industry.

The total value of the final demand for goods and services of the marine economy sector in the region has reached IDR 461 trillion, shared by South Sulawesi 45%, East Kalimantan 30%, South Kalimantan 14%, Central Sulawesi 9%, and West Sulawesi 3%. Almost all sub-sectors in each province are interconnected, meaning that output generated by provinces are used to the marine economic sub-sector in the region. Regional development can be carried out with the concept of comparative advantage approach. Based on the concept, it is recommended to maximize the output of sub-sectors in quadrant I and apply cost efficiency strategy by importing inputs of under developed sub-sectors. Therefore, the main strategy for inter-regional development and optimizing the leading sub-sectors in Makassar Strait area are aggressive growth policy strategy.

The relocation of State Capital (IKN) from Jakarta to East Kalimantan will have a significant positive impact on economic development in the Makassar Strait area. This is caused by the output absorption in each sector of the marine economy in each province will drastically increase. The main reason is due to the increasing population and investment in this area. Therefore, the government needs to focus on investment and developing

infrastructure and facility to support leading sectors in provinces due to its multiplier effect on the economy.

**Author Contributions:** Writing—review & editing: I.G., E.U.A.G., M.M. and Y.A.; Conceptualization and Writing—original draft: A.A.; Methodology: M.M. and A.A.; Data curation: A.A., R.F.R.R., N.I.A. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Conflicts of Interest:** The authors declare no conflict of interest.

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