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MOROWALI'S ECONOMIC DIVERSIFICATION POTENTIAL FOR NON-MINING PRODUCTS

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Morowali holds considerable economic potential in fisheries, tourism and environmental services sectors. Preparing a departure from the unsustainable dependency on mining sectors–especially the critical mineral nickel–to other prospective sectors could open up a more sustainable development option. The question now is how? Thus, we provide several options to prepare for long-term transformation towards a more sustainable economy.

1 Background

The drafting of Morowali Regency's RPJMD for 2025 needs to be used as an opportunity to explore more sustainable economic opportunities. At the very least, Morowali has untapped economic potentials based on the sectors of fisheries, tourism, agriculture, transportation and warehousing sectors, water supply, electricity, and gas, as well as waste processing and recycling. In addition, there are 5,216 MSMEs (Morowali Regency Regional Government, 2023) or informal sectors in Morowali that can support the industrial supply chain.

The urgency of economic diversification in Morowali Regency is closely related to the dominance of the nickel mining and processing industry, which poses a risk to long-term economic stability[1]. On the one hand, the downstream program provides an increase in export revenue, which has mostly benefited the central government. However, there is a shadow of environmental damage and other social problems due to the integrated nickel industry.

Currently, the dominance of the nickel industry in the Morowali Regency economy is extremely substantial. In 2024, it was estimated that more than 80% of Morowali's economy will come from nickel mining and the processing of mining products. Calculated using the production approach, the Central Statistics Agency (BPS) of Morowali (2024) noted that Rp143 trillion (US$8.8 billion[2]) of Morowali's GRDP in 2023 was generated from the mining and processing sector, compared to Morowali's total GRDP of Rp158 trillion (US$9.7 billion).

Meanwhile, the calculation of GRDP using the expenditure approach has revealed that the inequality between the economic sectors are increasingly widening. In 2023, the combined final consumption of government and household GRDP reached Rp8 trillion (US$490 million), or approximately a mere 5% of the total GRDP in Morowali Regency. The sectors that contributed the most to GRDP through this approach were gross fixed capital formation (44.2%) and net exports (50.6%) (BPS 2024).

Furthermore, Morowali's economic growth is highly concentrated in the components of economic growth originating from private company activities. In general, the growth of gross fixed capital formation and net exports do not provide much of a trickle down effect on a region (Suryadarma & Suryahadi, 2007). This is also indicated to have occurred in Morowali along with the relatively slow decline in poverty, despite very high economic growth and unemployment rates lower than the national average.

Morowali Regency's excessive dependence on nickel mining and the processing sector poses numerous risks to its economic activities. First of all—although most of the nickel processed by smelters in Morowali is in the form of nickel pig iron (NPI), which can only be used as a material for making stainless steel in China—as a primary commodity, the viability of nickel produced by Morowali's smelters remains subject to the dynamic and often volatile international nickel price. The volatility of world nickel prices can create uncertainty regarding the consistency of labor absorption and the prospects for Morowali's economic growth and regional income.

The dominance of the nickel industry in the Morowali economy has also reduced output from other sectors, such as fisheries and agriculture, due to water and soil pollution (CREA & CELIOS, 2024; Yunus, 2024) and land conversion. The massive use of land by the mining industry in Morowali and the conversion of land from the agricultural sector can be seen in the significant decrease in

1 Nickel reserves are increasingly limited and are estimated to be left for another 15 years. Meanwhile, massive nickel exploitation and excavation accompanied by the construction of new smelters pose a high risk to air quality, water, health impacts, waste, the spread of infectious diseases, and fishermen's catch. Relying on an extractive economy poses a risk to the GRDP of Morowali Regency and its buffer areas, as well as affecting regional income after a decline in mining and smelter sector revenues. https://ekonomi.bisnis.com/read/20230918/44/1695850/cadangan-nikel-ri-bakal-habis-15-tahun-lagi-menteri-esdm-jangan-boros

2 US$1 = Rp16,313; JISDOR exchange rate July 2025.

agricultural land (harvested area) for rice in Morowali, from 8,308 ha to 6,275 ha (BPS Central Sulawesi, 2024).

This will reduce the usage and output of land use by other sectors. In addition to reducing the area of agricultural land (Kamarudin, 2016), nickel industry activities—both mining and processing—also cause soil and water pollution that threatens the sustainability of the remaining agricultural land (Syarifuddin, 2022).

From a social perspective, this land conversion marks a change in people's lifestyles and cultures, which were initially farmers but now workers in the nickel industry. This trend becomes a problem when the nickel boom ends, and workers who previously depended on the nickel industry no longer had jobs. Because agricultural land has been converted and there has been a loss of skills and agricultural support systems, it will be very difficult for them to return to farming.

The problem of changing people's lifestyles does not stop there. The Morowali Regency Government has complained about a decline in the quality of human resources, which is indirectly caused by the nickel industry. Many school-age teenagers drop out of school and work as contract laborers in the nickel industry. In addition, many farmers who sell their rice fields then switch professions to become workers in the nickel industry, even though they are lacking in any specialized skills.

In addition to its direct economic aspect, the nickel industry in Morowali Regency can not only reduce environmental carrying capacity by affecting biodiversity and ecosystem sustainability but also affect the health of the Morowali community through the soil, water, and air pollution it causes.

For example, Indonesia Tsingshan Stainless Steel is indicated as one of the projects in Indonesia that has the potential to cause the most deaths related to air pollution in 2030 (CREA, 2024 in CREA & CELIOS, 2024). Furthermore, these environmental and health impacts threaten the sustainability of Morowali's economic activities. The negative impacts of nickel smelters on health can reduce workforce productivity and increase health costs for affected communities (CREA & CELIOS, 2024).

Ultimately, it must be recognized that nickel is a non-renewable natural resource. Although its reserves are limited, Indonesia remains one of the largest nickel producers in the world with Morowali as its main source.

It is possible that nickel reserves in Morowali will run out much faster than expected. Excessive dependence on the nickel mining sector poses a risk to the sustainability of Morowali's economy, especially when other sectors that can be a source of livelihood for most of Morowali's population are no longer able to produce output or have been damaged by the negative impacts of nickel mining and downstreaming.

Therefore, the diversification and protection of economic sectors outside of nickel must be carried out early on to ensure the sustainability of Morowali's economy in the long term.

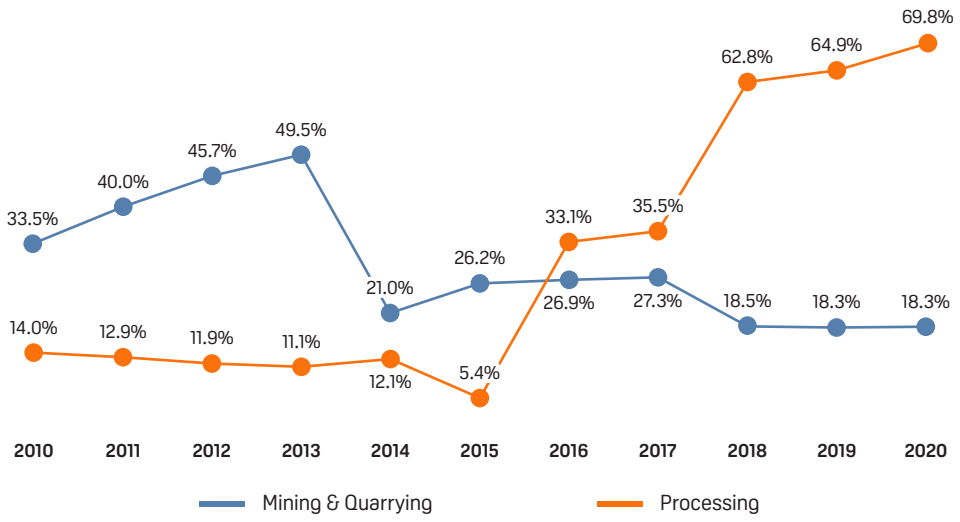
2 Macroeconomic Conditions and Development Indicators of Morowali

2.1. Growth Trends of Morowali Economic Sectors

Since 2016, the processing industry has been the largest contributor to Morowali's economy, followed by mining and quarrying and construction. It can be said that this trend is one of the impacts of downstreaming that is visible in Morowali's GRDP trend. After downstreaming, Morowali's economy, which was previously dominated by the mining and quarrying business sector, became dominated by the processing industry sector (**See Chart 1 and Chart 2**) so that most of Morowali's processing industry is currently indicated to come from nickel smelters.

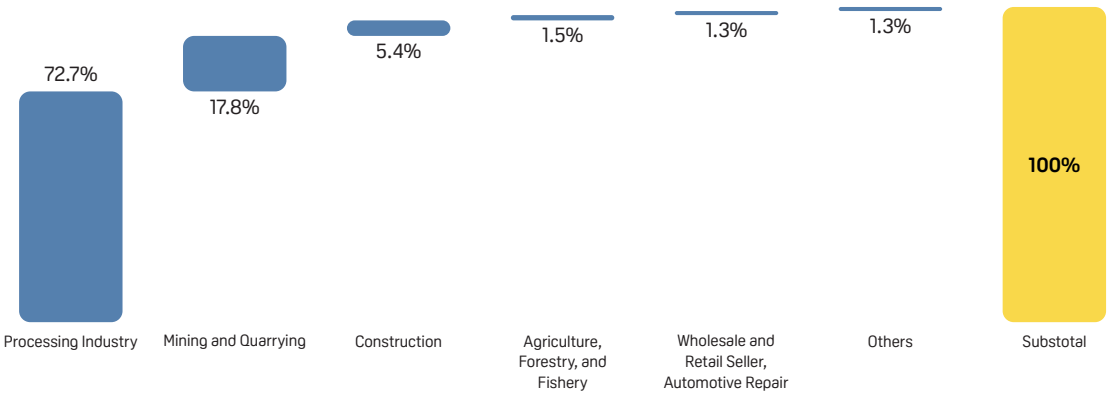
Thus, nickel still contributes most of Morowali's economy, although in a different form of production activity than before.

Chart 1. **Percentage of Mining & Quarrying Sector and Processing Sector to GRDP**



Source: Processed from BPS Morowali (2024)

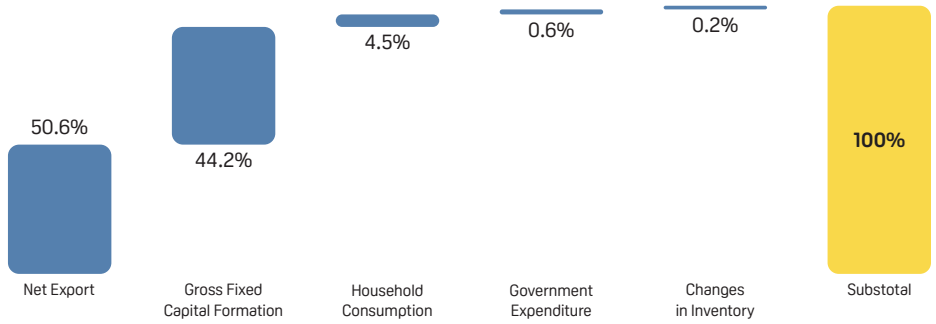
Chart 2. **Contribution of Each Sectors to Morowali's GRDP**



Source: Processed from BPS Morowali (2024)

From the expenditure aspect, net exports and gross fixed capital formation are the largest contributors to Morowali's current GRDP. On the other hand, household consumption and Non-Profit Institutions Serving Households (PK-LNPRT) only contribute less than 5% of Morowali's GRDP in 2023 or several years after nickel downstreaming begins in Morowali. The increase in household purchasing power is not in line with the growth in spending on capital goods in the nickel mining and processing sector.

Chart 3. **Morowali's 2023 GRDP (constant price) breakdown based on expenditure**

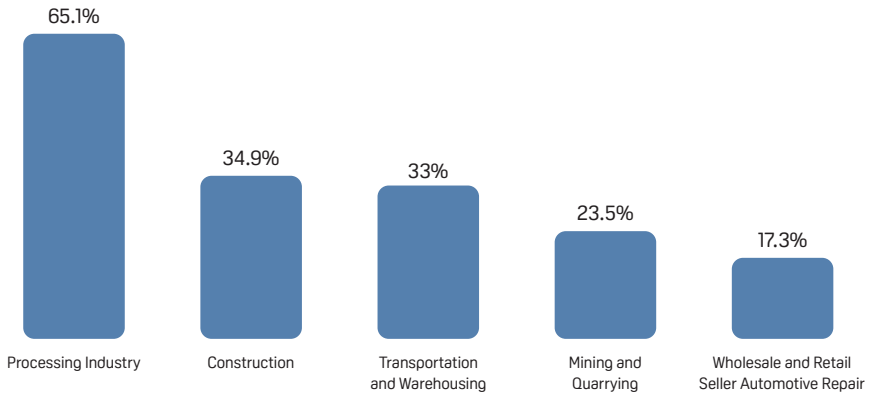


Source: Processed from BPS Morowali (2024)

In line with this trend, most of the sectors that have experienced high growth in recent years are the mining sector and related secondary and tertiary sectors. The highest growth (above 15%) was experienced by the processing sector (which focuses on nickel downstreaming) and sectors that strongly support nickel mining and downstream activities. In addition to mining and quarrying, construction experienced an annual growth rate of 34.9%, most likely from the construction of facilities to support nickel mining and processing activities.

The transportation and warehousing sector also experienced relatively rapid growth (by 33.0%). Wholesale and retail trade and car and motorcycle repairs are also likely to have grown quite high in recent years, possibly due to the need to support the activities of companies, workers, or executives of related nickel mining and processing companies.

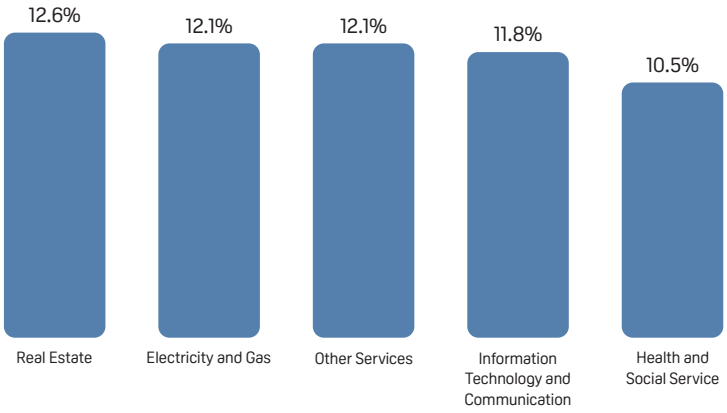
Chart 4. **Five Sectors with Highest Annual Growth 2013-2023**



Source: Processed from BPS Morowali (2024)

Interestingly, tertiary sectors (services), such as accommodation and food and beverage provision, real estate, electricity and gas supply, health services, social activities and tourism services, have also grown rapidly in the last decade. The information and communication sector has also grown above 10% in recent years. This trend can be attributed to the increase in demand for supply chain support services and nickel mining and processing workers.

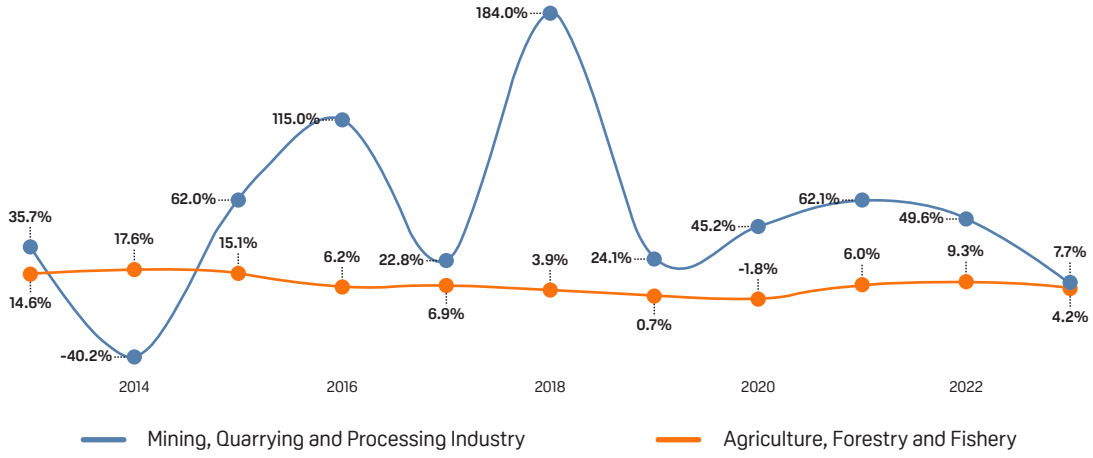
Chart 5. **Several Tertiary and Quaternary Sectors also saw more than 10% growth in 2013-2023**



Source: Processed from BPS Morowali (2024)

Along with the increasing value of GRDP (Gross Regional Domestic Product) from the nickel mining and processing sector, primary sectors, such as agriculture, forestry, and fisheries, were relatively stagnant and experienced relatively smaller growth with a CAGR (Compounded Annual Growth Rate) of 6.7% (in contrast to mining, quarrying, and processing which had a total CAGR of 42.4%). In fact, these sectors experienced negative growth in 2020 **(Chart 6)**, although their growth rate was 9.3% in 2022.

Chart 6. **Year-on-year Growth; Mining and Processing Industry VS Agriculture, Forestry, and Fishery**



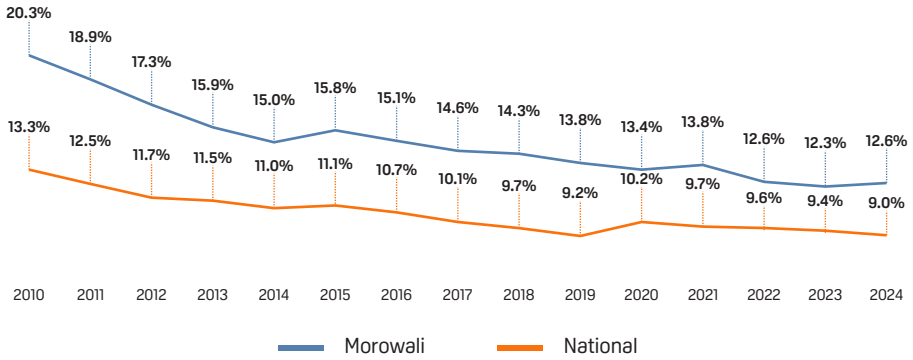
Source: Processed from BPS Morowali (2024)

2.2. Development Indicators

2.2.1. Poverty

According to the poverty indicator, Morowali has a higher percentage of poor people than the national level. However, the percentage of poor people in Morowali has experienced a downward trend over the past 11 years. This indicates an increase in welfare in terms of income.

Chart 7. **Percentage of Population Living Under Poverty Line: Morowali vs National**

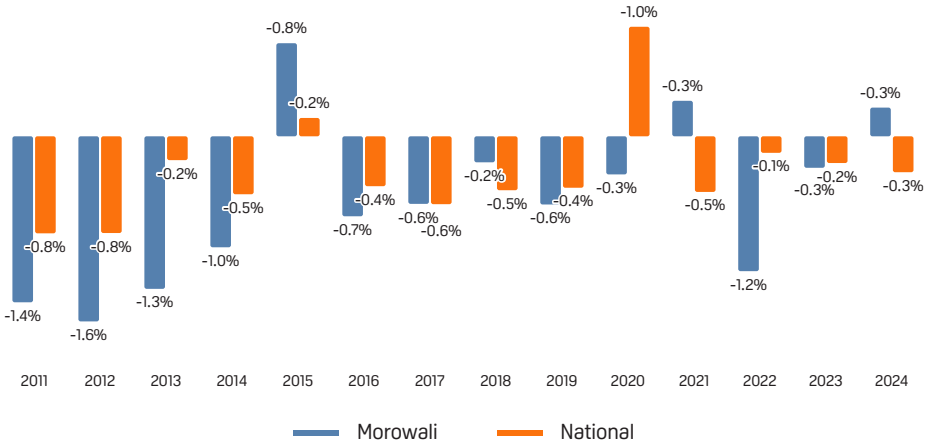


Source: Processed from BPS Indonesia (2024a)

Interestingly, the decline in the percentage of poverty in the period 2011-2024 occurred most consistently in 2011-2014 or when the contribution of the agricultural sector was still in the range of 18.6%-25.3% and before the massive downstreaming of nickel. In the following years, along with the increasing contribution of the nickel mining and processing sector and the decreasing contribution of the agricultural sector, the percentage of the poor population still decreased but not as much as in 2011-2013 and even increased, although it was at the 2011-2013 level in 2022 (by 1.2%).

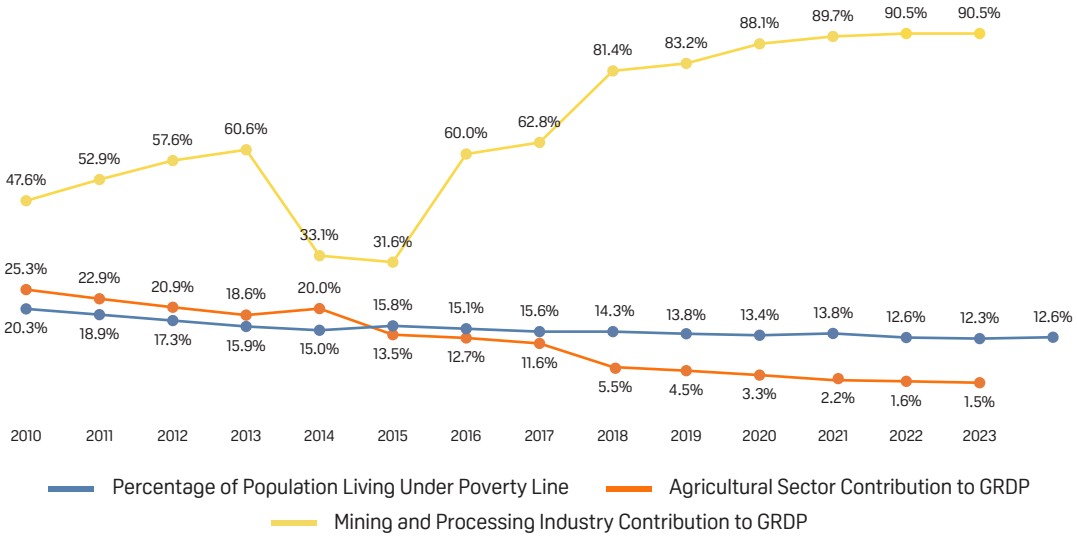
Although descriptive statistics cannot explain the association between the business sector and the decline in poverty rates as a whole, at least this trend indicates that the significant increase in the value of GRDP output in the mining, excavation, and processing sectors of the output of these sectors has not had a significant impact on poverty reduction. One condition that might be able to explain this condition is that in the development of the mining, excavation, and processing business sector, most of the returns are distributed to investors outside the region or abroad. This is indicated in the structure of Morowali's GRDP, which is dominated by gross fixed capital formation and net exports, which contrasts with household consumption and local government consumption, as explained in the previous section.

Chart 8. **Change in Population Living Under Poverty Line in Percentage**



Source: Processed from BPS Indonesia (2024b)

Chart 9. **Poverty Trend, Agricultural Sector and Mining & Processing Sector**



Source: Processed from BPS Indonesia (2024b) and BPS Morowali (2024)

2.2.2. Employment

Since the implementation of the nickel downstreaming program in Morowali Regency, accurately assessing the employment conditions there has been difficult. There are several aspects that obscure the actual conditions in the field, such as making the statistical data available inaccurate and do not reflect the actual conditions.

First, the existence of a large-scale nickel industry in Morowali has attracted job seekers from outside the region. Workers who come from outside the region come from areas around Morowali Regency with the hope of finding jobs in nickel mines or processing plants.

Second, not all job seekers from areas around Morowali are able to land a job in the nickel industry. Many of them end up working in supporting sectors of the nickel industry, such as the food and other service sectors. The existence of job seekers from outside the region was not included in the BPS employment statistics because the data only include workers from Morowali Regency. This resulted in the data failing to reflect the conditions in the field. There are more workers in Morowali Regency than in the BPS data.

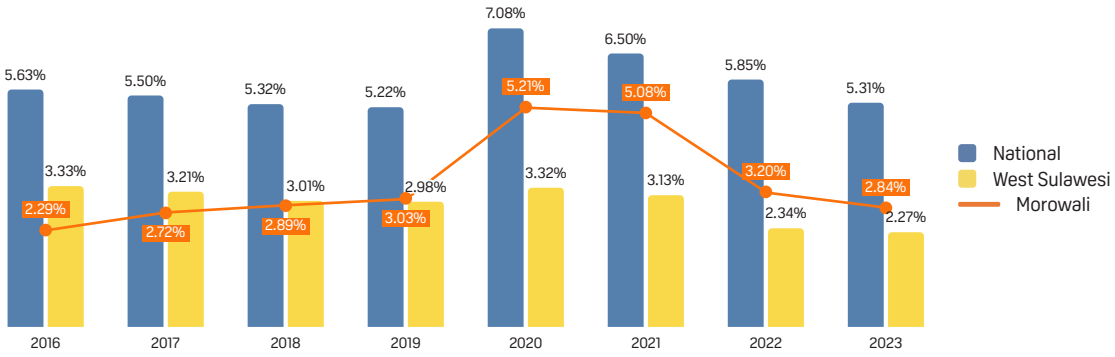
Third, apart from job seekers from the surrounding area, foreign workers (TKA) from abroad are employed in the Morowali nickel industry. Most of these TKAs originate from China and are mainly employed in nickel processing occupation, which require more technical skills than local workers. Meanwhile, local workers mostly work in areas that do not require specialized skills, such as becoming miners or stokers at captive power plants. Similar to local migrant workers, the number of TKA is also not included in the calculation of the Morowali Regency workforce and therefore does not appear in the statistical data.

Finally, many indigenous people of Morowali Regency who had previously worked as farmers and owned agricultural land eventually chose to sell their land and switch professions to become workers in the nickel sector. This change in profession cannot be fully captured in the annual BPS data; therefore, there can be bias in reporting employment data in the agricultural sector.

These problems also result in confusing unemployment and labor absorption statistics. In addition, these problems present a biased picture of the economic sector and do not match the actual conditions in the field. On paper, in the employment sector, there was a spike in the open unemployment rate in 2020 and 2021 (most likely driven by the COVID-19 pandemic), followed by a decrease in the percentage of unemployment in 2022-2023.

Although lower than the national average, in the last 5 years the open unemployment rate in Morowali has remained higher than in other regions, such as West Sulawesi, which does not rely on mining. West Sulawesi itself also has advantages in the fields of agriculture, forestry, and fisheries, as seen from the composition of the GRDP, which is dominated by these sectors (BPS West Sulawesi Province, 2024a).

Chart 10. **Unemployment in Morowali Compared to West Sulawesi and National**



Source: BPS Indonesia, 2024b; BPS Morowali Regency, 2024b; BPS Bali Province, 2024; BPS West Sulawesi Province, 2024b

On the other hand, there was a significant surge in the amount of the workforce in 2022-2023. This could indicate a migration of workers from outside the Morowali area to Morowali, accompanied by a decrease in the percentage of unemployment, which was partly driven by the absorption of workers from outside the Morowali area. This condition also likely indicates mining activities and related sectors that absorb a lot of workers from outside the Morowali area due to the need for a workforce profile that is different from the Morowali workforce profile. As of 2022, there were at least 10,000 Foreign Workers (TKA) holding visas with the intention of working in the Morowali Regency area (Morowali Data Portal, 2024).

2.3. Financing and Investment Program

One of the obstacles faced by the Morowali Regency Government in its efforts to diversify the economy is the lack of funding sources at the Regency level. Currently, the Morowali Regency Government's ability to raise funds is very limited, and the district government does not have sufficient tools and authority to finance this diversification program on an adequate scale. Moreover, when compared with the investment potential in the mining and heavy metal processing sectors, the non-mining sector is still unable to compete to attract enough investors.

There are several alternative financing and investment schemes that can be carried out by the Morowali Regency Government, especially in sectors that are a priority for developing economic diversification. These schemes include:

Table 1. **Alternative Financing and Investment Schemes**

Sector	Financing Scheme
Electricity and Gas Procurement	Establish cooperation with the private sector through the Corporate Social Responsibility (CSR) scheme. Submit energy transition funding assistance to international non-profit institutions.
Tourism	Open investment scheme for Morowali tourism area. Search for and participation in cheap expos and exhibitions held abroad to attract international interest in investing in the tourism sector. Using a private-public partnership scheme to develop Morowali tourism infrastructure.
Agriculture, Forestry and Fisheries	Distribution of business permits in the fields of agriculture, fisheries, especially aquaculture. Simplifying bureaucracy for establishing businesses in the agriculture and aquaculture sectors.

2.4. Summary: Morowali's Economic Conditions and Priority Sector Selection Strategy for Diversification

At least the following things can be concluded regarding the development of the Morowali economic sector in recent years:

a. Mining and quarrying dominate the growth of the primary sector and the economy of Morowali, accompanied by the performance of the agriculture, forestry, and fisheries sectors, whose growth is not too high.

b. The growth of some secondary and tertiary sectors is also indicated to have grown quite high recently along with an increase in mining company activities.

c. Unlike the agricultural sector, which takes several years before providing returns, nickel mining is expected by the government to be able to provide high growth quickly and bridge the welfare inequality faster. However, in reality, the very high growth in the mining sector and nickel downstreaming is not accompanied by a significant increase in welfare.

d. The three things above are several critical reasons for developing other sectors (economic diversification). Although returns and growth in these other sectors have increased gradually.

Based on the analysis of the present condition and requirements, the economic sectors that possess the following characteristics are prioritized for development:

a. Not too dependent on investment in capital goods (more labor-intensive) so that its development programme can be carried out relatively independently by the regional government or private partners with a profit-sharing scheme or purchase of Morowali's production output in a sustainable manner (Morowali can participate in the supply chain).

b. The potential for a fairly large welfare impact.

c. Has the potential for promising growth (demand for the output of the sector has not yet been fully met so that Morowali can meet it with an increase in production capacity).

d. Can provide a multiplier effect on the non-mining primary sector.

e. The potential to support or increase the environmental carrying capacity of Morowali Regency.

3 Impact of Morowali's Economic Growth Using I-O Until 2045

3.1. Method (Based on Firmansyah, 2006; Leontief, 1986; ten Raa, 2005)

This study uses the Input-Output (I-O) approach to analyze the impact of economic diversification. The IO method models the economy by describing the production chain between sectors and the level of linkages between sectors within a geographic area. By processing and analyzing this linkage system, the effects of external shocks on the economy can be determined.

To better understand the I-O method, an example of canned fish production can be used. Processed fish products are produced by the food and beverage industry and are the outputs resulting from inputs from various sectors. First, there are production factors of labor and skills used by fishermen to catch fish. Then, it enters the distribution process of the food processing industry. Not to mention during the production process, from the fish caught to the canned fish, there is also input of electricity, building rent, machine equipment, motor vehicles, etc.

In this example of canned fish production, production factors that are innate and not the result of production from other sectors, such as labor and skills of workers in this sector, are called primary inputs. Other inputs that come from the results of adding value to other goods, such as changing raw fish to fish that are ready to enter the factory, are called intermediate inputs. This input-output method traces the entire production process and inter-sectoral linkages to produce goods produced in an economy so that it can ultimately describe the production structure of all final outputs in an economy.

In practice, the I-O calculation uses a matrix form. This matrix was developed by economist Wassily Leontief and can be calculated using data collected by statistical institutions such as the Bureau of Labor and Statistics in the United States or the BPS in Indonesia. A simple illustration of this I-O matrix is provided in the example in **Table 2**. This table describes an economy divided into 3 sectors—agriculture, industry, and services—and the interactions between these sectors and their final production value.

Table 2. **Illustration of 3 Sector Input-Output Table**

Sector		Agriculture	Industry	Service	Final Consumption	Total Output
	Code	**1**	**2**	**3**	**C**	**Y**
Agriculture	**1**	Z11	Z12	Z13	C1	Y1
Industry	**2**	Z21	Z22	Z23	C2	Y2
Service	**3**	Z31	Z32	Z33	C3	Y3
Gross Value Added	**A**	A1	A2	A3		
Total Input	**Y**	Y1	Y2	Y3		

In the table, inter-sectoral relationships are depicted in the elements in their cells. For example, Z12 denotes the output of the agricultural sector used as an intermediate input by the industrial sector. Z33 means that the output of the service sector is used as an input for the sector itself. Of course, not all production results from a sector are always used as input for other sectors. The sector also contains the output directly consumed by the consumers as final products, which is represented in the final consumption column. The sum of the output values between sectors (Z11, Z12, Z13) and for direct consumption (C1) is in the total output column, where Y1 is the total output of the agricultural sector.

Similar to output, not all input comes from other sectors. There are primary input factors, such as labor and capital, in the production input of a sector, which in the table above are included in the Gross Value-Added category. The sum of the input values from other sectors in the form of intermediate inputs with this Gross Value Added produces a Total Input whose value is the same as the Total Output (Y1 = Y1) because in an economy, the output value should be the same as the input value.

Using this IO table analysis, the effect of a policy on the economy can be determined. This method could see the effect of the policy by observing changes in output sectorially or overall after the shock figures from the policy are entered. In addition to the output analysis, the IO table can be used to determine the impact of the policy on wages and employment.

The calculation of input-output in this study uses IO table data from 17 sectors from Central Sulawesi Province for producer prices. The use of this provincial IO table is preferred compared to the IRIO table because the analysis to be carried out has a limited scope in the Morowali Regency area and Central Sulawesi Province only. For the estimated output time span, a value of 20 years is used so that it is in accordance with the RPJPN and RPJPD 2045 targets.

3.2. General Assumptions

To simulate the effects of Morowali's economic diversification policy, this study uses several assumptions to create shock scenarios. In developing these assumptions, there are general non-sectoral and sectoral assumptions. General non-sectoral assumptions are used in all scenarios, whereas sectoral assumptions are applied to certain scenarios. Although the shock scenario used only covers the assets and economy of Morowali Regency, the analysis of its effects covers the entire Central Sulawesi Province. This study uses an IO analysis from the IO table of Central Sulawesi Province in 2016 using the assumption of prices prevailing in 2023. The employment analysis was also conducted using Sakernas data from 2023.

The general non-sectoral assumptions used in this study are as follows:

a. The I-O analysis is based on the 2016 IO table for Central Sulawesi Province.
b. The simulated shock scenarios only cover the assets and economy of Morowali Regency, but the effect analysis covers the entire Central Sulawesi Province.
c. There is no additional mining land or nickel processing in the Central Sulawesi Province area.
d. For the monetary value, the shock uses the assumption of current prices in 2023.
e. The employment analysis was conducted using the 2016 Sakernas data (BPS Indonesia, 2016).

3.3. Assumptions and effects of Sectoral Shocks

3.3.1. Impact of Electricity and Gas Procurement

Table 3. **Summary of Shocks and Impacts on the Electricity and Gas Supply Sector**

Indicator	Unit	Year 1	Year 2	Year 10	Year 15	Year 20
Total Output	million US$	0	1.2	45.3	1,463	47,129
GRDP	million US$	0	0	9.2	300.4	9,676
Employment	people	2	43	1,416	45,734	1,473,438
Wage Increase	million US$	0	0	3	107.3	3,461

The electricity and gas sector is a sector that in the results of the research team's model simulation can provide the largest added value of output and GRDP compared to other sectors, namely a total of Rp1,535 trillion (US$94.1 billion) and Rp315 trillion (US$94.1 billion), respectively, in a 20-year period.

This agrees with the role of electricity as a very crucial production input for other sectors. In addition, electricity also plays a role in improving community welfare and thus worker welfare. This increase in welfare can, for example, be translated into improved health services (although the health services sector is not specifically simulated in the IO model scenario in this study). For example, increased welfare, such as improving the quality of health services, can gradually increase worker productivity by reducing the incidence of infectious and non-infectious diseases. Increased productivity from increased access to electricity has been studied by many researchers (for example, see Bridge et al., 2016 and Alam et al., 2018). In this context, initiatives such as community-based renewable energy need to be an important part of local government policies in overcoming energy poverty in their regions.

In addition to potentially increasing worker productivity, the results of the IO model scenario of the research team also indicate that the electricity and gas procurement sector can absorb a large number of workers (around 2.9 million over a period of 20 years), with an average wage in the 20th year reaching Rp25.6 million (US$1,569) per person. Most of this effect is projected to come from community-based renewable energy development and maintenance efforts that involve many communities and youths. The results of this scenario simulation are in line with the findings of CELIOS and 350.org (2024), which identified the potential for large employment absorption from community-based renewable energy.

In this sector, the simulated input is quite small, only Rp600 million (US$36,780) per year used for the purchase of solar panels, micro hydro generators, and windmills. However, the output that occurs is already quite large. Thus, the Morowali Regional Government does not need to hesitate to roll out a community-based EBT program. By having community-based EBT, the electricity supply of the Morowali community also does not need to depend on the quota from the coal-fired power plant in the industrial area as it is currently.

Chart 11. **Simulated Effect of Electricity and Gas on Output (US$ Million)**

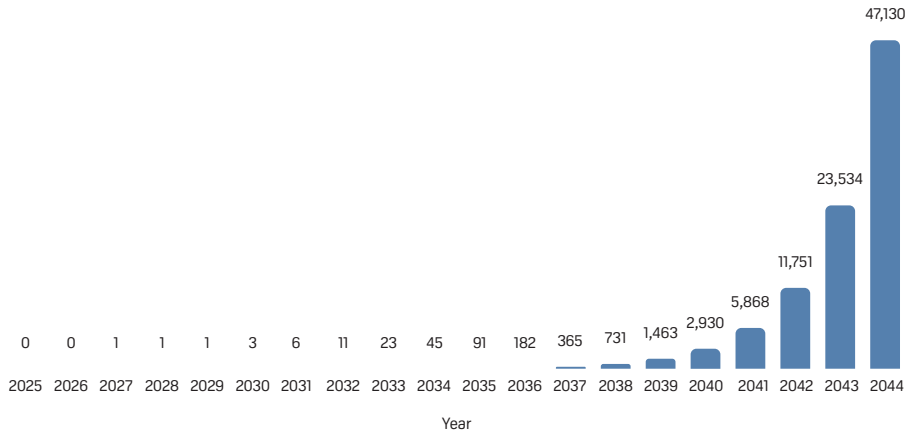


Chart 12. **Simulated Effect of Electricity and Gas on GRDP (US$ Million)**

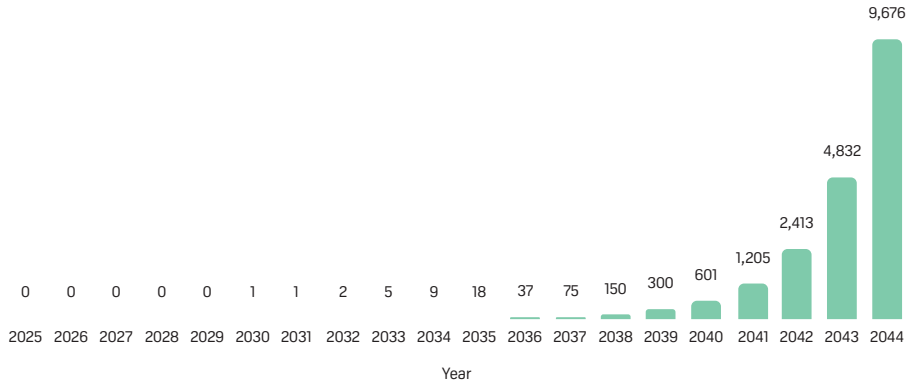


Chart 13. **Simulated Effect of Electricity and Gas on Employment (Unit)**

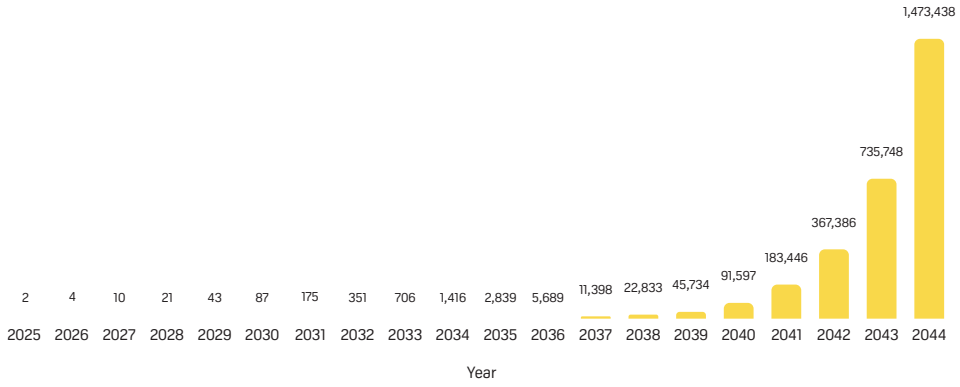
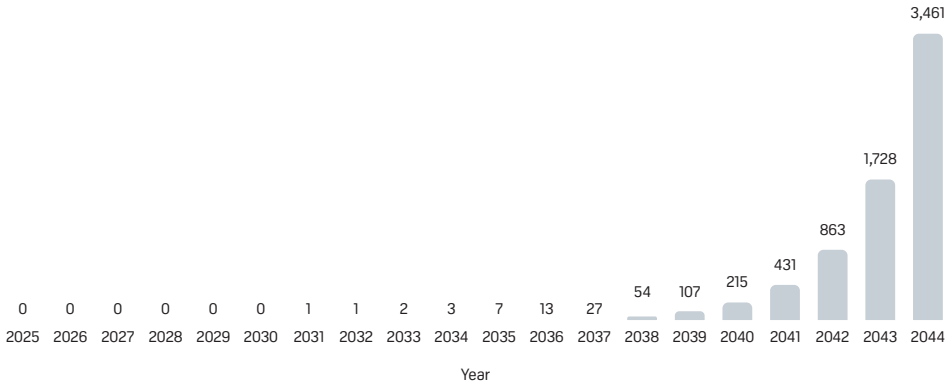


Chart 14. **Simulated Effect of Electricity and Gas on Wages (US$ Million)**



3.3.2. Impact of Tourism Services

Table 4. **Summary of Shocks and the Impacts on the Tourism Services Sector**

Indicator	Unit	Year 1	Year 5	Year 10	Year 15	Year 20
Total Output	million US$	0.6	1.8	21.5	607.5	19,339.2
GRDP	million US$	0	0	9.2	300.4	9,676.3
Employment	people	2	43	1,416	45,734	1,473,438
Wage Increase	million US$	0	0	3.1	107.3	3,461

The tourism service sector input in this simulation contributes to increasing tourism in the form of promotion and tourism support facilities. In this sector, the simulation indicates an input of Rp 5.775 (US$354,012) annually for five years. As a result, a total GRDP of more than Rp130.37 trillion (US$8 billion) can be created. The total workforce created over the past 20 years comprises more than 1.2 million workers. The average wage increase from this scheme is Rp17.4 million (US$ 1,067) in the 20th year.

Chart 15. **Simulated Effect of Other Services (Tourism) on Output (US$ Million)**

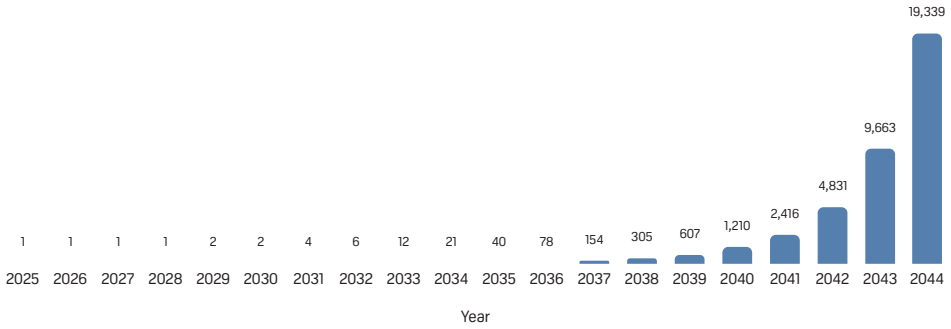


Chart 16. **Simulated Effect of Other Services (Tourism) on GRDP (US$ Million)**

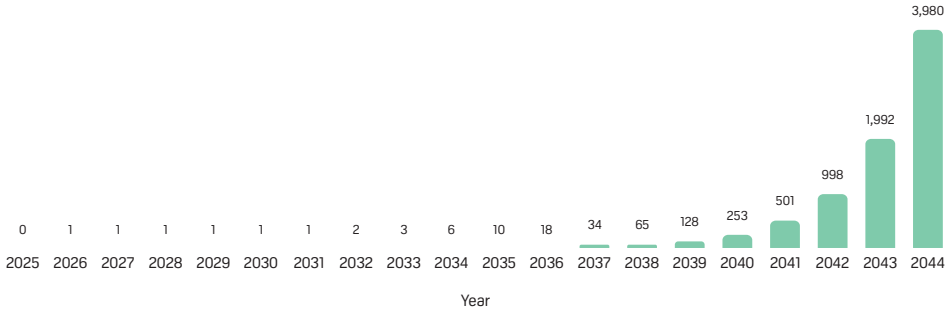


Chart 17. **Simulated Effect of Other Services (Tourism) on Employment (Unit)**

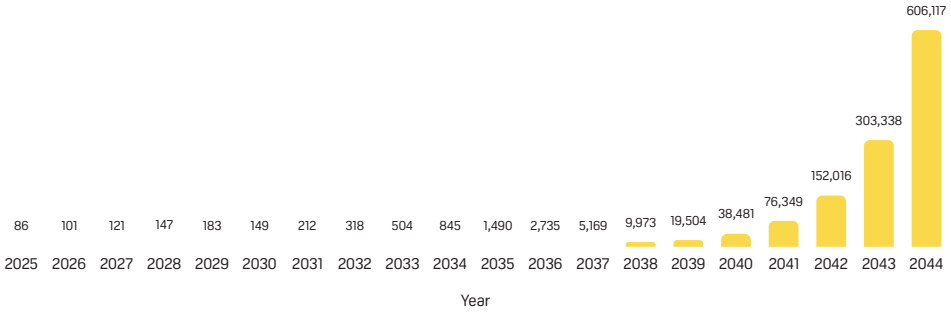
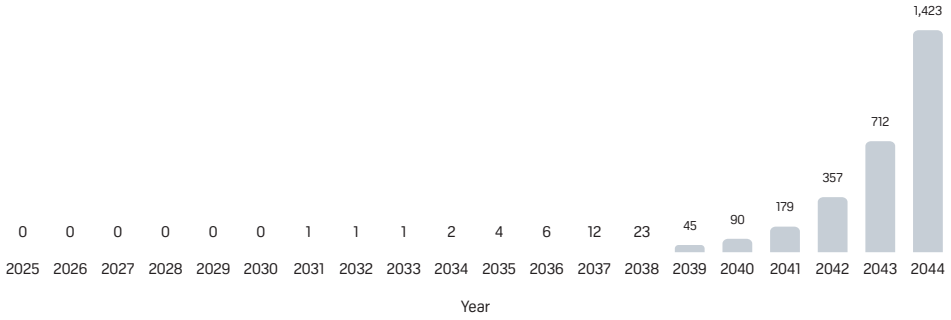


Chart 18. **Simulated Effect of Other Services (Tourism) on Wages (US$ Million)**



3.3.3. Impact of Government Administration, Defense, and Compulsory Social Security

Table 5. **Summary of Shocks and Their Impacts on the Government Administration, Defense, and Compulsory Social Security Sectors**

Indicator	Unit	Year 1	Year 5	Year 10	Year 15	Year 20
Total Output	million US$	1.8	5.5	65.6	1,874	59,627.3
GRDP	million US$	0	0	18.4	392.3	12,272.4
Employment	people	202	527	2,730	60,490	1,869,563
Wage Increase	million US$	0.6	1.2	6.1	141	4,389.1

The sector's annual input is Rp19.57 billion (US$1.2 million). This input is used as incentives in the health sector to improve Posyandu services and to increase the distribution of health workers to remote areas. The input is also used to increase the distribution of teachers among the regions. In addition, the input is also used to increase the BPJS Health and BPJS Employment membership. Finally, the input is used to provide incentives for youth organizations, such as PKK, RT, and RW activities in remote areas, to equalize economic circulation. The average wage increase from this scheme is Rp27.5 million (US$1,686) in the 20th year.

Chart 19. **Simulated Effect of Administration, Defense, and Social Securities on Output (US$ Million)**

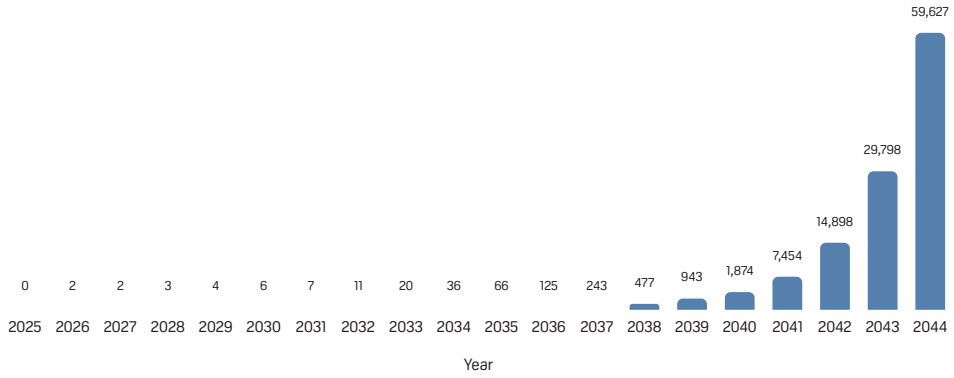


Chart 20. **Simulated Effect of Administration, Defense, and Social Securities on GRDP (US$ Million)**

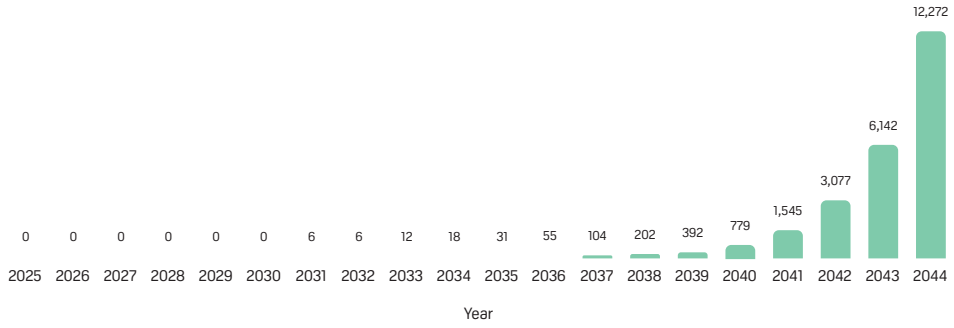


Chart 21. **Simulated Effect of Administration, Defense, and Social Securities on Employment (Unit)**

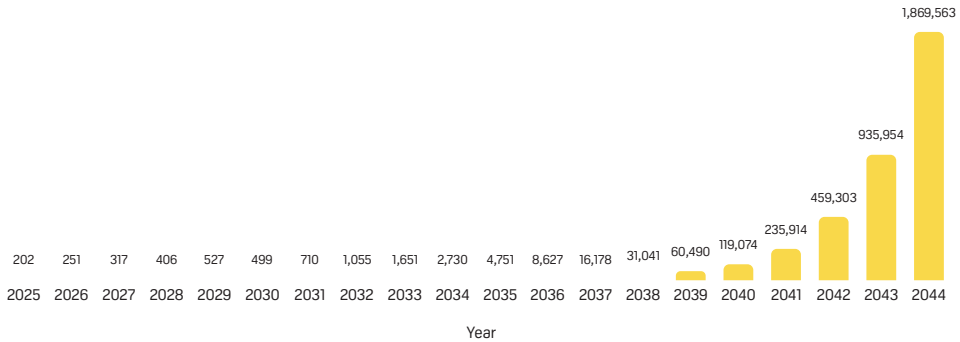
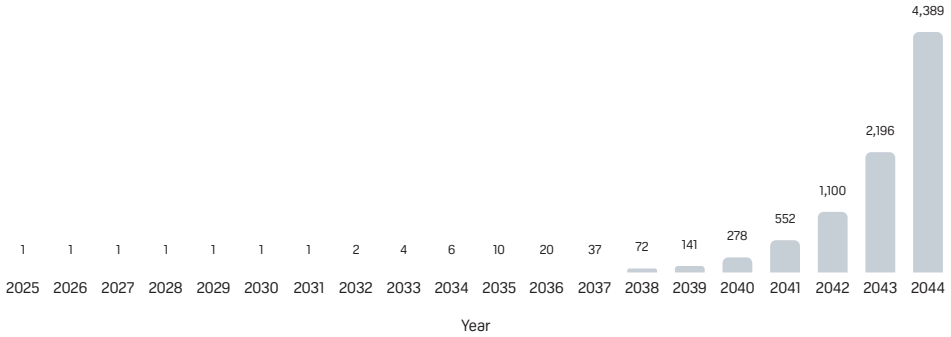


Chart 22. **Simulated Effect of Administration, Defense, and Social Securities on Wages (US$ Million)**



3.3.4. Impact of Transportation, Logistics, and Warehousing

Table 6. **Summary of Shocks and Their Impacts on the Transportation, Logistics, and Warehousing Sectors**

Indicator	Unit	Year 1	Year 5	Year 10	Year 15	Year 20
Total Output	million US$	0	2.9	39.7	1,105.3	35,069.6
GRDP	million US$	0	0	12.3	232.9	7,221.2
Employment	people	0	243	1,675	35,817	1,100,147
Wage Increase	million US$	0	0.6	3.7	83.4	2,582.6

The input of the transportation and warehousing sector is Rp60 billion (US$3.68 million). The input is the cost of procuring fishery transport vessels along the Kendari-Morowali-Banggai-Bitung route. The total GRDP output created over 20 years in the sector is Rp237 trillion (US$14.5 billion), with a total absorption of labor during that period of 2 million people. The average wage per worker over 20 years is Rp23.05 million US$1,423).

Chart 23. **Simulated Effect of Transportation and Warehousing on Output (US$ Million)**

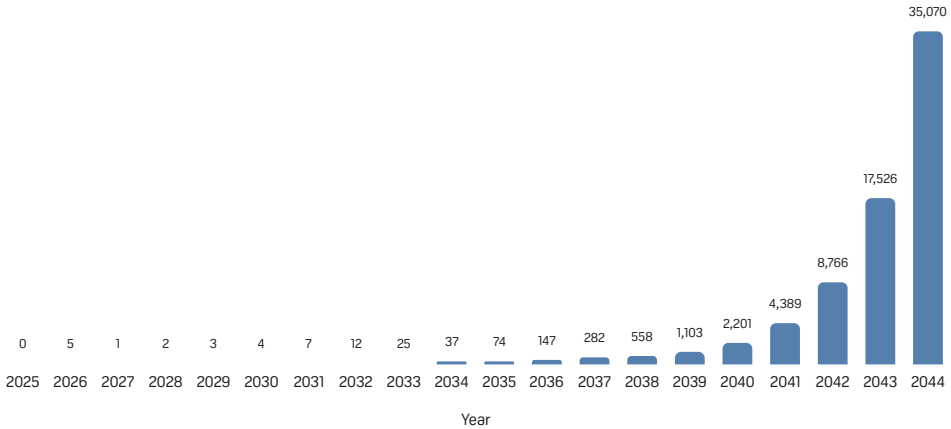


Chart 24. **Simulated Effect of Transportation and Warehousing on GRDP (US$ Million)**

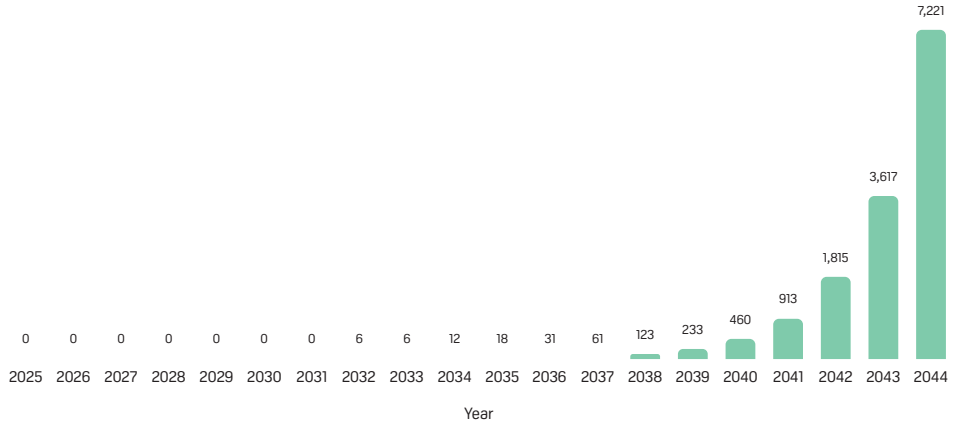


Chart 25. **Simulated Effect of Transportation and Warehousing on Employment (Unit)**

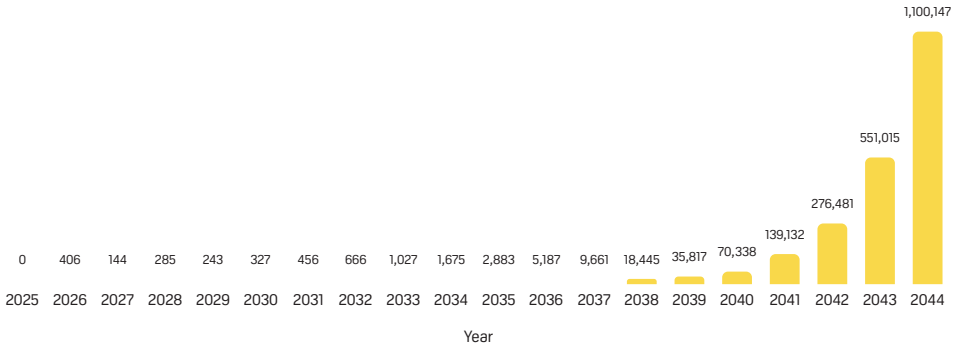
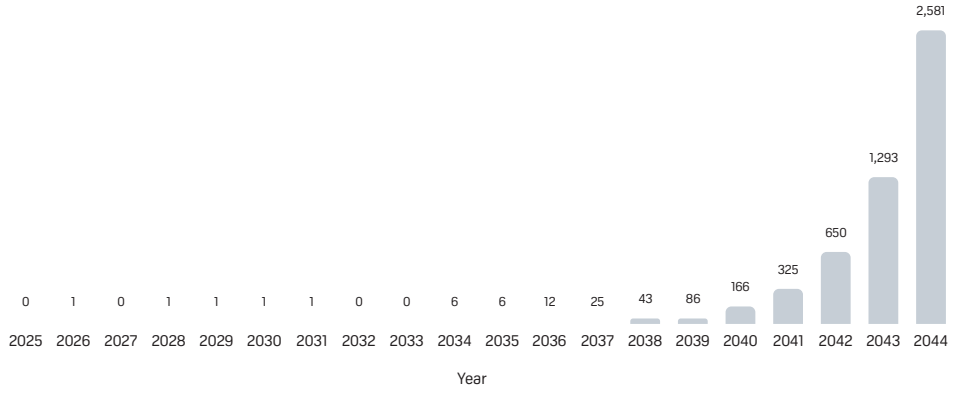


Chart 26. **Simulated Effect of Transportation and Warehousing on Wages (US$ Million)**



3.3.5. Impact of Water Supply, Waste Management, and Waste Recycling

Table 7. **Summary of Shocks and Impacts of the Water Supply, Waste Management, Waste and Recycling Sector**

Indicator	Unit	Year 1	Year 5	Year 10	Year 15	Year 20
Total Output	million US$	0	0.6	9.2	267.3	8,532.5
GRDP	million US$	0	0.6	2.5	55.8	1,755
Employment	people	44	80	349	8,541	267,300
Wage Increase	million US$	0	0	0.6	20.2	627.7

In this model simulation, the input to this sector is Rp3.85 billion (US$236,000) per year. The input is used to improve clean water distribution pipes, drinking water treatment facilities, and waste bank programs. The total output obtained over 20 years is Rp28.632 trillion (US$1.76 billion), with a total workforce absorption of more than 24 million people. Meanwhile, the average wage per worker over 20 years has increased by Rp10.28 million (US$630).

Not all inputs for water procurement, waste management, waste disposal, and recycling are included in this sector. The construction of dams that can also function as reservoir pools is part of the construction sector. In addition, some activities cannot be included because they do not meet the assumptions of the I/O model, such as land bioremediation and phytoremediation activities. Although the input and output cannot be simulated, we still recommend that the Morowali Regional Government have a business or at least provide incentives so that there are businesses in the bioremediation and phytoremediation sectors in Morowali considering the large potential demand and the importance of businesses in this sector for sustainable environmental carrying capacity in Morowali.

Chart 27. **Simulated Effect of Water Utility, Waste Management, and Recycling on Output (US$ Million)**

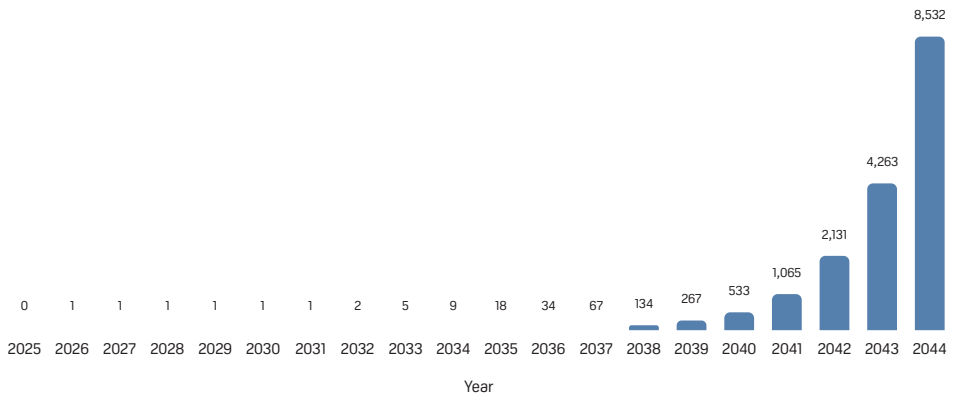


Chart 28. **Simulated Effect of Water Utility, Waste Management, and Recycling on GRDP (US$ Million)**

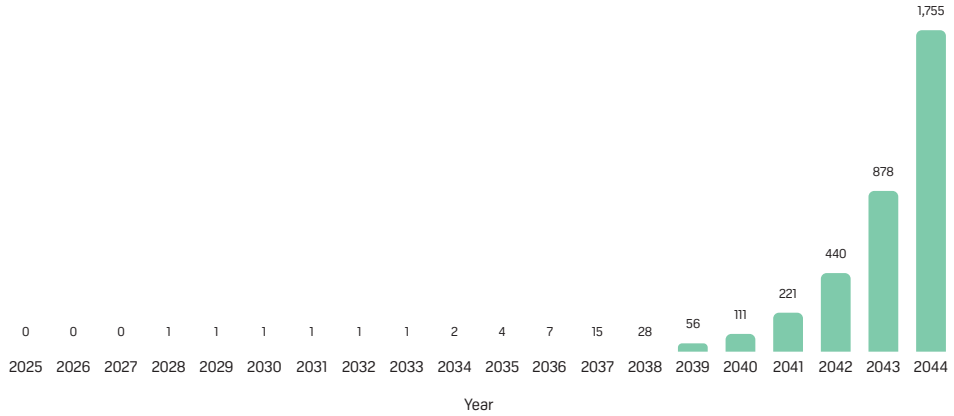


Chart 29. **Simulated Effect of Water Utility, Waste Management, and Recycling on Employment (Unit)**

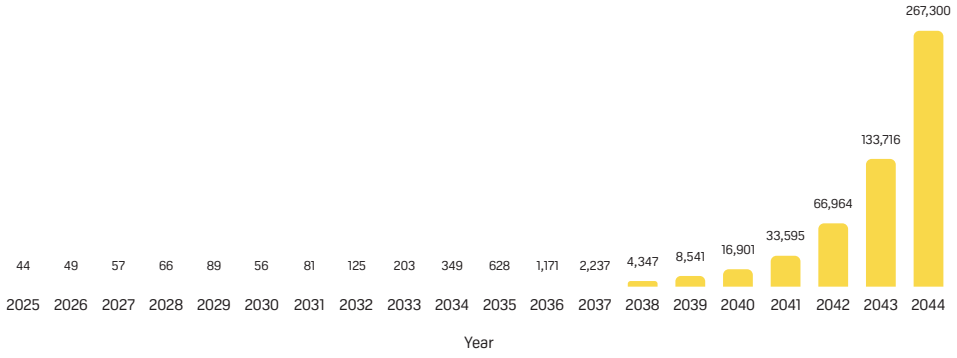
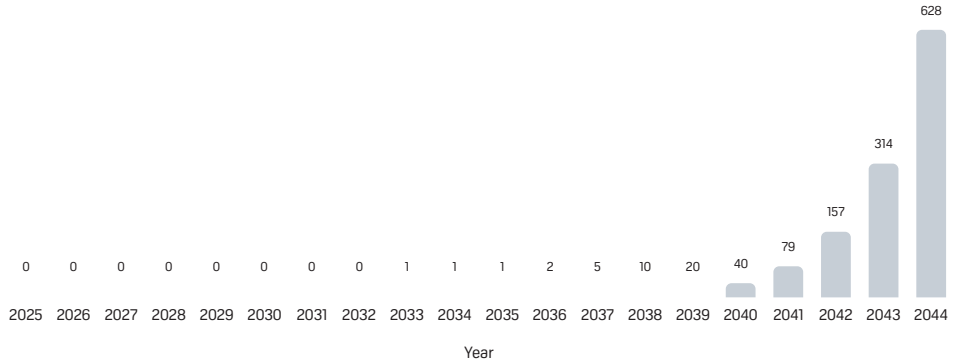


Chart 30. **Simulated Effect of Water Utility, Waste Management, and Recycling on Wages (US$ Million)**



3.3.6. Impact of the Processing Sector

Table 8. **Summary of Shocks and Their Impacts on the Manufacturing Sector**

Indicator	Unit	Year 1	Year 5	Year 10	Year 15	Year 20
Total Output	million US$	0	0	18.4	386.2	12,125.3
GRDP	million US$	0	0	6.1	85.8	2,501.1
Employment	people	6	175	753	12,778	381,013
Wage Increase	million US$	0	0.6	1.8	29.4	894.4

The input of the processing sector is simulated at Rp1 billion each year, except in the second year at Rp29 billion (US$1.78 million). The Rp1 billion (US$61,300) per year is an input for developing MSMEs, including the development of orange and papaya processing industries, coconut oil, and VCO. In addition, in the second year, there is input for the development of the coconut industry in the form of the construction of a coconut oil, coconut milk, and VCO factory worth Rp23 billion (US$1.41 million) and the development of other basic coconut processing industries such as white copra, cocopeat, and charcoal worth Rp4 billion (US$245,200).

The non-mining goods processing sector can also drive increased output and GRDP. The added value generated from this sector is recommended to come from agricultural and fishery products. For example, as discussed in the previous section, the processing of coconuts into white copra, coconut oil and VCO, coconut and oranges and papaya into various local snacks is expected to be a number of economic activity options for the Morowali community. Based on the results of the IO model simulation, in the first 15 years, the average output obtained with additional input for the processing sector is Rp855 billion (US$52.41 million) with an additional GRDP of Rp206 billion (US$12.6 million).

However, after the 15th year, this sector was able to contribute an average of Rp15.8 trillion (US$968.5 million) to Central Sulawesi's GRDP each year, ceteris paribus, along with the increasing learning curve of Morowali in producing output from this sector and the development of related primary sectors (agriculture and fisheries). Indirectly, when compiling the model scenario, the research team assumed that the development of this processing sector cannot occur without the development of agriculture and fisheries.

Along with the increasing production activities of coconut derivatives, oranges, and papaya, the research team estimated that additional employment absorption over 20 years could reach an average of 38,543 people each year (770,870 people in a period of 20 years), with wages per person also reaching Rp13.2 million (US$809) in the 20th year. The employment absorption that occurred in this sector was mainly driven by the increasing demand for processed coconut, orange, papaya, and fish products in the coming years and the existence of production lines to produce these products.

Annual details of total output, GRDP and labor absorption, and wage increases are presented in the following graph:

Chart 31. **Simulated Effect of Processing Industry on Output (US$ Million)**

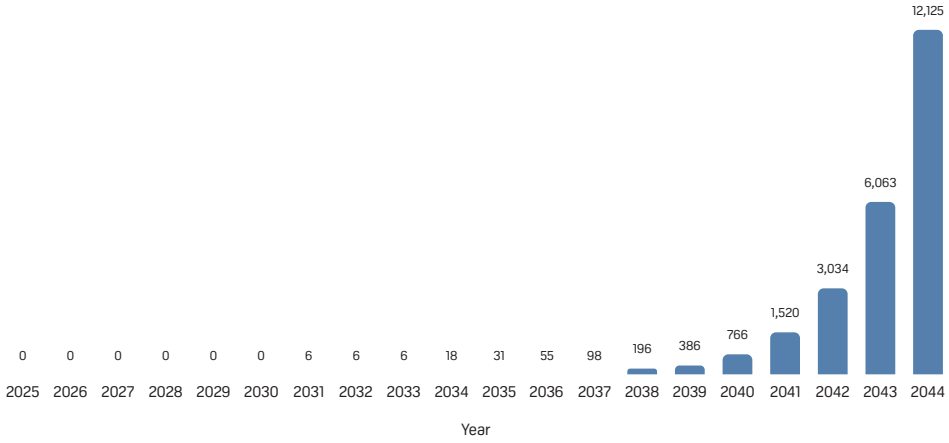


Chart 32. **Simulated Effect of Processing Industry on GRDP (US$ Million)**

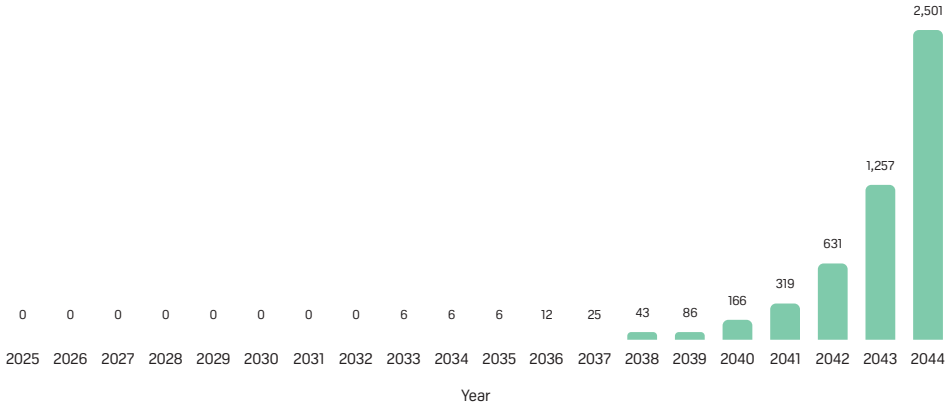


Chart 33. **Simulated Effect of Processing Industry on Employment (Unit)**

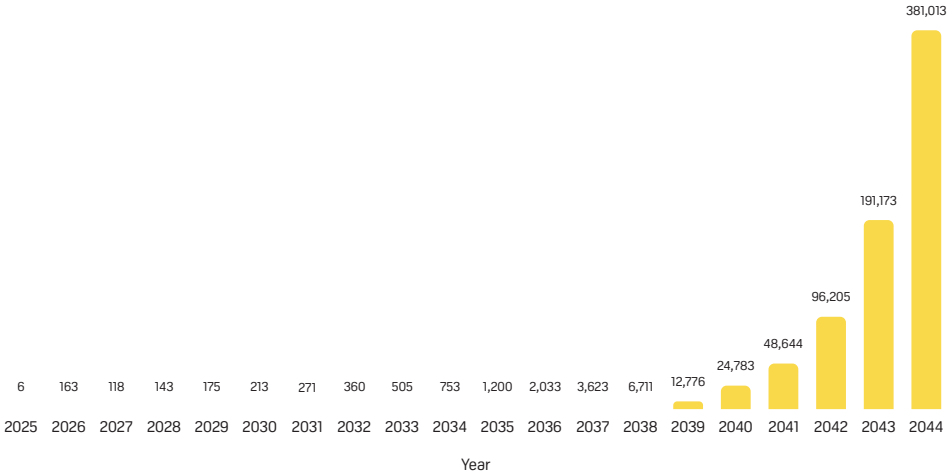
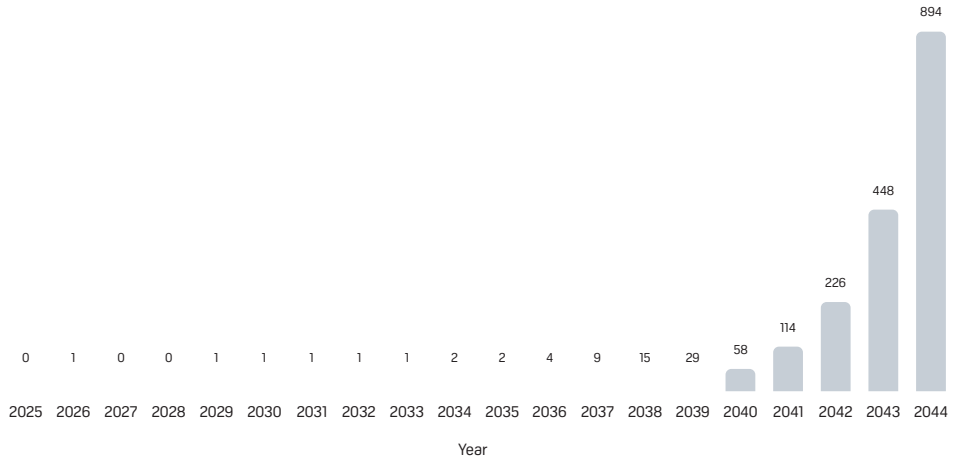


Chart 34. **Simulated Effect of Processing Industry on Wages (US$ Million)**



Trivia Box 1

Economic Potential of Digital MSMEs

As previously explained, the economic diversification of Morowali Regency requires the development of downstream industries in the agricultural, plantation, and fisheries sectors, which in turn will be supported by micro, small, and medium enterprises (MSMEs). In order to boost the competitiveness of the MSME sector, MSME digitalization is needed. In theory, the existence of this digital ecosystem can help business actors penetrate the global market, encourage product innovation, and gain greater access to scientific networks in similar industries. The MSME digitalization process is also encouraged to enable business actors to compete online, both nationally and globally (Widyastuti, et al., 2023).

In Indonesia, the MSME sector has experienced a lot of development, especially with the increasing popularity of digital access. This digitalization process has also received encouragement from the government, one of which is seen in the intensification of the MSME digitalization process during the Covid-19 pandemic through the National Movement Proud of Indonesian Products (Gernas BBI) program. Through this program, 11.7 million MSME units have transitioned to the digital world, with a target of 30 million micro, small, and medium enterprises transitioning by the end of 2023.

Based on data collected by the Indonesian Internet Service Providers Association (APJII), up to early 2024, there were 221,563,479 internet users out of a total population of 278,696,200. This indicates that the internet penetration rate in Indonesia has reached 79.5%, representing an increase of 1.4% from the previous period. Given this large number, there is a large potential payoff for MSMEs in various regions to transition toward digitalization.

However, although it seems practical, the implementation of digitalization in the MSME sector faces several complex problems. Inequality in digital literacy is a major stumbling block to the digital transition process in MSME. This inequality is related to the ability to use online media, inequality in internet access, inadequate available infrastructure, and several other limitations (Widyastuti, et al., 2023). Therefore, adequate digital infrastructure access is needed to support the digitalization process of MSMEs.

3.3.7. Impact of Construction

Table 9. **Summary of Shocks and Their Impacts on the Construction Sector**

Indicator	Unit	Year 1	Year 5	Year 10	Year 15	Year 20
Total Output	million US$	15.3	29.4	232.9	6,035.7	190,204.7
GRDP	million US$	6.7	14.7	68.7	1,299	39,225.8
Employment	people	908	2,272	10,732	198,413	5,974,546
Wage Increase	million US$	1.8	4.3	23.3	461.6	14,023.2

The total input for the construction sector for 5 years is Rp628.9 billion (US$38.5 million). The input is used to upgrade the class of districts passed by heavy vehicles to class I roads, and the construction of dual-use dams that can be used to meet the needs of pumped storage-hydroelectricity, irrigation, and raw water supplies. For 20 years, the input will generate a total GDP output of Rp1,291 trillion (US$79 billion), with a total absorption of more than 12 million workers. The average wage per worker for 20 years is Rp34.1 million (US$2,090).

Chart 35. **Simulated Effect of Construction on Output (US$ Million)**

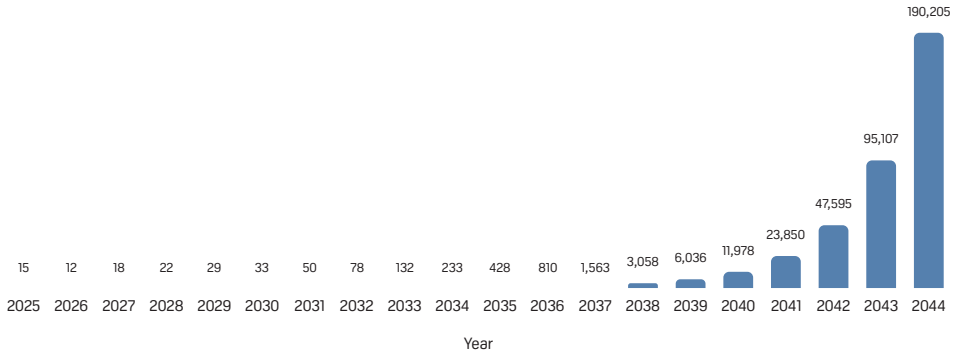


Chart 36. **Simulated Effect of Construction on GRDP (US$ Million)**

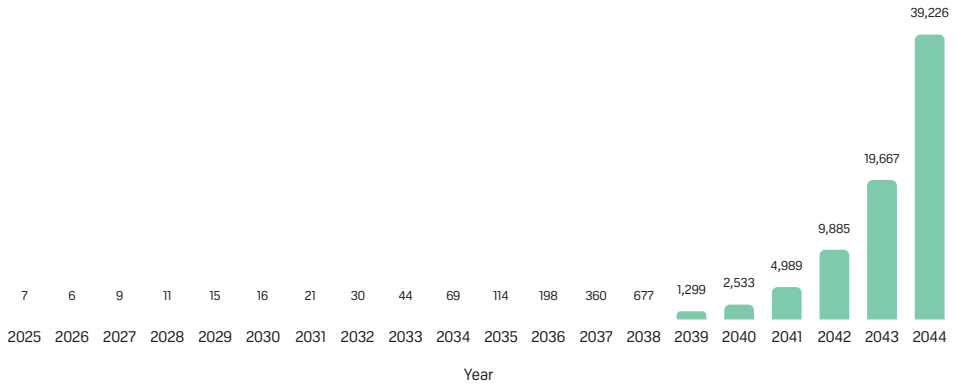


Chart 37. **Simulated Effect of Construction on Employment (Unit)**

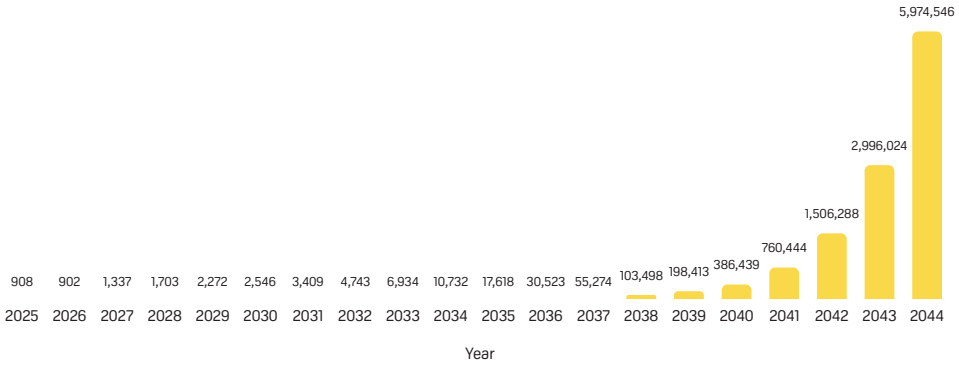
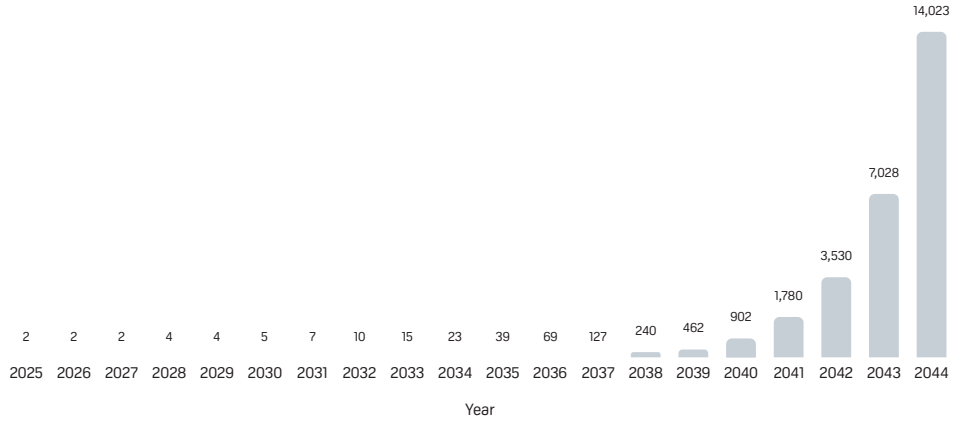


Chart 38. **Simulated Effect of Construction on Wages (US$ Million)**



3.3.8. Impacts of Agriculture, Forestry, and Fisheries

Table 10. **Summary of Shocks and Impacts on the Agriculture, Forestry, and Fisheries Sectors**

Indicator	Unit	Year 1	Year 5	Year 10	Year 15	Year 20
Total Output	million US$	0	6.1	12.3	251.3	7,656.5
GRDP	million US$	0	6.1	6.1	55.2	1,587.7
Employment	people	287	1.3	885	9,019	242,448
Wage Increase	million US$	0.6	1.8	1.8	20.2	567.6

In this model, the inputs of the agriculture, plantation, forestry, and fisheries sectors in the first to fifth years are simulated at Rp14.75 billion (US$904,100); Rp19,954 billion (US$1.2 million); Rp25.65 billion (US$1.57 million); Rp43.36 billion (US$2.6 million), and Rp57.56 billion (US$3.5 million). In accordance with the previous description, the input consists of: intensification and rejuvenation of coconut, orange, and papaya; intensification and development of forest plant cultivation such as meranti, rattan, biopharmaceuticals, and other perennial plants; mangrove planting; procurement of motor boats, outboard motors, and fishing equipment; increasing the capacity of ice factories; increasing the capacity of freezers; intensification of seaweed cultivation; development of integrated mangrove/silvofishery/wanamina fisheries cultivation with multitrophic commodities (IMTA); construction of shrimp hatcheries and nurseries; construction of crab hatcheries; construction of tilapia and milkfish nursery centers; increasing post-harvest seaweed; and environmental conservation services through increasing coral reef and mangrove cover.

Trivia Box 2 **Silvofishery**

Silvofishery aquaculture, also known as integrated mangrove shrimp (IMS) aquaculture, is a sustainable shrimp—and also crab and sea fish—cultivation technique that uses mangrove forest areas. The main attraction of silvofisheries is the synergy between shrimp farming economic activities and mangrove forest conservation; with silvofishery practices, people do not need to clear mangrove forests to open land for shrimp ponds. Instead, the use of silvofishery encourages the replanting of mangrove forests in pond areas.

In addition to its conservation value, silvofishery has other advantages compared with conventional ponds. Due to climate change, many shrimp ponds have experienced crop failures because of extreme weather conditions such as heat and storms. In addition, changes in water quality caused by extreme weather can increase the susceptibility of pond animals susceptible to disease. Silvofishery can reduce the impact of extreme weather by placing ponds in mangrove areas. Mangrove habitats make livestock less susceptible to disease because they live in environments with maintained water quality. Mangrove canopies also protect livestock from the adverse effects of climate change, such as excessive heat or rainfall.

Unlike conventional shrimp, crab, and marine fish farming practices that rely heavily on special feed and antibiotics to maintain the quality of their pond animals, silvofishery relies on the presence of mangroves as a factor that can control water quality and protect ponds from extreme weather. Therefore, silvofishery-based cultivation has a lower capital burden than conventional pond-based cultivation and is more affordable for local communities.

Cumulatively until the 20th year, the development of the agricultural sector is estimated to be able to provide additional output and GRDP of Rp251 trillion (US$ 15.4 billion) and Rp25.9 trillion (US$1.6 billion), respectively. In the first 15 years, the agricultural sector development policy is estimated to provide an average output effect of Rp603 billion (US$37 million) and an average GRDP effect of Rp164 billion (US$10 million). The output and GRDP effects mainly come from increased agricultural output, most of which comes from the coconut farming intensification program and the development of oranges and papaya through the "mandatory local" program which requires the provision of local Morowali oranges and papayas in Morowali retail centers and in the provision of food by the Morowali culinary industry.

The effects of developing the fisheries sector by increasing the capacity of the fishing fleet, increasing the supply from ice factories, building ports, and fish auction centers, and pioneering Kendari-Morowali-Banggai-Bitung fisheries logistics. One of the welfare impacts estimated to be generated from the agricultural sector is the absorption of a total of 502,537 workers over 20 years. In addition to coming from port construction activities and fish auction places, which require many laborers, this absorption also comes from coconut intensification activities that require workers for superior seed planting activities. Along with the increase in coconut production, the need for labor.

The results of the model simulation also show the potential for total wages to reach Rp9.26 trillion (US$ 568 million) or Rp9.68 million (US$ 593) per person in the 20th year, ceteris paribus, or 11 times the current Morowali UMR of Rp3.49 million (US$214). If this scenario occurs, then Morowali workers' wages should be able to exceed inflation, which in the last 10 years has averaged 7.4%, on the condition that the increase in wages mostly comes from an increase in output productivity so that it does not cause a significant inflationary effect.

Details of total output, GRDP and labor absorption, and wage increases are presented in the following chart:

Chart 39. **Simulated Effect of Agriculture, Forestry, and Fishery on Output (US$ Million)**

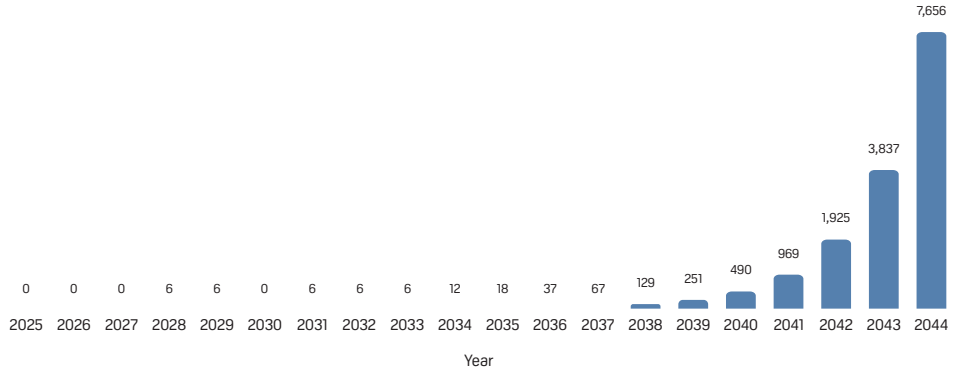


Chart 40. **Simulated Effect of Agriculture, Forestry, and Fishery on GRDP (US$ Million)**

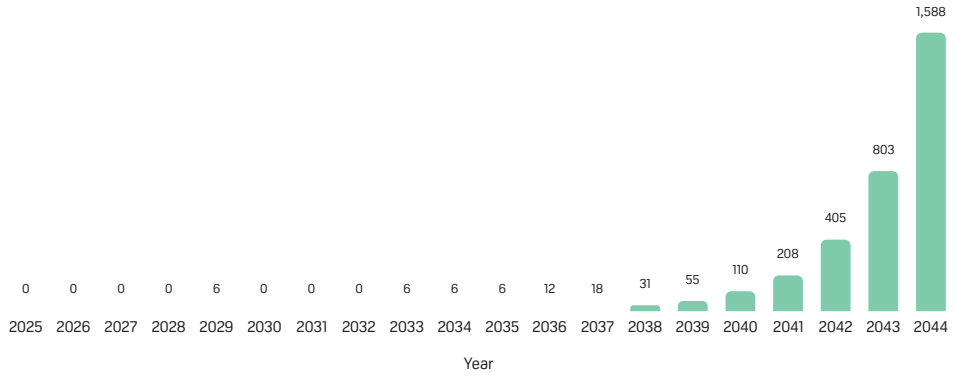


Chart 41. **Simulated Effect of Agriculture, Forestry, and Fishery on Employment (Unit)**

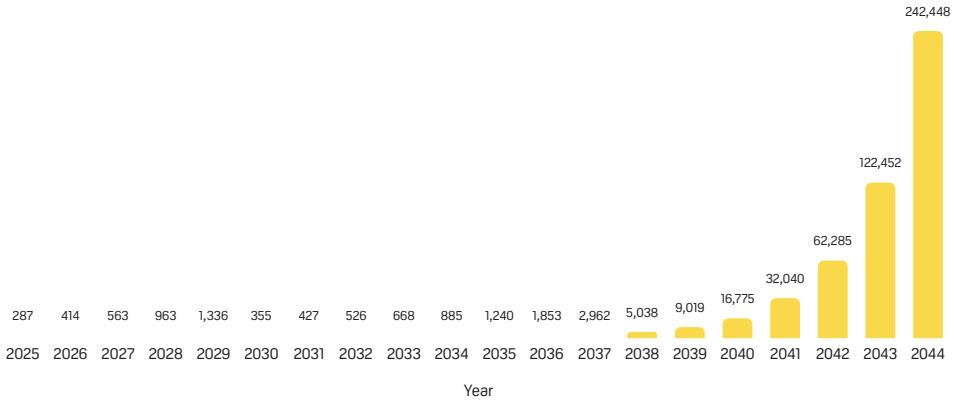
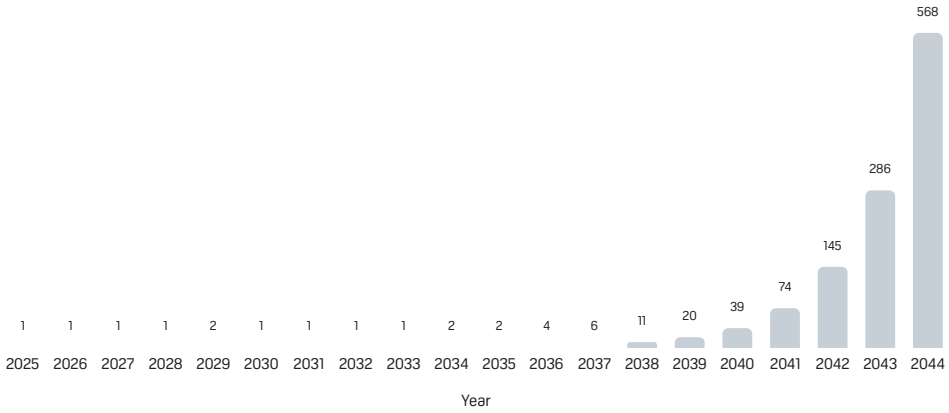


Chart 42. **Simulated Effect of Agriculture, Forestry, and Fishery on Wages (US$ Million)**

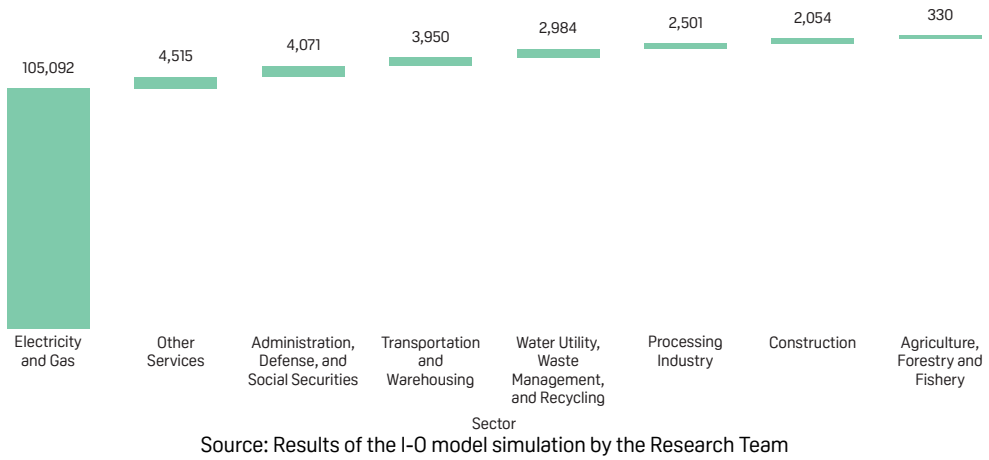


4 Morowali Economic Opportunities

Morowali needs a special strategy to reduce its dependence on the nickel mining and processing sector. Other sectors that currently no longer contribute to GRDP on a large scale because there is no significant capital expenditure actually offer advantages that nickel mining and processing do not have, such as labor absorption (labor-intensive) and lower environmental impacts compared to nickel mining and processing. CELIOS analyzes that in the mining, processing, and construction sectors, GRDP growth of Rp8.4 billion is needed to absorb just one worker. Meanwhile, only Rp105 million in GRDP growth is needed to absorb one worker in the agriculture, fisheries, and plantation sectors.

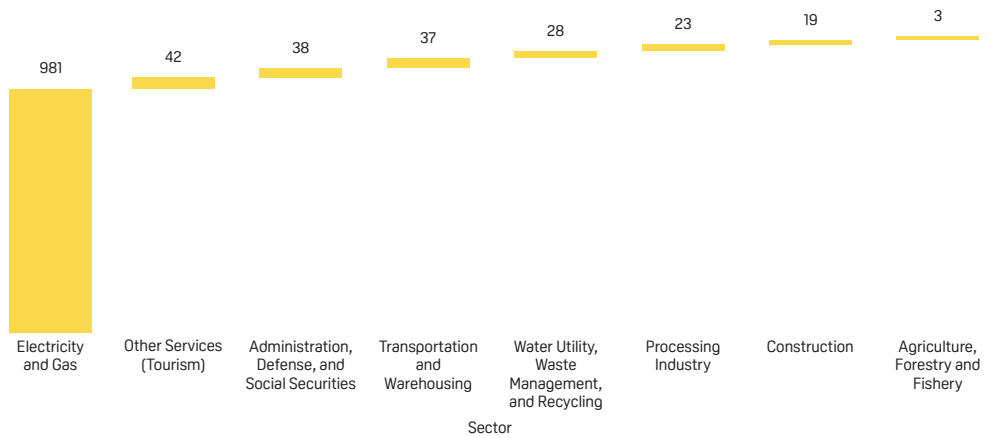
Continuing the analysis in the previous section, many industries other than nickel mining and processing can be developed to achieve the goal of diversifying Morowali's economic sectors. The following assessment is based on the results of the IO simulation. The main criteria used to determine this priority sector are Gross Value Added per Input and Labor per Input.

Chart 43. **GRDP to Input Ratio**



Source: Results of the I-O model simulation by the Research Team

Chart 44. **Labor Absorption per Million Rupiah of Input**



Source: Results of the I-O model simulation by the Research Team

The following is a further discussion of a number of sectors that have the potential to balance the contribution of nickel mining and processing, along with a summary of the strategies needed to encourage the growth of these sectors. Most of the recommended sectors below are not supporters of nickel mining or processing, although water supply, waste management, waste, and recycling are expected to be sectors that minimize the environmental impact of nickel mining and processing. The existing secondary and tertiary sectors can be further developed to support agriculture, forestry and fisheries, which are Morowali's primary sectors, in addition to mining. A more detailed analysis in the following section uses a gap analysis approach by focusing on issues that hinder the recommended priority sectors and the policy recommendations needed.

Note: ***The processing and construction sectors simulated in the IO model are not discussed specifically in the following sub-chapters because the scenario inputs are part of other sectors that have been described.***

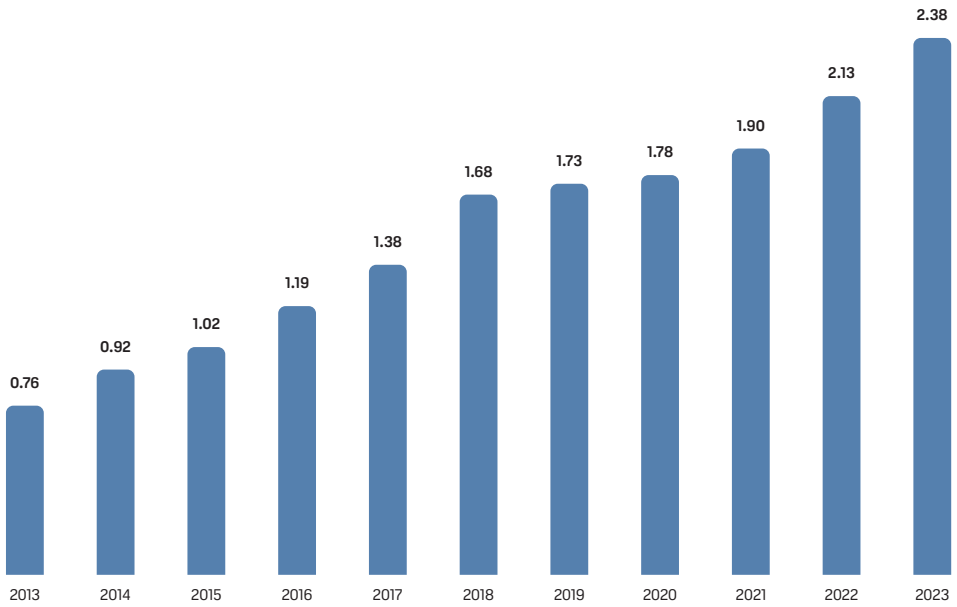
a. All processing inputs are related to agricultural product processing;
b. All construction inputs are related to transportation and logistics, agriculture, and electricity supply.

4.1. Electricity and Gas Procurement

4.1.1. Potential

Although it has not experienced very high growth, electricity and gas procurement has consistently grown from 2015 to 2023. In absolute terms, the average value of the sector's GRDP output in those years has reached at least 2 times compared to 2012-2014.

Chart 45. **Electricity and Gas Sector's Contribution to GRDP for the Last 10 Years (Rp Billion)**



Source: BPS Morowali Regency (2024)

Morowali has great potential for a community-based renewable energy sector. Central Sulawesi Province itself has quite a large potential for solar and wind power. The National Energy Council (2023) in Pristiandaru (2024) stated that this province has a solar energy potential of 6.18 GW and a wind energy potential of 908 MW. Meanwhile, from the same report, Central Sulawesi's mini-hydro and micro-hydro energy is said to have a potential of 370 MW.

Currently, there are several large-scale initiatives that use EBT in the Morowali Industrial Area. For example, there has been an agreement to provide environmentally friendly energy from PT Sumber Energi Surya Nusantara (SESNA) to support nickel ore processing by Nickel Industries (NIC) with the operation of a 200-MWp solar power plant (PLTS) and 20-MWh battery storage in the Indonesia Morowali Industrial Park (IMIP) (antaranews.com, 2023). PLN's subsidiary, PLN Indonesia Power, has also signed an MoU with China Energy Engineering Corporation (CEEC) and Baoshuo Taman Industry Investment Group (BTIIG) for the development of a 5,000-MW renewable energy captive power plant in the industrial area.

Ironically, on the other hand, some areas inhabited by the Morowali community are still experiencing problems with electricity reliability. For example, the Bumi Raya and Witaponda Districts still reported a high frequency of power outages every day as of March 2024, following the transfer of the PLN electricity network from the Kolonodale substation to Morowali (Indonesia Satu Morowali, 2024).

This problem provides an opportunity to complement the large-scale renewable energy projects implemented in the IMIP through community-scale initiatives. Research by 350.org and CELIOS (2024) conducted modeling using the Interregional Input-Output (IRIO) method, estimated that the potential contribution of the sector to GDP from community-scale renewable energy could reach Rp10,529 trillion over 25 years. In addition, the same research stated that the potential impact of community-based renewable energy on total economic output could be worth Rp18,636 trillion.

Because this initiative is community-based, the community can be actively involved in its business activities. This involvement can help create jobs at the community level in an area, increase income, and reduce poverty rates, especially if supported by adequate funding and training for the community and workers involved (350.org & CELIOS, 2024).

4.1.2. Development Strategy

Electricity procurement in Indonesia is generally dominated by the central government. However, the concept of community-based renewable energy (EBT) can be a breakthrough for the Morowali Regency Government in developing this sector. The EBT can consist of a combination of solar power plants (PLTS), wind power plants (PLTBa), microhydro power plants (PLTMH, and ocean wave power plants (PLTGL). In the concept of community-based EBT, power plants are managed by community groups through cooperatives. The Morowali Regency Government can act as a facilitator and mentor for these communities.

Community-Based EBT Case Study: Mixing PLTMH, PLTS, and PLTBa and Pumped Storage Hydroelectricity (PSH)

One of the problems in implementing renewable energy is the disparity between peak electricity supply and demand. In PLTS, peak electricity supply production occurs during the day, while peak electricity demand occurs in the evening and night. The same thing also happens to PLTBa, which depends on the wind speed, and PLTMH, which depends on the water discharge. Thus, energy storage technology is needed to store excess energy produced during peak production so that it can be used during peak energy demand, which usually falls at 17.00-22.00.

In general, this energy disparity can be overcome using batteries. However, batteries have many weaknesses, including their expensive price, storage capacity that continues to decrease sharply with use, the risk of explosions and fires, and the leaking of battery waste, which pollutes the environment. The battery production process also requires the massive mining of various metals and minerals, which can damage the environment. In addition to these shortcomings, there are also limitations in the supply of batteries, which make it impossible for more and more people to switch to renewable energy. Therefore, an alternative energy-storage mechanism other than batteries is needed.

Pumped Storage Hydroelectricity (PSH) can be a cheap and flexible energy storage solution. In simple terms, a PSH can be constructed by building two reservoirs/dams in two adjacent locations with a significant difference in height. At peak production, the excess supply of EBT electricity available from PLTS, PLTBa, and PLTMH is used to pump water from the reservoir/dam below to the dam/reservoir above. At peak electricity loads, water from the upper dam is released to the lower dam; thus, the power of the water current to be used to rotate the PLTA/PLTMH turbines to produce additional electricity when electricity demand spikes.

PSH technology is very easy to create and has been used for more than 100 years. In Indonesia, PSH will only be applied to a giant PLTA with a capacity of 1400 MWh in Cisokan (The World Bank Group, 2021), West Java, in 2025. This amount is very small compared to the potential of 800 TWh that Indonesia has in more than 26,000 points (Silalahi et al., 2022).

Morowali has great potential related to PSH. Geographically, there is a location that allows for the construction of two dams capable of storing 1500 GWh of electrical energy for 60 hours. The two dams are each only 2500 ha in size and require only a 9.5 km connecting pipe. This efficiency is very rare in other Indonesian regions. If studied more seriously, this project could be proposed as a new national strategic project (PSN) that supports the availability of electricity from clean and renewable sources not only in Morowali but also in Central Sulawesi and even throughout Sulawesi Island. The construction of this dam is not only useful for supporting the EBT but can also be used for tourism, irrigation, fisheries, and clean water supply.

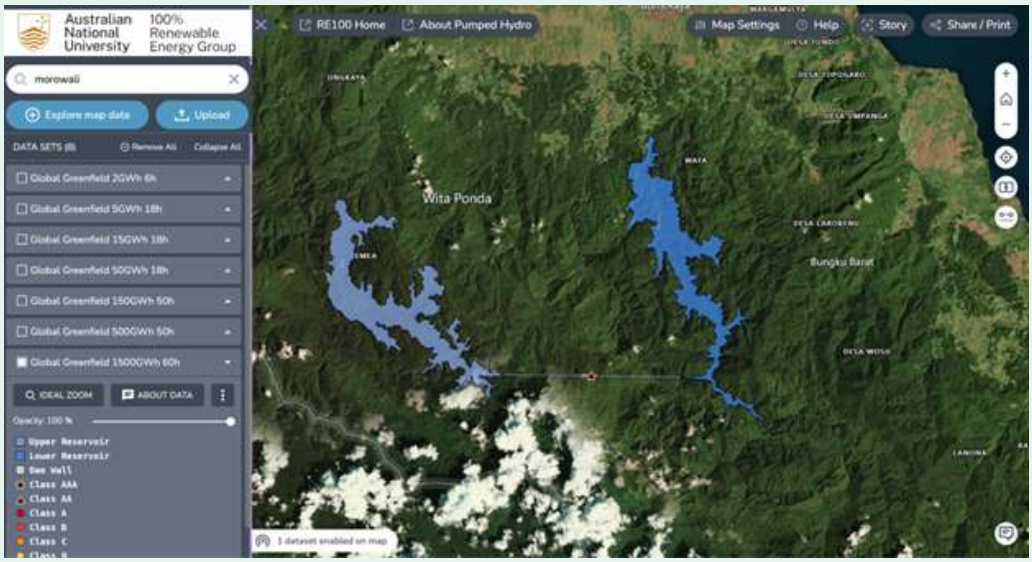


Figure 1. **Map of the most efficient PSH dam construction locations in Morowali**

Source: ANU RE100 Map (n.d.)

In addition to the potential for large-scale PSH development, Morowali could use some former mining basins as lower reservoirs. The Morowali Regency Government only needs to build numerous dams/reservoirs covering dozens of hectares as upper reservoirs. These small-scale PSHs can be integrated into the concept of community-based EBT.

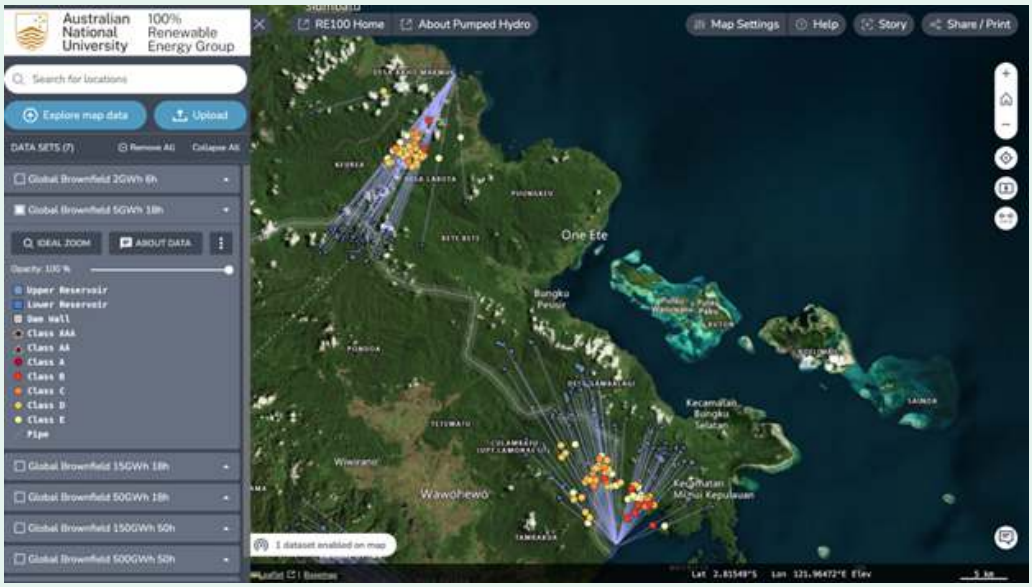


Figure 2. **Map of potential former Morowali mining excavations that can be utilized for PSH with a capacity of 5GWh.**

Source: ANU RE100 Map (n.d.)

In community-based EBT, the Regency Government can act as a facilitator of facilities, provide technical assistance, and provide coaching for community groups that can become EBT managers. The Morowali Regency Government, along with community groups/communities in need, can plan the construction of PLTMH, PLTBa, or PLTS based on the potential in the community environment. The Morowali Regency government, with PLN, can then build a smart electricity transmission network connected to the nearest PSH to stabilize the electricity supply. This smart electricity transmission network can be made decentralized or off-grid from the existing PLN network, or connected to the existing PLN network. The society/community can work together in the construction process, carry out maintenance, and even collect contributions that can be used to cover operational costs and depreciation of the PLTMH, PLTBa, and PLTS that are being built.

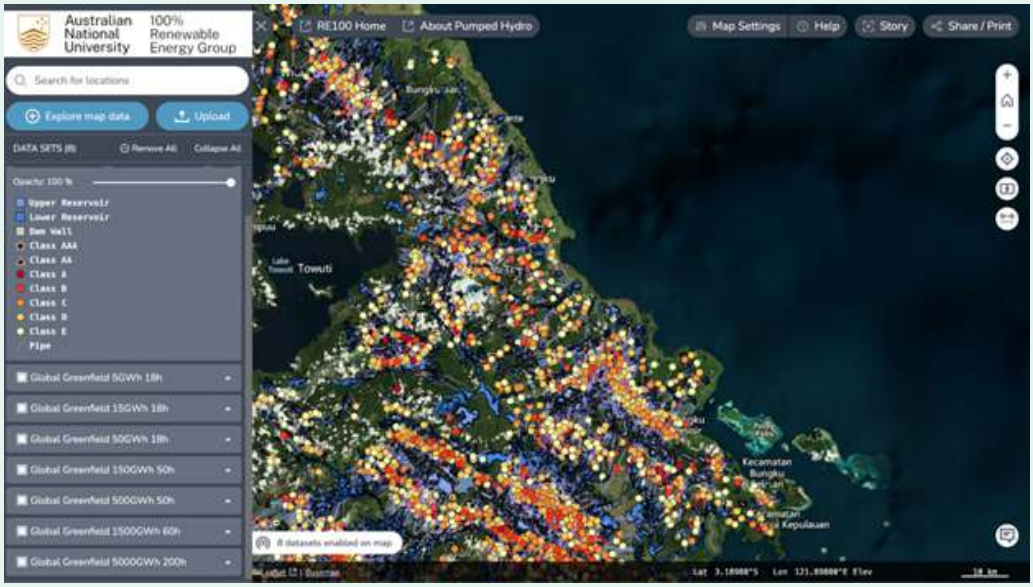


Figure 3. **Map of hundreds of potential PSH points of various sizes in Morowali and its surroundings**

Source: (ANU RE100 Map, n.d.)

4.2. Tourism Services

4.2.1. Morowali Tourism Sector Potential (Including Food and Beverage Accommodation for Tourism)

Morowali made the largest contributor to the number of tourists in Central Sulawesi in 2023, with a contribution of 26% (Central Sulawesi Provincial Government Tourism Office, 2024). The same report also states that after COVID-19, tourist visits to Morowali have increased and even almost tripled in 2023, with a total of 1.34 million tourists. Domestic tourists dominate the number of visits with a portion of more than 95% of all tourists. The research team has not found statistical data related to the value of Morowali's tourism GRDP. However, assuming that one tourist spends an average of 500,000 on accommodation and food, the tourism sector could contribute approximately Rp670 billion to Morowali's GRDP each year. This calculation must be confirmed.

To diversify the Morowali Regency economy, increasing the productivity of the tourism sector is expected to contribute to the welfare and economic value of the local community. This can be initiated by identifying opportunities and challenges in business units, human resources, and workers, as well as by supporting infrastructure development, including road repairs.

Transportation and road quality support will make it easier for tourists to visit. The impact of tourism on the local economy can also be more evenly distributed if tourists are brought to more areas. However, an increase in the number of tourist arrivals must also be anticipated with adequate support, including from the waste management sector.

The Morowali Regional Government also needs to ensure the standardization and certification of tourism businesses so that it is easier to supervise tourism activities that may conflict with the vision of a sustainable economy. For example, waste sorting is a requirement for tourism business certification.

The Morowali Regional Government also needs to improve human resource management and increase its HR capacity. The most basic program that can be implemented is improving foreign language skills. Singapore's experience demonstrates that foreign language skills are an advantage that makes it a favorite destination for tourists from various countries.

Trivia Box 3 **Wildlife Ecotourism**

One of the non-conventional tourism options that can be explored in Morowali Regency is wildlife tourism. Of course, in the context of sustainable wildlife tourism, the one that is developed must be wildlife tourism that prioritizes aspects of conservation and environmental preservation, or what is often referred to as wildlife ecotourism.

The main advantage of this wildlife tourism is that the capital requirement is not as large as that of conventional tourism, as this type of tourism does not require a lot of infrastructure investment. On the contrary, because sustainable wildlife tourism prioritizes conservation and nature preservation factors, the area used as a tourist destination should be preserved as much as possible according to its natural conditions, and the construction of conventional infrastructure, such as hotels or asphalt roads, will actually damage the attraction of this tourism.

The disadvantage of wildlife tourism is the dependence of tourism on biological wealth in the tourist destination area. The areas that can be developed for wildlife tourism include those that are rich in unique and endemic flora and fauna species, as well as those with natural beauty that can serve as tourist attractions. In addition, areas that are used as a wildlife tourism site needs to be conserved to maintain the natural environmental appeal of the area.

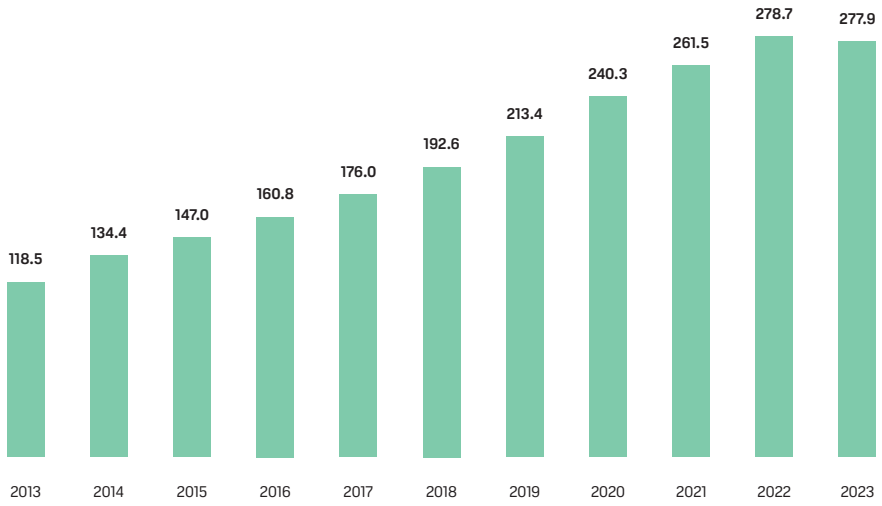
Different from conventional tourist attractions, the target market for wildlife tourism is mostly foreign tourists. Therefore, it requires a different approach to accommodation and marketing than conventional tourist attractions. This target market of foreign tourists can also bring positive synergy with the goal of wildlife tourism proconservation due to foreign tourists' high awareness of environmental preservation and their higher exposure in the international arena.

4.3. Government Administration, Defense, and Compulsory Social Security

The GRDP value of government administration, defense, and mandatory social security has also continued to grow in the last decade. Although the Regency Government has not done much for defense spending, which is the authority of the central government, government administration and mandatory social security can be optimized by the Morowali Regency Government. This is done not only to support economic growth but also to promote economic equality. Therefore, efforts to improve the economy in this sector should be directed toward marginalized communities in remote, outermost, and more remote areas.

Optimization of this sector can be significantly increased by investing in precision data collection processes, such as the Precision Village Data program, which displays not only text and numeric data but also spatial data by name and address in real time. With Precision Village Data, aid distribution will be more targeted, accountable, and ready to be used to optimize priority sectors, such as health, education, youth, social assistance, and employees, and other areas of government administration.

Chart 46. **Administration, Defense, and Social Securities Sector's Contribution to GRDP for the Last 10 Years (Rp Billion)**



Source: BPS Morowali Regency (2024)

a. Health Sector

The first optimization that the Morowali Regency Government can implement is in the health sector. The Morowali Regency Government can collaborate with BPJS Kesehatan to expand the coverage of participants, including both independent participants and those covered by the government. The Regency Government can also increase the number of primary healthcare facilities in rural areas by opening village clinics or providing assistant healthcare centers. Then the Regency Government can also increase the capacity of health centers and regional hospitals to minimize the number of patients referred outside Morowali. In addition, the Regency Government can recruit more health workers, such as doctors, midwives, nurses, pharmacists, and nutritionists, on the condition that the health workers live in the village or sub-district according to their assignment. The Regency Government can also increase weekly Posyandu activities in all RWs in Morowali by completing the necessary facilities and providing incentives for local Posyandu cadres.

The Regency Government can also provide local food-based nutritional assistance to pregnant women, breastfeeding mothers, babies, and toddlers through Posyandu activities. Thus, improving public health will also be accompanied by improving and equalizing the regional economy, as most of the consumption of health workers and public and government spending in the health sector will continue to revolve in the Morowali area, especially in remote or outermost areas.

b. Education and Youth Sector

In the education sector, the Morowali Regency Government can provide more scholarships and school operational assistance to improve learning opportunities and the quality of education. The Regency Government must ensure that the location and costs of elementary, high, and vocational schools are affordable for all levels of society. In higher education, the Regency Government can create regional development scholarship in collaboration with universities both in and outside Morowali.

Scholarship participants must contribute to research that advances Morowali during the college process and return to Morowali after graduating to work for a certain time. The Regency Government must ensure the effectiveness of and expand educational assistance programs, such as KIP, to reduce the dropout rate. In addition, recruiting teachers to live and teach in remote schools can be a driving force for improving the quality of education and driving the Morowali economy.

In the field of youth and sports, the revitalization of the role of youth organizations must be encouraged at both the RT and RW levels. Incentives for youth organization administrators, including providing sports facilities and support for youth activities, can help improve the quality of life for youth and drive the economy to remote areas.

c. Social and Employment Sector

In the social sector, the District Government can optimize many existing programmes such as PKH and Raskin, by expanding the scope of aid recipients and ensuring that aid is truly delivered intact and on target. In the employment sector, the District Government must work together with BPJS Ketenagakerjaan to expand the scope of Morowali workers' participation , including informal sector workers.

d. Other Government Administration Sectors

Increasing government administrative spending in other sectors must be undertaken carefully so as not to simply fatten bureaucracy. Increasing the capacity of the existing apparatus must be prioritized over recruiting a new one. Adopting information technology with a proven *platform is needed to reduce public service bureaucracy.* Recruitment of new apparatuses can be considered based on the needs and distribution of assignment locations; for example, recruiting agricultural and fisheries extension workers domiciled in villages or sub-districts based on assignment location can be prioritized compared to recruiting apparatus who serve in the district capital or sub-district capital. Alternatively, the Regency Government can optimize RT, RW administrators, youth organizations, PKK cadres, and Posyandu as partners in data collection and implementation of government programs by providing training and incentives for program implementation.

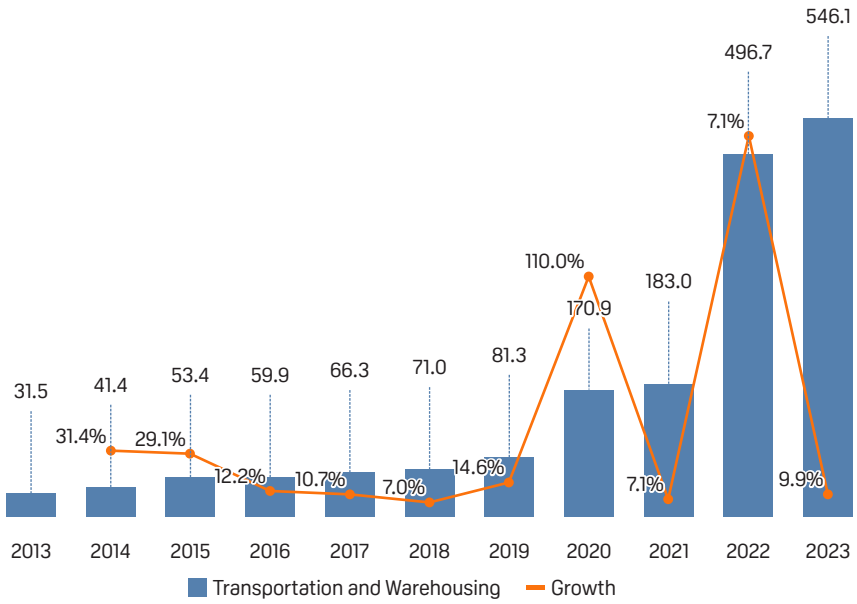
e. Supporting other sectors

The Morowali Regional Government can also support development programs in other sectors by creating a State Civil Apparatus for supervision of the environmental services sector, provide technical assistance for community-scale renewable energy, assist with ecotourism, and support small-scale fish processing industries.

4.4. Potential of the Morowali Transportation and Warehousing Sector

The logistics sector (transportation and warehousing) has experienced fluctuating but relatively high growth in recent years, especially in 2020 and 2022. In the last 2 years, the contribution of GRDP from this sector was above Rp300 billion, up from only Rp27.7 billion in the previous 10 years. In other words, this sector is growing annually with a CAGR (*Compound Annual Growth Rate*) of around 27.99%. Although the growth rate has varied considerably over the past 4 years, the GRDP figure contributed by this sector, which has now reached more than 10 times that of 2013, shows that this sector has great growth potential in the future.

Chart 47. **GRDP Growth from Transportation and Warehousing Sector in the Last 10 Years (Rp Billion)**



Source: BPS Morowali Regency (2024)

However, it is likely that up to now, this growth has mostly come from the transportation of nickel mining/smelter products. Therefore, a strategy is needed to enhance the synergy of this sector and the non-mining sector. For example, the logistics sector can focus on the transportation of fisheries, plantations, and agriculture products.

With a contribution to the 2023 GRDP still very small, namely 0.38%, the transportation and warehousing sector of Morowali still has great potential to grow many times over. The large loading and unloading activities and the high capacity of the Morowali port provide opportunities for much greater growth in the transportation and warehousing sector. However, the poor condition of roads in Morowali, especially district roads, can be a barrier to the growth of this sector, especially in areas outside the special industrial area.

Improving the quality of roads and logistics infrastructure will support the productivity of other sectors, especially those related to the trade of goods. This sector needs to be developed to support the transportation of goods production other than mining/downstreaming . The warehousing sector is also still centered in industrial area parks such as IMIP, while road access to build warehouses outside the special industrial area is very poor. Therefore, warehousing also needs to be developed to support the non-mining industrial supply chain.

4.4.1. Development Strategy

Logistics at *the first mile*, *mid-mile*, or *last-mile* need to be further developed in Morowali for raw material supply chain management, especially for agricultural, forestry, and fishery products.

Logistics and warehousing support for non-mining sector production results that can be developed

a) Fishery

The main logistical support needed is the existence of a fishing port pier that can be docked for ships weighing more than 30 GT. The existence of a pier is needed for a routine transportation route to the Bitung Special Economic Zone and Kendari City. The Bitung Special Economic Zone is the closest Special Economic Zone to a fisheries focus. The new Special Economic Zone has just had a fisheries export route to China and Taiwan in February 2024, after 12 years of establishment. The existence of this route should be optimized by Morowali. On the other hand, the local fish trade with Kendari City must also continue to develop to create a stronger fisheries supply chain. The existence of the Kendari-Morowali-Bitung PP fish transport pier and route will increase Morowali's GRDP from the fisheries sector and even allow Morowali to create its own fisheries Special Economic Zone in the upcoming RPJMN.

The existence of a pier and a fisheries product transportation route needs to be supported by the availability of adequate facilities, such as fuel for fishermen, increasing the capacity of the fishing fleet, and the availability of an ice factory so that the supply of ice cubes is always adequate. In addition, post-catch processing facilities are also needed. The existence of an electric freezer warehouse , a warehouse to support the fish drying, salting, smoking, smoking, and canning industries, is also no less important to develop, along with the rate of increase in catches.

b) Plantation and Forestry

Morowali does not have wide rivers, deep enough, or fast enough to transport forest products and plantation products like Kalimantan. Thus, a solid road infrastructure is needed to transport forest products, such as wood and rattan, as well as plantation products, such as coconuts, in large quantities. The main roads crossing forest products and other industries in Morowali must at least meet the criteria of class II roads, or better yet, class I roads, so that they are not damaged when passed by heavy vehicles.

In addition, a more suitable port is needed for the loading and unloading activities of plantation and forestry products. The existing port in Morowali is primarily designed for loading and unloading mining products. Additional areas are needed for loading and unloading plantation and forestry products, especially if processed plantation products have developed into coconut oil. This requires special ports and warehouses for loading and unloading liquids.

Posh Port, Bumpy Road

Morowali Port ranks third nationally in terms of the weight of goods loaded and unloaded. Unfortunately, the busyness of the port is inversely proportional to the condition of the district roads: 65% are badly damaged, and even the asphalt is no longer visible .

Table 11. **Imports by the Main Import Unloading Port 2021-2022**

Pelabuhan Bongkar	2021		2022		Perubahan Nilai 2022 thd 2021 (%)	Peranan (%) terhadap Terhadap Impor 2022
	Berat (Juta Kg)	Nilai (Juta U$$)	Berat (Juta Kg)	Nilai (Juta U$$)		
Tanjung Priok	34.463,4	75.786,3	37.330,0	89.445,6	18,02	37,67
Tanjung Perak	18.871,0	18.119,0	18.457,4	20.385,8	12,51	8,59
Sukarno Hatta (U)	181,1	20.774,8	185,6	18.854,2	-9,25	7,94
Morowali	16.822,8	6.942,6	18.924,1	10.044,2	44,67	4,23
Batu Ampar	1.733,5	7.268,0	2.117,4	8.697,1	19,66	3,66
Lainnya	105.687,5	67.299,3	106.220,9	90.020,2	33,76	37,91
Total	**177.759,3**	**196.190,0**	**183.235,4**	**237.447,1**	**21,03**	**100.00**

Source: BPS Indonesia (2023)

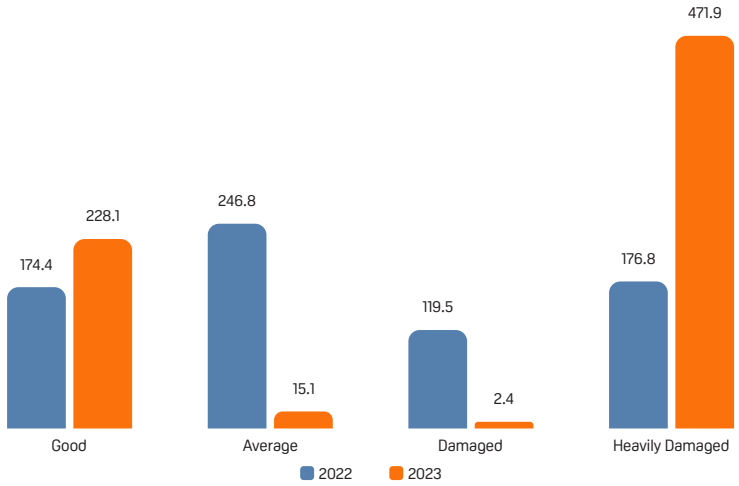
Road damage in Morowali has a direct impact on the contribution of the transportation, logistics, and warehousing sector's GRDP, which is only 0.35% of Morowali's total GRDP. Typically, areas with such busy ports have GRDP from the transportation, logistics, and warehousing sector, which is above the national average of 4.24%.

In addition to the badly damaged roads, the unusually small GRDP of Morowali from the transportation, logistics, and warehousing sectors is also caused by the port loading and unloading activities, which are heavily dominated by mining products, especially nickel. Thus, the large effect of port volume is concentrated only in the special nickel industry area; there is almost no *spillover* exit from the area, except for potholes.

Thus, improving the transportation, logistics, and warehousing sectors in Morowali requires three basic solutions. The first is increasing road capacity and ensuring road repairs. Morowali must have a clear class I road for heavy vehicles, separated from public roads used by smaller motorized vehicles, especially within the city. Second, a port is needed that can accommodate loading and unloading activities outside mining goods. Third, spatial planning regulations are needed regarding the location of warehousing, with adequate road and port access outside the current nickel industrial area warehouse.

Several strategies are needed to improve Morowali's ability to build a logistics industry that supports industries other than nickel. First, there needs to be repair and an increase in road capacity. Data on the length of roads according to road conditions in the Morowali district and city shows that from 2022 to 2023, there has been a significant decline in road conditions. The increase in the length of roads in good condition is exceeded by the increase in the length of roads with severe damage. This indicates an acceleration in the decline in road conditions that exceeds the acceleration of road construction and repair. This condition needs to be addressed by increasing the pace of road construction and maintenance, as well as by establishing a clearer separation between national roads and provincial roads, so that the burden of freight transportation is more proportional to road capacity.

Chart 48. **Road Length According to Its Condition in Morowali (km), 2022-2023**



Source: Public Works Department of Morowali Regency in BPS Morowali (2024c)
Note: This data only includes the length of roads managed by Morowali Regency.

In general, the investment needed for ports for fisheries exports and logistics requires a cost of around Rp82 billion, not including the revitalization of the Bungku TPI, which does not yet have a dock deep enough for ships > 10 GT and a place to moor ships, and is experiencing shallowing problems (Metro Sulteng, 2022).

Table 12. **Recapitulation of the Budget Plan for the Development of the Lafeu Fishing Port**

No	Work Items	Cost in Rupiah
1	Preliminary works	8.587.787.656,33
2	Embankment retaining wall work	54.796.472,51
3	Machine workshop	1.265.991.575,86
4	Cold storage (60 tonnes)	1.569.319.909,58
5	Packing room	1.493.642.651,19
6	Administration office	2.053.170.918,08
7	Fishermen's kiosks	260.015.100,71
8	Fishmarket stalls (retail)	2.149.009.468,74
9	Fishmarket stalls (wholesale)	1.885.239.438,94
10	Kiosks for fishing net repairs	1.616.770.511,67
11	TPI Lafeu ice factory	1.234.206.664,37
12	Water tower	53.065.997,94
13	Inspectorate building	1.099.967.107,92
14	Fishermen's meeting hall	1.633.793.766,21
15	Fishing equipment store	988.231.780,65
16	ATM	87.100.944,13
17	TPI Lafeu Building	2.633.769.604,40
18	Port's palisades and fences	1.791.989.910,87
19	Pier, trestle and mooring works	51.608.881.242,13
	Total	**82.066.750.000,00**

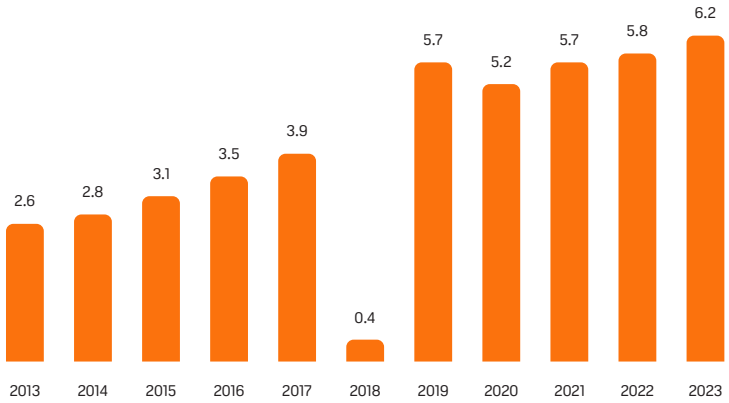
Source: Morowali Regency Regional Trade and Industry Service (2018)

4.5. Water Supply, Waste Management, Waste and Recycling

Water supply, waste management, waste, and recycling are other sectors that need to be considered in efforts to diversify the Morowali economic sector. Although it experienced a drastic decline in 2018, this sector has shown relatively consistent absolute GRDP growth over the last 5 years. This trend indicates a need for this sector.

The current condition of Morowali's carrying capacity also needs to be observed in the context of the need to develop this sector, considering the increasingly massive industrial activities and population growth of Morowali from time to time. The Morowali Regional Government itself also acknowledges that along with the increase in population and the development of economic activities, waste processing solutions such as waste recycling centers and waste banks are urgently needed (Morowali Regency Government, 2022).

Chart 49. **GRDP Growth from Water Supply, Waste Management, Wast and Recycling Sector in the Last 10 Years (Rp Billion)**



Source: BPS Morowali Regency (2024)

4.5. Pengadaan Air, Pengelolaan Sampah, Limbah dan Daur Ulang

Pengadaan Air, Pengelolaan Sampah, Limbah dan Daur Ulang menjadi salah satu sektor lainnya yang perlu dipertimbangkan dalam usaha diversifikasi sektor perekonomian Morowali. Meskipun sempat mengalami penurunan drastis pada 2018, sektor ini menunjukkan pertumbuhan nilai PDRB absolut

1. Water supply

Although the supply of clean water for industrial areas is abundant ("Indonesia Morowali Industrial Park (IMIP)," n.d.). Morowali still has a big challenge in providing clean water outside the industrial area. Morowali needs many clean water reservoirs, especially in rural areas. The provision of these reservoirs can be in the form of reservoirs or dams that are integrated with the provision of electricity based on PLTMH and Pumped Hydroelectric Power Plants. Storage Hydroelectric (HEV).

In addition, Morowali has serious problems in protecting river basins (DAS). Mining activities will increase water runoff and soil erosion by 23% (BRIN, 2023). The water discharge will increase in downstream areas, potentially causing many obstacles in the provision of clean water, such as flooding and mud. A thicker green belt with harder and denser vegetation is needed in the four most affected watersheds, namely the Bahomotefe, Bahopenila, Lamasara, and Dampala rivers.

2. Waste and garbage processing

The Morowali Regional Government or the Central Government needs to issue a waste management regulation related to company activities. Morowali can also cooperate with private parties who have the ability or technology for large-scale waste management, such as waste from industrial activities or waste generated from the presence of workers, such as food packaging waste. These waste management companies can also be a source of new job creation in Morowali.

For household waste, waste banks are one of the solutions implemented in Morowali. Unfortunately, the implementation of waste banks in various regions has experienced many obstacles, leading to a lack of a model for waste management and regional waste banks that can serve as a reference. There is no adequate statistical data to determine the level of success of waste banks in Indonesia, but a number of media outlets have reported that the operations of waste banks in the region are generally on strike or are threatened with strikes. The problems commonly mentioned are limited funds or losses from operational activities, one of which is due to the lack of public interest in dumping waste. This means that the volume of waste obtained is not large enough to be managed and produces enough added value to cover or even exceed operational costs—a condition also experienced by exemplary waste banks, such as the Sicanang Main Waste Bank (see VOA Indonesia, 2022).

In the early years of their operation, household waste banks need to obtain adequate public funding so that they do not become stagnant. This is because, in the supply chain of waste management businesses, community involvement is needed, which must experience behavioral changes, for example in separating waste independently.

In addition, the development steps that can be taken to develop household-scale waste banks include:

a. Formalization of waste banks

The formalization of waste banks as a source of livelihood for the community is very necessary. So far, most waste banks in various other regions are run independently by the community (Setiadi, 2020). The formalization of waste banks also facilitates the creation of new jobs in this sector.

b. Preparation of incentives for the community to sort waste

Behavioral changes are needed to ensure that waste goes to the waste bank. Local governments can position households as waste suppliers by purchasing plastic waste and other waste that is separated from organic waste, allowing it to be recycled with attractive incentives but without causing *moral hazard*. *Moral hazard*: What is meant here is that buying garbage should not result in excessive consumption behavior just to earn income from garbage sold to the garbage bank.

c. Research and development of waste recycling and waste processing supply chains

Waste that has been deposited in the waste bank can be sold to *the recycling industry* or better yet, *upcycling rubbish*. For this program, cooperation with the private sector will be essential.

3. Bioremediation

Bioremediation is defined as "the use of microorganisms to destroy or reduce the concentration of toxic waste in a contaminated area" (Boopathy, 2000).

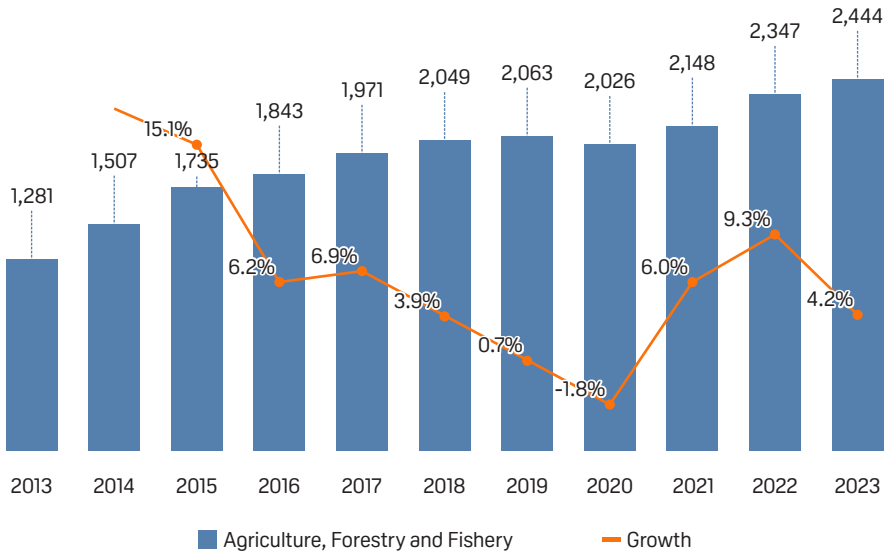
Until now, there have not been many studies from domestic researchers discussing bioremediation in Morowali. However, there is already literature that identifies the types of microorganisms that can be used. For example, a study that identified *Exiguobacterium indicant* and *Bacillus Mobility* as two microorganisms that can reduce the concentration of the heavy metal chromium (Cr) (Maslan, 2022).

To support the development of bioremediation, the government can create special policies that require the use of mining company operational funds for bioremediation .

4.6. Agriculture, Forestry, and Fisheries

Agriculture, forestry, and fisheries are Morowali's primary sectors, whose growth has been relatively stagnant recently (Chart 13). However, the output value of this sector in 2023 is still much higher compared to 2013. This shows that agriculture, forestry, and fisheries can grow even with minimal resource support. Therefore, increasing inputs for this sector can generate even higher growth.

Chart 50. **GRDP (Rp Billion) and Year-on-Year Growth from Agriculture, Forestry and Fishery Sector, 2013-2023**



Source: Processed from BPS Morowali (2024)

No-go zones or the determination of protected areas for agriculture, forestry, and fisheries are needed so that mining activities in Morowali do not continue to have negative impacts that reduce the productivity of these sectors. In addition, each sector also requires a special strategy and has different potentials.

4.6.1. Agricultural Sector (including Plantations)

The agricultural sector is one of the main sectors recommended by the research team to prioritize because it is a primary sector other than mining, which has *a multiplier impact*. greater than other sectors (Vogel, 1994). Some literature also suggests that increasing the productivity of the agricultural sector can reduce poverty (Christiaensen et al. , 2011).

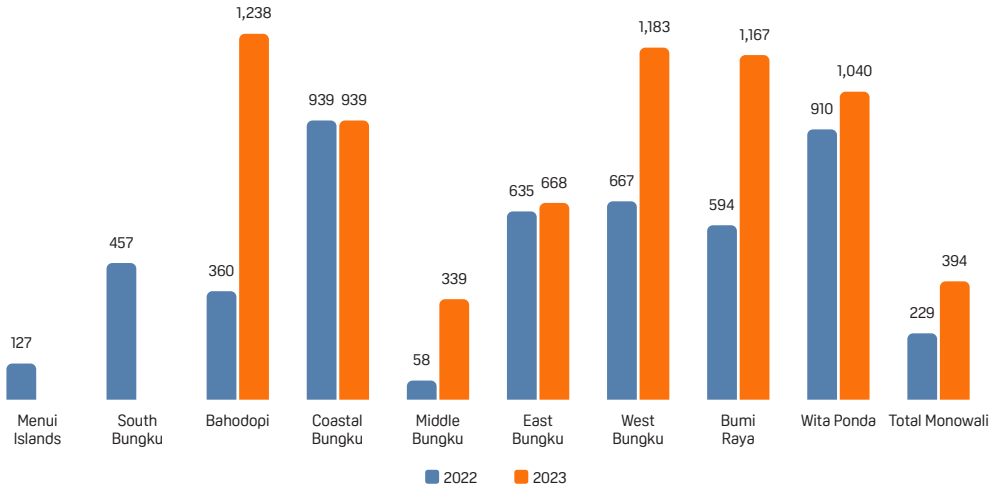
Considering the current skills of the Morowali population, agriculture is still a sector that can be the main source of livelihood. A little additional input in the form of investment in capital goods or increased skills can provide high output. However, in general, agriculture, especially plantations, requires medium-term investment before providing a high enough return.

Key agricultural commodities that can be further developed are as follows:

1) Coconut

Coconut is a major agricultural commodity that can be developed in the Morowali region. From the available data, there was an increase in the productivity of Morowali coconut harvests in 2023 compared to the previous year.

Chart 51. **Coconut Output Productivity (tonne/ha) in Various Districts in Morowali**



Source: BPS Morowali (2024)

At present, most of the Morowali coconut harvest is still sent to coconut processing industry centers outside Morowali to be processed into copra, *Virgin Coconut Oil* (VCO), and traditional coconut oil. There are several possibilities behind this condition. First, the Morowali processing industry, which is currently still focused on nickel processing, has not yet accommodated other commodities. An alternative explanation is that Morowali is not yet competitive enough to process its own coconut harvest, either in terms of cost or quality that meets market demand.

This is very unfortunate because, with the ability to cultivate coconuts, Morowali can build a coconut management center that is efficient in terms of logistics. In addition, this commodity has a lot of potential in Indonesia in general because Indonesia is consistently one of the largest coconut producers in the world (Food and Agriculture Organization , 2024).

In addition, increasing the productivity of coconut plantations is a challenge in itself. Rejuvenation of coconut plants with superior varieties can be a leading program, along with farmer training and fertilizer assistance. The Morowali Regency Government can invest in establishing a BUMD/UPT for coconut commodities, equipped with a center for breeding superior varieties with the latest technology, such as tissue culture, and a demonstration garden for farmer training. For the time being, if there are no resources to process coconuts, the coconut harvest can still be sent to areas around Morowali that require a higher volume of coconut supplies without land expansion.

A multiplier effect of agricultural sector toward processing services can still be improved from this commodity. If the coconut harvest is stable enough, Morowali can invite private partners to open factories or coconut processing centers to develop various derivative products that can be sold with higher margins on the market. As an initial step, copra processing can be continued with the processing of subsequent derivative products such as coconut oil, VCO, and charcoal (coconut briquettes).

2) Orange and Papaya

The increasing number of middle class in Morowali, along with the increasing number of workers from outside Morowali, can increase the demand for local fruit consumption. Oranges and papaya as commodities growing in Morowali have great potential to meet this demand. There was a significant increase in orange and tangerine production, from 1,459 quintals in 2022 to 26,332 quintals in 2023. Papaya also increased, from 4,069 quintals to 16,653 quintals (Central Statistics Agency of Morowali Regency, 2024).

Local Morowali Oranges and Papaya can be made a mandatory menu by catering services operating in Morowali. The Morowali Regional Government can also require modern retailers to provide local Morowali products, including oranges and papaya. Furthermore, if the supply is still sufficient, an orange and papaya processing industry is needed. Orange and papaya processing can be carried out from the UMKM scale to large industries, depending on the availability of raw material supplies and supporting infrastructure. Oranges can be processed into various drinks and foods, such as juice, jam, pudding, sweets, and dodol. Meanwhile, papaya can also be processed into papaya vegetables, chips, papaya mustofa, sweets, sauces, dodol, and canned. Therefore, the *multiplier effect* from the agricultural sector to food supply services can still increase from citrus and papaya commodities.

4.6.2. Forestry Sector

Specifically for the forestry sector, the Morowali Regional Government needs to consider the potential of phytoremediation to reduce the rate of land damage due to mining waste. Phytoremediation is the use of plants to absorb pollutants from the soil.

Phytoremediation refers to the use of plants and soil microbes to reduce the concentration or impact of pollution in the environment (Greipsson, 2011). Furthermore, Greipsson (2011) also refers to phytoremediation as a substitute for technical procedures that “have a more destructive impact on the soil”. The same literature also states that phytoremediation should ideally not exceed 10 years and should be limited to the root area of the plant.

The limitation of this technology is that the application can only be done if the contaminant is not toxic to plants. Here is a comparison of several phytoremediation technologies .

Table 13. **Comparison of some phytoremediation technologies**

Technology	Treatment of contaminants	Main contaminant types	Vegetation
Phytostabilization	Retained in situ	Organic and metal	Cover maintained
Phytodegradation	Attenuated in situ	Organic	Cover maintained
Phytovolatilization	Removed	Organic and metal	Cover maintained
Phytoextraction	Removed	Metal	Harvested repeatedly

Source: Greipsson (2011)

4.6.3. Fisheries (and Marine) Sector of Morowali

The Morowali fisheries sector has become the basis of the economy, supporting the skills of most local people and has high potential in improving the welfare of locals in the long term. However, fisheries resources are very vulnerable to human actions, so they need to be managed carefully and cautiously. Excessive exploitation can cause ecological pressure and reduce the quality of these resources in the long term. Therefore, instead of increasing the exploitation rate, the urgency of increasing the productivity of this sector is urgently needed.

Unfortunately, the facilities provided by the government for the fisheries sector are currently not enough to accommodate the needs of fishermen and small-scale micro-fishery business actors. More than 8,500 fishermen have not been able to receive optimal and equal benefits from the fisheries facilities provided by the local government. For example, out of 8,621 fishermen in Morowali, only 26 of them have a boat size with a capacity of more than 10 Gross Tonnage (GT) **(Table 12)**.

Table 14. **Number of Fishing Boats and Marine Fish Resources in Morowali in 2022**

No	Subdistrict	Boat Size		Number of Sea Water Fish (tons)
		< 10 GT	> 10 GT	
1	Wita Ponda	258	0	3,023.3
2	Bumi Raya	301	0	612.9
3	West Bungku	337	0	963.9
4	Middle Bungku	641	8	2,603.2
5	East Bungku	391	1	1,074.2
6	Bahodopi	219	0	382.6
7	Coastal Bungku	353	4	1,472
8	South Bungku	3,303	9	14,761.8
9	Menui Islands	2,710	0	8,526.9
	Total	**8,595**	**26**	**33,420.8**

Source: Morowali Data Portal (2022a, 2022b)

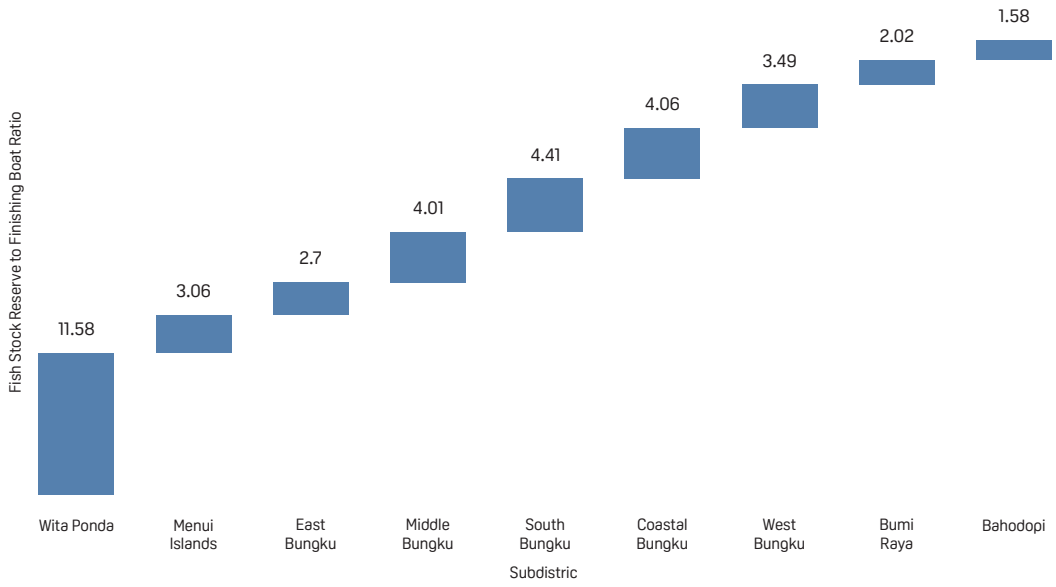
In terms of potential, Morowali has quite diverse fish resources, especially marine fish such as skipjack tuna, mackerel, tuna, shrimp, and others, with a total economic value reaching more than 1 trillion in 2024. **(Table 3 and Table 4)**.

Table 15. **Number of Fish Commodities in Morowali**

No	Types of Fish	Volume (Tons)	Value (Rp Million)
1	Skipjack Tuna	2,536	76,083
2	Cob	2,326	49,489
3	Tuna	3,674	115,482
4	Shrimp	166	8,731
5	Others	24,709	877,718
	Total	**33,411**	**1,127,504**

Source: Central Sulawesi Province BPS (2024)

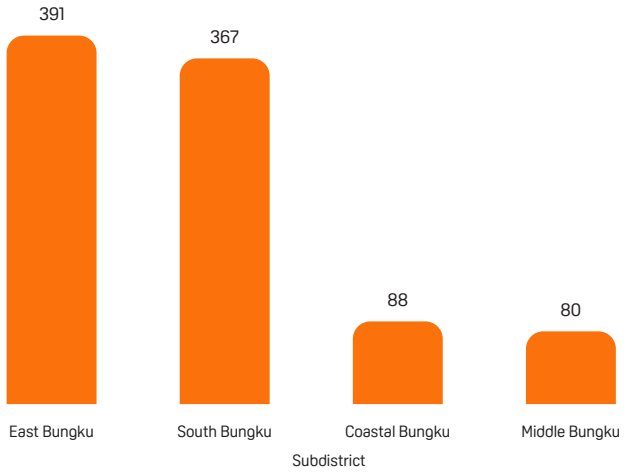
Chart 52. **Ratio of Fish Resources to the Total Number of Fishing Vessels in Various Districts in Morowali**



Source: Processed from Morowali Data Portal (2022a, 2022b)

Morowali fishermen's fishing facilities consist of vessels with a capacity of <10 Gross Ton (GT) and a capacity of >10 Gross Ton (GT). From the data above, it can be assumed that the ratio of Wita Ponda District is still high because the number of fishing boat facilities has not balanced the abundant amount of fish resources in the area. In other words, it has the highest exploitation potential. With this potential, further management and environmentally friendly and sustainable exploitation need to be implemented. The smallest number of fish resources is found in the Bahodopi District, which also has the fewest boat facilities, so its exploitation potential is quite low.

Chart 53. **Large Boat to Small Boat Ratio**



Source: Processed from the Morowali Data Portal (2022b)

Of the 9 sub-districts, only 4 sub-districts have vessels with a capacity of more than 10 GT: Bungku Tengah, Bungku Timur, Bungku Pesisir, and Bungku Selatan. Although the Bungku Selatan sub-district has the most fish resources and fishing boats, the ratio between small boats and large fishing boats is very unbalanced, with 1 large boat to 367 small boats. There is still room for local governments to lower this ratio.

The catch of fish on the Bahodopi Sea coast has started to decline since 2019, forcing fishermen to go further out to sea at higher costs and longer times. The sea water has become cloudy due to waste contamination from the mining area and nickel industry in the *Indonesia Morowali Industrial Park* (IMIP), Bahodopi District. The use of nickel metal, both directly and indirectly, is very harmful to the environment.

Nickel not only pollutes water but also settles in sediments and accumulates in the bodies of living things through the process of bioaccumulation. Accumulated heavy metals have a residence time which can reach thousands of years. The high levels of nickel in this location certainly affect the survival of organisms in these waters. Contamination of nickel and other metals causes physiological disorders in fish, forcing them to adapt and can cause tissue damage to organs such as gills, liver, muscles, and intestines (Lestari et al. , 2024).

Although Morowali Regency Regulation Number 13 of 2023 regulates fisheries management, the implementation challenges are still great. Strategic problems faced in the development of superior commodities in the fisheries sector include several aspects, especially in terms of physical and non-physical facilities and infrastructure that are currently still inadequate. For example, there is no ocean fishing port available, and the electricity supply for the manufacturing process is also inadequate. In addition, basic infrastructure, such as roads and airports that exist are also not able to support Morowali's fisheries business activities. The condition of the road to the production center area needs to be improved, and there is no airport to support direct exports. In addition to infrastructure, increasing the knowledge and skills of human resources in the cultivation and processing of fishery products is essential.

Tempat Pelelangan Ikan (TPI) Matano yang Belum Optimal

Matano Fish Auction Place (TPI) Matano

Fish Auction Place (TPI) is the main facility provided by the local government to support the economic activities of fishermen at sea. TPI Matano is located in Matano Village, Bungku Tengah District, Morowali Regency, Central Sulawesi. TPI is part of a fishing port that serves as one of the infrastructures of the fisheries business system aimed at improving the welfare of fishermen, with TPI Matano Morowali being the largest. This TPI is equipped with ice factory facilities, a place to sell seafood, and fishing equipment. The auction activity of this TPI aims to protect fishermen by providing a fair selling price and money for the proceeds from the sale of fish that is safer and more secure.

Initially, the demands of fishermen's needs in selling their catches, which have high bargaining power, have encouraged the Morowali Regency Government to seek funding from the Ministry of Marine Affairs and Fisheries in order to build TPI facilities. However, this loan proposal was then transferred to the Urban Sector Development Reform Project (USDRP) program and received a loan continuation fund from the World Bank . This loan proposal was approved in early November 2011 with funds of Rp 19.1 billion.

Urgency for the Revitalization of Bungku Port

After being built, TPI Bungku was actually deserted. Fishermen were actually jostling with traders at the Loading and Unloading Port, which also coincided with the activities of cement transport ships. Some fishermen used large vehicles at the loading and unloading ports to transport their catch to TPI Matano. Why did it have to go through the Port and not be taken directly to the port or TPI Matano pier? The community expressed the reason that the TPI Matano Port was narrow and shallow, causing ships to run aground. The shipping costs were also expensive because the catch could not be sold directly without going through TPI screening.

Table 16. **Data on the Condition of Facilities at Bungku Fish Auction Place**

Category	Facility	Capacity	Condition
Basic Facilities	Dock	35 x 8 m	Underutilized
	Boat anchorage	30 x 35 m	Underutilized
	Parking Lot	8 x 20 m	Utilized
	TPI Area Size	40 x 90 m	Utilized
Functional Facilities	TPI Service Office	3 x 6 m	Utilized
	Cold Building Storage	4 x 8 m	Not Utilized
	Ice Factory Building	4 x 8 m	Not Utilized
	Seaweed Building	4 x 8 m	Not Utilized
	Fish Auction Building	6 x 8 m	Utilized
	Electrical installation	4 x 6 m	Utilized
	Clean Water Installation	5 x 5 m	Underutilized
Supporting Facilities	Guardhouse	3 x 4 m	Utilized
	Islamic Prayer Room	6 x 8 m	Utilized
	Bathroom/Toilet	4 x 6 m	Utilized
	Mess	4 x 8 m	Underutilized
	Garbage dump	3 x 4 m	Utilized

Source: Isma (2023)

The quiet fishing activities at TPI Matano have led many TPI facilities to be underutilized or no longer operated. For example, the ice factory facility is still limited because not all islands in Morowali have electricity. This lack of electricity hampers fisheries productivity in Morowali, despite the abundant marine resources the area has. The fish consumption rate in Central Sulawesi Province was 67.36 kg/capita in 2022.

The amount of fish production landed at TPI is also very different compared to the amount of fish landed at non-ports. For example, in 2022, the total fish production landed at TPI Matano reached 338.9 tons. While at non-ports , only the specific production of skipjack tuna could reach 1,374.2 tons.

Despite experiencing a number of problems, fisheries are one of the non-mining sectors that have high potential to be developed in Morowali. Key fishery commodities that have the potential to be further developed are as follows:

1) Potential for Seaweed Cultivation

Types of seaweed that have economic value and the potential to be developed in Morowali Regency include *Eucheuma cottonii* and *Eucheuma spinosum* (carrageenophyte), as well as Gracilaria sp (agarophyte). From the data below, it can be seen that the Bungku Selatan, Menui Kepulauan, and Wita Ponda Districts are the main areas for seaweed production in Morowali Regency. The type of seaweed *Eucheuma cottonii* has long been a source of livelihood for the coastal population of the South Bungku and Menui Islands. This type of seaweed has a fairly high economic value compared to other types of seaweed.

Table 17. **Total Wet Weight of Morowali Seaweed Production 2023**

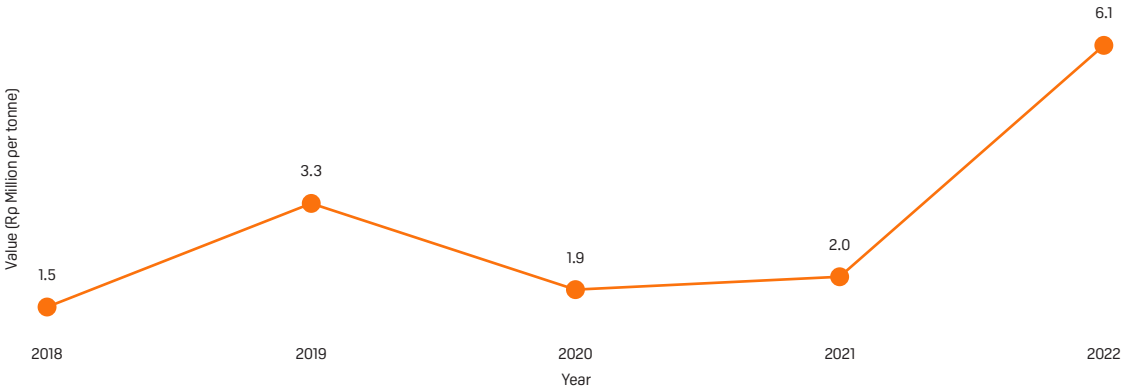
No	Subdistrict	*Gracilaria sp* (Ton)	*Eucheuma Spinosum* (Ton)	*Eucheuma Cottonii* (Ton)
1	Wita Ponda	0	0	9,010.8
2	Bumi Raya	777	0	5,403.6
3	West Bungku	0	0	0
4	Middle Bungku	0	0	0
5	East Bungku	0	0	0
6	Bahodopi	0	0	0
7	Coastal Bungku	0	0	0
8	South Bungku	0	0	6,700.3
9	Menui Islands	0	7,571	4,630.3

Source: Morowali Data Portal (2023)

Unfortunately, high seaweed production in this area does not lead to significant economic welfare improvements for the community. Seaweed is sold as a primary product and does not undergo processing. When *overproduction occurs*, the price drops drastically. In fact, sometimes not all production results can be marketed at a reasonable price. As a result, farmers often leave seaweed without special treatment or simply store it. This condition causes seaweed farmers to limit the area of their planting land (Ya'la, 2008).

This is due to the price game determined by collectors and buyers. People usually borrow capital from collectors to start businesses and meet their daily needs. However, in practice, the harvest is sold at a very low price, and often the income obtained is used only to pay debts. Seaweed management by coastal communities in Morowali Regency is still traditional, with the use of relatively low production inputs and limited to local seeds. Many farmers have not carried out intensive repairs or maintenance. However, this type of seaweed is resistant to disease, so even with simple techniques and minimal management, farmers can still enjoy and produce products that are fit for consumption.

Chart 54. **Per-tonne Value (Rp Millions) of Seaweed Produced in Morowali; 2018-2022**



Source: Processed from BPS Central Sulawesi Province (2024a)

Seaweed Commodity Development Strategy

As a legal basis to encourage the development of marine aquaculture businesses, the government has stipulated Presidential Decree No. 23 of 1982 concerning the development of marine aquaculture in Indonesian waters. The development of the seaweed industry from upstream to downstream has strategic value, covering everything from cultivation, processing, to research and development activities.

Most of the added value of seaweed commodities lies in the processing industry. Therefore, the development of seaweed cultivation must be followed by the development of adequate processing industries or agro-industry. Seaweed can still be processed into various products using traditional methods, such as nori, carrageenan , fish sausage, and jelly . For example, the type of carrageenan agro-industry business in various villages in Morowali shows figures that meet the eligibility requirements, with the highest yield of pure carrageenan located in Jawi-Jawi Village , which is around 30%. The payback period of the carrageenan industry in Morowali is also relatively short, at 3 years and 5 months. It has shown a positive figure and IRR (*internal rate of return*), which is above the prevailing bank interest rate.

2) Potential of Capture Fisheries Results

a) Skipjack tuna

Skipjack tuna, in addition to being used as a domestic consumption material, is also a significant export commodity. This fish should be able to play an important role in increasing fishermen's income and increasing the country's foreign exchange if managed properly. In various processing industries, skipjack tuna is usually used as a raw material for products such as skipjack tuna fufu, kayu fish, canned fish, and skipjack tuna floss because of its good meat texture and high taste. Skipjack tuna is usually exported in various forms, such as fresh, frozen, and processed.

Table 18. **Volume and Value of Morowali Skipjack Tuna Production 2019-2022**

2019		2020		2021		2022	
Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)
3,304	44,611	2,810	68,700	2,466	41,169	2,536	76,083

Source: Central Statistics Agency of Central Sulawesi Province (2024)

b) Tongkol

The tongkol commodity in Morowali is relatively high, with an average production of 2,992.2 tons with an average production value reaching Rp46.7 billion.

Tabel 19. **Volume and Value the Tongkol Fish Morowali Production 2019-2022**

2019		2020		2021		2022	
Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)
2,017	22,929	2,679	54,267	3,972	60,479	2,325	49,489

Source: Central Statistics Agency of Central Sulawesi Province (2024)

c) Tuna

The tuna commodity in Morowali is relatively high, with an average production of 2,992.2 tons with an average production value reaching Rp46.7 billion.

Table 20. **Volume and Value of Morowali Skipjack Tuna Production 2019-2022**

2019		2020		2021		2022	
Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)
2,681	75,848	2,180	72,176	1,073	18,684	3,674	115,482

Source: Central Statistics Agency of Central Sulawesi Province (2024)

Tuna is a fish with significant economic value in Indonesia. Regions reliant on tuna as the focus of management must undergo various intensive preparations. Tuna management cannot be treated the same as other fish resources because tuna is an export commodity that requires special handling. Local governments are required to provide adequate facilities and infrastructure to support this. In addition, cooperation between management regions is very important, considering the vast tuna migration area. Thus, an effective integrated management strategy is needed to maximize the utilization of tuna resources.

Indonesia's tuna market is mostly exported to the United States, reaching 75% or worth 162.12 million USD. The remaining exports are aimed at Japan at 9%, Vietnam at 5%, France at 3%, Australia at 2%, and other countries at 6%. The orientation of fisheries exports, especially tuna in Indonesia, is still in the form of raw materials, so there is no added value in the product (Nugroho, 2024).

d) Shrimp

Table 21. **Volume and Value of Morowali Shrimp Production 2019-2022**

2019		2020		2021		2022	
Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)
1,502	22,488	126	4,862	180	4,961	166	8,731

Source: Central Statistics Agency of Central Sulawesi Province (2024)

Capture Fisheries Sector Development Strategy

(1) Standardization of Fish Processing Business Actors

In 2023, the Ministry of Maritime Affairs and Fisheries issued a Certificate of Eligibility for Processing (SKP) for 5,703 Fish Processing Units, an increase of 114% compared to the previous year. In Morowali, there are only around 91 micro-smallfish processing units registered, and there are no medium-large fish processing units.

Based on data from the Ministry of Maritime Affairs and Fisheries in 2019, fish processing business units in Central Sulawesi are still dominated by micro and small businesses, with a total of 1,442 units, in contrast to medium to large-scale fish processing businesses which only number 9 units. In Morowali itself, there are only micro and small fish processing units that have experienced a significant reduction in 2022. Due to limited funding, technology, and human resources, micro and small-scale fish processing businesses face difficulties in producing high value-added products. Even so, the large number of micro and small-scale businesses can provide a new opportunity to start a fishery product downstreaming program in Morowali.

Table 22. **Number of Fish Processing Units in Morowali 2019-2021**

Business Scale	Province	Regency	2019	2020	2021
Total	Central Sulawesi	Morowali	500	500	500
Micro Small			500	500	500

Source: Ministry of Maritime Affairs and Fisheries (nd.)

(2) Standardization required for fisheries exporters/entrepreneurs

Standards for the fisheries sector have been updated in the Regulation of the Minister of Maritime Affairs and Fisheries (Permen KP) Number 14 of 2021 concerning Standards for Non-Food Fishery Products and Development of Fishery Product Quality Standards, and Permen KP Number 59 of 2021 concerning Increasing the Added Value of Fishery Products.

Table 23. **Volume of Central Sulawesi Fisheries Export Results (units: tons)**

Province	2018	2019	2020	2021	2022	2023	2024
Central Sulawes	5,814	3,493	1,355	2,552	1,010	2,417	992

Source: Ministry of Maritime Affairs and Fisheries (nd.-a)

Standards for Assuring Fish Health, Quality, and Safety of Export and Domestic Fishery Products include:

a. Health Publishing SOP Certificate for Fish and Fishery Products MP and HP Based on CKIB or HACCP and End Product Testing;
b. Health Publishing SOP Certificate for Fish and Fishery Products MP and HP Based on CKIB and HACCP;
c. Health Publishing SOP Certificate for Fish and Fishery Products or Domestic Fish and Fishery Product Health Certificate for the Release of Carrier Media Based on End Product Testing (End Product) Product Testing);
d. Health Publishing SOP Certificate for Fish and Fishery Products or Domestic Fish and Fishery Product Health Certificate for the Release of CKIB-Based Carrier Media;
e. Health Publishing SOP Certificate for Exporting Fish and Fishery Products.

A Case Study of Good Practices in the Thai Union Group

Thai Union Group implements a business model that focuses on sustainability and compliance with fisheries industry standards. The company ensures that all fish obtained come from fisheries that have Marine Stewardship certification. Council (MSC) or those involved in Fishery Improvement Projects (FIPs).

Significant investments are being made to support regulatory and sustainability standards in their fishing practices. For example, plans to invest $90 million to ensure that all of their tuna supplies come from fisheries certified by *Marine Stewardship Council* (MSC) or are involved in *Fishery Improvement Projects* (FIPs). The Thai Union aims to achieve at least 75% of their target by the end of 2020, sourcing tuna from around the world that adheres to stringent standards and is MSC certified, which is claimed as the gold standard of seafood sustainability by global experts.

Thai Union was ranked first in the inaugural Seafood Stewardship Index (SSI) for its contribution to the UN's Sustainable Development Goals (SDGs). Thai Union operates processing facilities around the world, transforming raw fish into ready-to-eat products. These products are distributed through a global network of retailers and distributors, reaching international consumers.

(3) Potential for Development of Downstream Fisheries

Table 24. **Volume and Value of Marine Capture Fisheries Production Morowali Regency 2019-2022**

Commodity	2019		2020		2021		2022	
	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)	Production Volume (tons)	Production Value (Rp Million)
Shrimp	1,501.56	22,488	126	4,862	180	4,961	166	8,731
Tuna	2,681.00	75,848	2,180	72,176	1,073	18,684	3,674	115,482
Skipjack Tuna	3,304.50	44,611	2,811	68,700	2,466	41,169	2,536	76,083
Cob	2,016.80	22,929	2,679	54,267	3,973	60,479	2,326	49,489

Source: Central Statistics Agency of Central Sulawesi Province (2024)

Table 25. **Comparison of Fish Consumption Rates Between Sulawesi Provinces 2022**

No	Province	Fish Consumption Rate (kg/capita/year)
1	West Sulawesi	66.10
2	South Sulawesi	69.53
3	Central Sulawesi	67.36
4	Southeast Sulawesi	73.38
5	North Sulawesi	74.84

Source: (Ministry of Maritime Affairs and Fisheries, nd.-a)

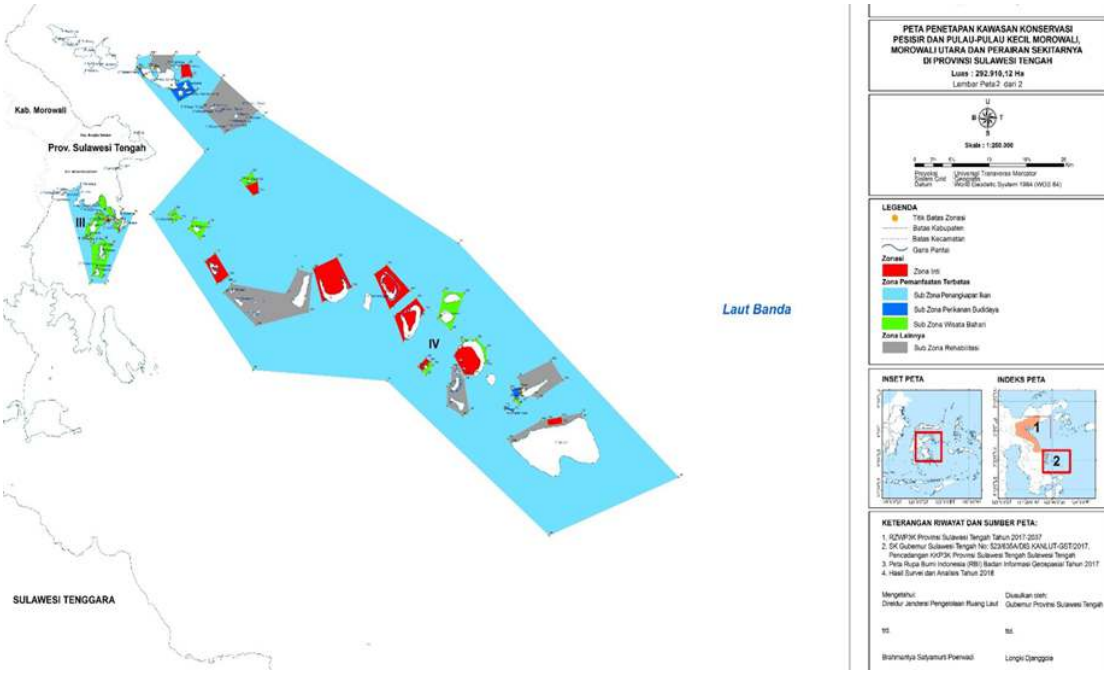
Potential environmental services for coral reef conservation

The Morowali coral reef cluster is part of the Lesser Sunda-Banda Seascape, covering the provinces of Bali, NTB, NTT, South Sulawesi, Southeast Sulawesi, Central Sulawesi, and Maluku. The Lesser Sunda-Banda Seascape is included in the coral reef conservation area that will be revitalized in *the debt agreement for nature swap* between Indonesia and the United States (*Ministry of Marine Affairs and Fisheries*, n.d.). In the agreement, the US will transfer Indonesia's debt repayment obligations worth 35 million US dollars for coral reef conservation activities. This potential funding can be utilized by the Morowali district to improve coral reef conservation, which is very important for the sustainability of the capture fisheries sector and has the potential to develop into a conservation-based marine tourism area.

Coral reefs in Morowali have been designated as a regional conservation area (KKD) of Morowali-North Morowali in the Decree of the Minister of Marine Affairs and Fisheries no. 52/KEPMEN-KP/2019. Specifically, the Decree regulates coral reef conservation areas in Morowali into areas III and IV, covering an area of 8,387.15 ha and 243,739.89 ha, respectively. These areas include coral reefs, seagrass beds, mangroves, turtles, dolphins, lemuru, mackerel, skipjack tuna, whale sharks, clams, and sea bamboo. Although it has been designated as a regional conservation area, the coral reefs in the area are in very dire condition. There is only 23.4% live coral reef cover in the area, so the coral reefs in KKD Morowali are included in the damaged category (Salanggo et al., 2022).

This condition is very urgent to be fixed considering that damage to coral reefs will immediately impact the decline in capture fisheries. Seeing the urgency of the current coral reef conditions, the Morowali regional government can immediately work together with the parties that manage *the debt swap program for nature* like The Ministry of Marine Affairs and Fisheries (KKP), as well as with bilateral and multilateral debt creditors. This will help include the Morowali coral reef area, significantly revitalized through the scheme. The Morowali Regency Government can also provide funding for coral reef area improvements through other schemes, such as conservation and environmental services.

Figure 4. **Map of the Morowali Conservation Area and its surroundings**



Potential and Challenges of Each Sector Recommended as a Priority Sector in the Diversification Program

Sector	Potential	Challenge
Procurement of electricity and gas	• *Community-based renewable electricity* • *Pumped storage hydroelectricit*	• HR Readiness • PLN smart electricity network readiness
Tourist	• Marine tourism • Natural tourism	• Marine pollution from mining • Readiness of road infrastructure and accommodation
Government administration and compulsory social security	• Equal distribution of teachers to remote areas • Equal distribution of health workers and services to remote areas • Increasing BPJS Health and Employment membership	• Incentives, facilities and work security in remote areas • Involvement of informal sector workers in BPJS Health and Employment membership.
Transportation, logistics and warehousing	• The Kendari-Morowali-Banggai-Bitung sea fisheries toll road. • Heavy vehicle logistics and warehousing	• The absence of a fleet of ships transporting fishery products. • Road damage and low road class.
Water Supply, Waste Management, Waste and Recycling	• Can supply services to nickel mining and processing companies (especially for waste management and recycling) • Can help minimize the impact of nickel mining and processing (especially for waste management and recycling).	• It is likely that workers from outside Morowali will have to be involved. • Needs *upskilling* (skills improvement) which is quite significant if it involves native Morowali workers. • It is likely to require quite a large amount of capital if you manage company waste and mining smelters .
Construction	• Construction of class I roads • Twin dam construction	• Land acquisition • Local contractor readiness

Sector	Potential	Challenge
Fishery	• Abundant fish stocks • Demand for foreign tuna is high with high selling value • Requires relatively small capital expenditure to obtain much larger output . The number of motorized vessels in Central Sulawesi is currently relatively small. The addition of motorized vessels can increase the productivity of fishermen's catches and income or profit per catch session. • Labor absorption is relatively large compared to nickel mining and processing, which tends to be machine-based. The value of GRDP growth needed to absorb labor is relatively small compared to the nickel mining and processing sector. • Relatively in accordance with the population's skill profile, geographical position, and natural potential of Morowali. Morowali's marine fisheries are the largest in Central Sulawesi (33,411 *tonnes* in volume or equivalent to Rp1,127,504,400 (US$69,100)). Morowali has the largest tuna population in Central Sulawesi. • Still has great potential that has not been developed much, especially aquaculture. • It can be a sector that helps maintain food security in Morowali and its surroundings. • In line with the vision of the *Sustainable Development Goal* of Central Sulawesi Province to develop the fisheries sector. • Can utilize existing nickel supply chain supporting facilities, such as ports, energy infrastructure, road access and transport vehicles.	• Fishing facilities and infrastructure, such as the deserted Fish Auction Place (TPI), have resulted in fishermen switching to the cement loading and unloading port at Syahbandar Port, where, in addition to being crowded with other traders, there is also a risk of being hit by heavy goods. • Limited electricity supply for the operation of the ice factory at TPI as a storage and processing facility for fishery commodities. • Reliable fuel supply that is affordable for fishermen due to the limited subsidized fuel for small fishermen. • Needs *upskilling* which is quite substantial. For example, fishermen need to be equipped with skills in operating motorboats and modern fishing gear. • It is necessary to observe the level of pollution from mining and nickel smelters on the waters and fishery commodities that will be developed (Bahodopi Sea). If the pollution causes a contamination hazard, then there is a possibility that there will be very few fish populations that can be caught for sale. Alternatively, it can develop a *Recirculated Aquaculture System* (RAS) or recirculation fisheries cultivation system that is not too susceptible to pollution from surface water sources. In addition, a silvofishery or wanamina system can also be developed , namely a fisheries cultivation system that is integrated with mangrove forest conservation that can reduce heavy metal pollution on the coast.
Agriculture and plantations)	• Positive trends in the production of certain crops indicate potential demand for agricultural and plantation products. For example, there was a significant increase in orange production from 1,459 quintals in 2022 to 26,332 in 2023. Papaya production also increased from 4,069 quintals to 16,653 quintals. • Labor absorption is also quite large. The value of GRDP growth needed to absorb labor is relatively small compared to the nickel mining and processing sector. • It can be a sector that helps maintain food security in Morowali and its surroundings.	• The current condition of Morowali's agricultural sector is increasingly squeezed by the mining sector. In addition to reducing land area, land pollution from massive mining activities also threatens the sustainability of land potential for agricultural commodities. • At present, dependence on palm oil commodities is quite high. • Data for the application of precision agriculture (soil condition data, weather and climate data, fertilizer distribution and use, etc.) is still insufficient. • Land degradation due to nickel mining or processing is likely to result in a decrease in agricultural output that is safe for consumption in a number of areas in Morowali.

Key Risks and Mitigation of Each Sector's Development

Sector	Risk	Mitigation
Procurement of electricity and gas	**Implementation** • Stability of quality, quantity and sustainability of electricity supply from renewable energy • Inter-regional conflict over the distribution of electricity resources • Fire or electric shock **Side effects** • Disruption of aquatic or air animal migration routes	**Implementation** • Institutionalization of community-based renewable energy installation and monitoring activities through BUMD or BumDes • Establishment of communication and discussion forums between villages regarding the use of shared infrastructure. **Side effects** • Adequate ecological studies • Creating fish lanes so as not to disrupt the migration patterns of aquatic animals • Ensure there are no windmills in bird migration areas
Tourism services	**Implementation** • Overcapacity of transportation infrastructure. • Degradation of tourist areas. **Side effects** • Rising cost of living and transfer of land ownership. • Prostitution, alcohol and drugs	**Implementation** • Good land, sea and air traffic management. • Provision of public transportation. • Supervision at tourist sites. **Side effects** • Enforcement of regulations regarding zoning and land ownership.
Government Administration, Defense, and Compulsory Social Security	**Implementation** • Increasing staffing burden. • Increasing burden of health subsidies. **Side effects** • Increased inflation due to increased consumption. • Over Capacity of Health Facilities	**Implementation** • Prioritization of promotion-based mutations over new recruitment • Early retirement program • Increasing independent participation **Side effects** • Community savings program • Increasing the capacity of health facilities
Transportation, Logistics and Warehousing	**Implementation** • Increased risk of traffic accidents. • More complex traffic management. **Side effects** • Rising vehicle pollution.	**Implementation** • Improvement of road and transportation infrastructure. • Improvement of traffic flow engineering. **Side effects** • Regulation and enforcement of vehicle emission standards.
Water Supply, Waste Management, Waste and Recycling	**Implementation** • Contamination of clean water channels. • Leaks and pollution from waste and sewage treatment plants **Side effects** • Increased population of scavengers and slums around waste processing sites.	**Implementation** • Sterilization of raw water and routine maintenance of the network. • Standardization of waste and garbage processing center design • Maintenance and inspection of waste and garbage processing centers. **Side effects** • Closed and clean *(lean) processing* without residual waste

Sector	Risk	Mitigation
Processing	**Implementation** • Industrial waste • Underage workers **Side effects** • The low-wage job trap with no career path	**Implementation** • Standardization of waste processing • Standardization of employee recruitment procedures **Side effects** • Vertical and horizontal synergy with related industries, especially large and medium industries, which enables career change. • Skills training and certification
Construction	**Implementation** • *Cost overrun* • Construction failure • Work accident **Side effects** • Increased air pollution in areas around infrastructure development areas • Ecological impacts and land use that disrupt biodiversity	**Implementation** • Supervision of procurement of goods • Contractor qualification improvement • Transparency and oversight of the tender process • AMDAL process improvement • Adequate material selection • Occupational Health and Safety (K3) Management **Side effects** • AMDAL process improvement • Installation of dust filters and other devices that minimize pollution • Ecological studies and adequate planning
Agriculture, Forestry and Fisheries		
Agriculture	**Implementation** • Stability of quality, quantity and sustainability of coconut processed supply from community plantations **Side effects** • Excessive land expansion	**Implementation** • Institutionalization of agricultural and plantation production through BUMD/BumDes/Cooperatives **Side effects** • The focus of agricultural and plantation commodity development is on increasing productivity from year to year. • *No go zone* or areas free from mining and heavy metal industry.
Kehutanan	**Implementation** • Suitability of metal accumulator plants with the climate and soil conditions of Morowali • Governance of phytoremediation is not yet clear • Good technical implementation of cultivation **Side effects** • The economic value of forestry products is still low	**Implementation** • *Pilot project* in collaboration with phytoremediation experts • Restorative economic model - restoring damaged land or forests by relying on sustainable and inclusive production processes. • Clarify spatial planning and conservation areas so that they do not overlap with mining/smelter areas. Prevent the release of forest areas. **Side effects** • Good technical implementation of cultivation

Sector	Risk	Mitigation
Capture Fisheries	**Implementation** • Types of vessels and fishing gear that are less suited to the needs and capabilities of local fishermen. • Reliable and affordable fuel supply • The infrastructure that was built did not meet the needs, for example, a freezing warehouse was built to accommodate the needs of an ice cube factory. • Assistance with production equipment and product quality certification for fish processing businesses is not well targeted and effective. **Side effects** • Overfishing above sustainable thresholds	**Implementation** • Direct verification and involvement of local fishing communities in program planning and implementation. • Coordination with Pertamina • Direct verification and involvement of local fishing communities in the planning and implementation of aquaculture infrastructure development programs. • Direct verification and ongoing assistance in fish processing businesses. • Supporting facilities in the form of machine and tool repair centers, *workshops*, etc. **Side effects** • Consistent determination of fishing zones and conservation zones
Aquaculture	**Implementation** • Good silvofishery cultivation procedures in Morowali. • Incentives for farmers to adopt the *silvofishery system*. • High initial investment costs. • Requires contractors, management, technicians and operators with specialized skills. • Reliability of electricity supply. **Side effects** • Pollution from aquaculture waste. • Deforestation *mangroves*.	**Implementation** • Opening of pilot cultivation areas with assistance from academics and expert practitioners *silvofishery*. • *Mangrove* seeds, fish seeds, operational costs, training and mentoring for novice cultivators. • Embracing investors with ease of licensing, security and legal protection, provision of land for cultivation areas, tax incentives, and increased infrastructure reliability. **Side effects** • Mandatory wastewater treatment installation. • Application of wanamina/*silvofishery*.

4.7. Welfare Achievement Indicators

The estimated impact of economic diversification that has been simulated in the previous chapter on the target achievements of the Morowali Regency Government can be seen in the three tables below.

Table 26. **Impact on GRDP Achievement and the Environment**

Scenario	Contribution of the Manufacturing Industry	Contribution to the Provincial GRDP	Greenhouse Gas Emissions	Environmental Quality Index
Electricity and Gas Procurement	▲	▲	▼	▲
Tourism services	—	▲	▲	—
Government administration, defense, and compulsory social security	—	▲	▲	—
Transportation, logistics and warehousing	▲	▲	▲	▼
Water, waste and sewage treatment	—	▲	▼	▲
Processing	▲	▲	▲	▼
Construction	▲	▲	▲	▼
Agriculture, Forestry, Fisheries	▼	▲	▼	▲

▲ Increase ▼ Decrease — Same

Source: Processed from the Directorate of Macro Planning and Statistical Analysis BAPPENAS (2024)

The biggest impact on the achievement indicator of the Contribution of the Manufacturing Industry lies in the development of the Electricity and Gas Supply sector, followed by the Transportation, Manufacturing, and Construction sectors. These four sectors are important in developing the infrastructure needed for the growth of the manufacturing industry. On the other hand, the development of the Agriculture, Forestry, and Fisheries sector will naturally reduce the proportion of the manufacturing sector in the GRDP.

The development of the EBT-based Electricity Procurement, Water, Waste and Waste Management, and Agriculture sectors will relatively reduce or at least mitigate greenhouse gas emissions. Other sectors still have a negative effect on greenhouse gas emission levels, although in practice, this will be mitigated by the assumption of using electricity from clean and renewable energy sources. The same thing also applies to the environmental quality index.

Table 27. **Impact on Poverty, Entrepreneurship and Employment Outcomes**

Scenario	Poverty Level	Proportion of the Number of Small and Medium Industries	Regional Entrepreneurship Ratio	Job Creation
Electricity and Gas Procurement	▼	▲	▲	▲
Tourism services	▼	▲	▲	▲
Government administration, defense, and compulsory social security	▼	—	—	▲
Transportation, logistics and warehousing	▼	▲	▲	▲
Water, waste and sewage t reatment	▼	▲	▲	▲
Processing	▼	▲	▲	▲
Construction	▼	▼	▼	▲
Agriculture, Forestry, Fisheries	▼	▲	▼	▲

▲ Increase ▼ Decrease — Same

Source: Processed from the Directorate of Macro Planning and Statistical Analysis BAPPENAS (2024)

The potential for poverty alleviation and increasing employment opportunities lies primarily in the electricity supply sector, which has a high *linkage effect to other economic sectors* and *a multiplier effect*. high to the economy as a whole. Apart from the Electricity Procurement Sector, the Tourism Sector and the Construction Sector also have quite a large effect on indicators of poverty achievement, small and medium industries, entrepreneurship, and job creation.

Table 28. **Impact on Capital Formation and Welfare**

Scenario	Gross Fixed Capital Formation	Households with Access to Decent, Affordable, and Sustainable Housing	Percentage of Independent Villages
Electricity and Gas Procurement	▲	▲	▲
Tourism services	▲	—	▲
Government administration, defense, and compulsory social security	—	▲	▲
Transportation, logistics and warehousing	▲	▲	▲
Water, waste and sewage t reatment	▲	▲	▲
Processing	▲	—	▲
Construction	▲	▲	▲
Agriculture, Forestry, Fisheries	—	—	▲

▲ Increase ▼ Decrease — Same

Source: Processed from the Directorate of Macro Planning and Statistical Analysis BAPPENAS (2024)

For the indicators of capital formation and the welfare of village communities, the development of sectors that have the greatest effect is in the Transportation, Water, Waste, and Waste Management sectors. However, beyond that, the development of the Electricity Procurement and Agriculture sectors is very necessary to create independent villages, both economically and economically. It is hoped that with the combination of the development of the electricity sector through EBT, enhancing transportation infrastructure, and the improvement of agriculture , villages in Morowali Regency can become more independent and sustainable in the areas of energy, food, and job creation.

5 Policy Support

Program Name	RPJMN-RPJMD Conformity Indicators	Central Government Support	Provincial Government Support	District Government Support
Purchase of solar panels, micro hydro generators , and windmills, community-based renewable energy management	• Reduction in GHG emission intensity (%) • Environmental Quality Index • Regional Green Economy Index • Portion of EBT in Primary Energy Mix (%) • Electricity consumption per capita (kWh), • Primary energy intensity (BOE/Rp billion)	• EBT fiscal incentives • Smart network development renewable energy grid • Development of industrial scale renewable energy	• Medium-scale renewable energy development • Medium-scale community-based renewable energy development	• Development of household scale renewable energy • Small-scale community-based renewable energy development
Tourism promotion, improving tourism facilities, developing the creative economy	• Number of Foreign Tourist Guests (Thousand People) • Proportion of Creative Economy GRDP to National Creative Economy GDP (%) • Proportion of the number of non-agricultural small and medium enterprises • Proportion of the number of small and medium industries • Regional Entrepreneurship Ratio • Open Unemployment Rate • Female Labor Force Participation Rate • Information and Communication Technology Development Index	• Integration of Morowali tourist destinations into the national tourism program • Promotion of Morowali's creative industry in national and international exhibitions	• Integration of Morowali tourist destinations into the provincial tourism program • Promotion of Morowali's creative industry in regional, national and international exhibitions	• Morowali tourism promotion through digital platforms • Assistance with production facilities for the creative industry.
Improving Posyandu services, increasing the distribution of health workers in the regions, increasing the distribution of teachers in the regions, scholarships and educational assistance (KIP < BOS etc.), social assistance (PKH, Raskin , etc.), increasing the coverage of BPJS Health and BPJS Employment membership, providing incentives for youth organizations, PKK, RT and RW activities, digital transformation of government.	• Life Expectancy (UHH) • Maternal Mortality Rate • Prevalence of Stunting (short and very short) in toddlers • Coverage of Tuberculosis case finding • Tuberculosis treatment success rate • Coverage of national health insurance participation • Percentage of educational units achieving minimum competency standards in national level assessments for: Reading Literacy and Numeracy • Average length of schooling for people aged over 15 years • Old School Expectations • Poverty Level • Coverage of Employment Social Security participation • Percentage of Independent Villages • Electronic Government System Index • Public Service Index • Gender Inequality Index (GNI) • Family Quality Development Index	• Increase in the quota for social security/assistance, education and health covered by the central government • Assistance with health equipment and facilities for regional public hospitals, community health centers, village clinics and integrated	• Increase in the quota for social security/ assistance, education and health covered by the provincial government • Assistance with health equipment and facilities for regional public hospitals, community health centers, village clinics and	• Increase in social security/ assistance, education and health quotas covered by district governments • Assistance with health equipment and facilities for regional public hospitals, community health centers, village clinics and

Nama Program	Indikator Kesesuaian RPJMN-RPJMD	Dukungan Pemerintah Pusat	Dukungan Pemerintah Provinsi	Dukungan Pemerintah Kabupaten
		• health posts • Health worker assistance from the central government. • Assistance with educational tools and facilities for school universities	• integrated health posts • Health worker assistance from the provincial government. • Assistance with educational tools and facilities for schools, universities and community learning centers	• integrated health posts • Health worker assistance from the provincial government. • Assistance with educational tools and facilities for schools, universities and community learning centers • Strengthen-ing of PKK, Posyandu, Karang Taruna, RT and RW institutions
Procurement of fisheries transport vessels serving the Kendari-Morowali-Banggai-Bitung route	• Inter-regional Price Variation Coefficient • Exports of Goods and Services (% of GRDP)	• Funding and procurement of ships • Opening of the sea toll corridor	• Partial funding of operational facilities	• Efficient managemen t of fisheries loading and unloading activities
Improvement of clean water distribution pipes, improvement of drinking water treatment facilities, bioremediation , and waste bank programs	• Regional Biodiversity Management Index • Regional Environmental Quality Index • Households with Access to Safe Sanitation • Generation Processed In Waste Processing Facilities • Proportion of Households (RT) With Full Waste Collection Services • Raw Water Capacity • Urban Household Access to Piped Drinking Water (%)	• Large-scale drinking water treatment facility grant • Procurement of large scale waste processing center • Procurement of large scale recycling centers • Strengthen-ing waste manage-ment regulations • bioremediati on regulations	• Procurement of integrated waste processing facilities • Improve-ment of clean water pipe network	• Waste bank program • Communal IPAL Program • Improving PDAM services

Nama Program	Indikator Kesesuaian RPJMN-RPJMD	Dukungan Pemerintah Pusat	Dukungan Pemerintah Provinsi	Dukungan Pemerintah Kabupaten
Development of orange and papaya processing industry, coconut oil, and VCO. Development of basic coconut processing industry such as white copra, cocopeat , and charcoal.	• Manufacturing Industry GDP Contribution • Poverty Level • Gini Ratio • Economic growth • Proportion of the number of non-agricultural small and medium enterprises • Proportion of the number of small and medium industries • Regional Entrepreneurship Ratio • Female Labor Force Participation Rate • Level of Mastery of Science and Technology • Open Unemployment Rate • Gender Inequality Index (GNI) • Proportion of Formal Employment Creation • Gross Fixed Capital Formation • Export of Goods and Services	• Involvement of Morowali MSMEs in national and international exhibitions • Increasing subsidized credit programs for MSMEs • Assistance in certification of product suitability to national and international standards (SNI, BPOM, HACCP, ISO, etc.).	• Grant of appropriate production facilities • Involvement of Morowali MSMEs in provincial and national level exhibitions	• Product safety and marketing training • Mandatory purchase regulations for local MSME products • Assistance with regional product eligibility certification (PIRT, etc.)
Upgrading the class of districts passed by heavy vehicles to class I roads, and the construction of twin dams that can be used to meet pumped water needs. storage-hydroelectricity , irrigation and raw water supply.	• Price Variation Coefficient Between Provinces • Raw Water Capacity (m^3/sec)	• Repair and increase of national road capacity • Large scale dam construction • Increasing the capacity of fishing ports and non-mining goods ports.	• Repair and increase of provincial road capacity • Medium scale dam construction • Increasing the capacity of fishing ports and people's ports	• Repair and improvement of district, sub-district and village roads • Construction of small scale reservoirs • Increasing the capacity of fishing ports and people's ports
Intensification and rejuvenation of coconut, orange, and papaya; intensification and development of forest plant cultivation such as meranti, rattan, biopharmaceuticals and other perennial plants; mangrove planting ; procurement of motor boats, outboard motors, and fishing equipment; increasing the capacity of ice factories; increasing the capacity of freezers;	• Indonesia Blue Economy Index (IBEI) • Regional Green Economy Index • Poverty Rate (%) • Gini Ratio • Prevalence of Stunting (short and very short) in toddlers • Poverty Level • Open Unemployment Rate • Female Labor Force Participation Rate (%) • Level of Mastery of Science and Technology • Export of Goods and Services • Family Quality Development Index • Gender Inequality Index (GNI) • Regional Biodiversity Management Index • Prevalence of inadequate food consumption (Prevalence of	• Opening of superior coconut and horticulture seed center • Increased allocation of subsidized fertilizer • Procurement of fishing vessels • Special economic zone project for fisheries • Strengthening regulations	• Ease of fishing vessel permits • Assistance with fishing vessels and equipment	• Creation of aquaculture clusters • Rejuvenation and intensification program for coconut, orange and papaya plantations • *Silvofishery* program/ wanamina and IMTA

Nama Program	Indikator Kesesuaian RPJMN-RPJMD	Dukungan Pemerintah Pusat	Dukungan Pemerintah Provinsi	Dukungan Pemerintah Kabupaten
intensification of seaweed cultivation; development of integrated mangrove fisheries/*silvofishery*/ aquaculture with multitrophic commodities (IMTA); development of shrimp hatchery and nursery; development of crab hatchery; development of tilapia and milkfish nursery centers; improvement of post-harvest seaweed; and environmental conservation services through increasing coral reef and mangrove cover.	Undernourishment) (%) • Exports of Goods and Services (% of GRDP) • Percentage of GHG Emission Reduction • Disaster Risk Index (IRB)	on forest and agricultural land conversion • Opening of fish seed center • Assistance with fish farming equipment		

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Appendix I

Annual growth rate (CAGR) of business fields in Morowali throughout 2013-2023 (in billion rupiah)

Industry	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	CAGR 2013-2023
Processing industry	588.0	667.9	2,926.7	3,734.5	4,552.2	17,169.0	21,304.2	28,813.5	35,981.5	47,573.5	59,604.1	58.70%
Construction	352.1	1,905.7	1,911.0	1,745.2	1,864.0	1,980.8	2,244.4	1,872.3	3,266.3	4,397.0	4,500.5	29.02%
Transportation and Warehousing	27.7	35.0	45.1	48.4	51.5	53.3	56.7	115.1	122.7	308.8	326.9	27.99%
Mining and Quarrying	3,334.7	1,494.7	3,153.0	3,655.3	4,237.4	6,409.0	7,676.3	10,315.6	12,701.5	14,889.0	16,985.4	17.68%
Wholesale and Retail Trade; Automobile and Motorcycle Repair	347.2	392.8	488.2	536.6	570.0	603.1	620.6	589.7	642.8	1,042.8	1,096.9	12.19%
Information and Communication	103.6	114.7	127.0	138.7	151.4	170.8	182.5	195.4	214.6	265.2	282.9	10.57%
Electricity and Gas Procurement	0.8	1.0	1.1	1.2	1.4	1.6	1.6	1.7	1.8	2.0	2.2	10.28%
Real Estate	68.5	81.1	96.2	101.1	103.8	106.1	109.0	109.9	111.2	143.1	172.1	9.64%
Provision of Accommodation and Food and Beverages	11..0	11.7	13.1	13.8	14.7	14.0	14.5	13.0	14.9	23.2	27.1	9.45%
Health Services and Social Activities	38.2	41.8	45.8	50.3	55.4	58.8	63.7	68.1	70.9	72.4	77.7	7.37%
Financial Services and Insurance	78.9	79.4	86.1	94.6	101.4	106.8	107.0	121.1	130.6	138.4	138.8	5.81%
Other services	29.0	30.8	32.9	35.1	38.0	39.8	40.9	43.7	45.9	48.0	50.6	5.72%
Water Supply, Waste Management, Waste and Recycling	2.7	2.9	0.5	3.4	3.7	0.7	3.9	4.2	4.3	4.4	4.5	5.16%
Corporate Services	1.9	2.0	2.1	2.3	2.5	2.3	2.4	2.3	2.4	2.7	3.0	4.54%
Administration, Defense and Compulsory Social Security	108.2	115.2	123.8	131.3	141.0	145.0	152.4	154.0	161.1	156.2	160.1	4.00%
Educational Services	62.3	67.6	72.5	77.5	8.2	82.8	85.3	85.2	85.8	86.2	90.1	3.76%
Agriculture , Forestry and Fisheries	1,048.7	1,164.5	1,291.9	1,345.2	1,396.4	1,411.3	1,437.3	1,397.5	1,442.5	1,468.6	1,464.4	3.39%
Total	**6,203.6**	**6,208.9**	**10,419.8**	**11,714.4**	**13,363.8**	**28,358.4**	**34,102.7**	**43,902.3**	**55,000.6**	**70,621.5**	**84,987.2**	**29.92%**

Source: BPS Morowali Regency (2024)

Appendix II

Facilities to Increase Productivity of the Fisheries Sector (Boats and Motorboats)

Subdistrict	Number of Ships/Boats in Morowali Regency								
	Motor Boat			Motor Boat			Tidak Bermotor		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
Menui Islands	125	142	326	740	806	1,205	279	229	361
South Bungku	130	152	414	871	975	1,642	221	246	492
Bahodopi	12	15	4	58	58	55	17	27	48
Coastal Bungku	31	37	47	187	198	172	27	53	54
Middle Bungku	130	130	125	171	235	232	43	45	100
East Bungku	22	30	23	109	129	179	18	38	46
West Bungku	9	12	7	104	124	169	55	45	48
Bumi Raya	7	10	4	166	176	142	18	35	58
Witaponda	36	36	25	60	60	74	5	25	31
Morowali	502	564	975	2,466	2,761	3,870	683	743	1,238

Source: BPS Morowali Regency (2024a)

Appendix III

Indonesia's Exports by Mode of Transportation and Sea Port 2021-2022

Mode of Transportation	2021		2022	
	Weight (Thousand tons)	Value (Million US$)	Weight (Thousand tons)	Value (Million US$)
Sea	615,312.5	219,244.0	641,631.6	278,869.4
Land	54.8	27.8	96.7	61.7
Pipe	6,012.2	2,841.3	4,794.4	3,043.7

Source: BPS Indonesia (2023a)

Appendix IV

SECTOR	CODE	BACKWARD LINKAGE						FORWARD LINKAGE					
		Backward Linkage	Total Backward Linkage	Indirect Backward Linkage	Normalize Backward Linkage	Normalize Total Backward Linkage	Normalize Indirect Backward Linkage	Forward Linkage	Total Forward Linkage	Indirect Forward Linkage	Normalize Forward Linkage	Normalize Total Forward Linkage	Normalize Indirect Forward Linkage
Agriculture, Forestry and Fisheries	A	0.122229	1.15097	1.02874	0.5222826179	0.8642962964	0.3420136785	0.230276	1.26757	1.03729	0.74364386710	0.873303563	0.1296596959
Mining and Quarrying	B	0.153152	1.19105	1.0379	0.6544201495	0.8943952838	0.2399751343	0.496737	1.58323	1.08650	1.60414393000	1.090785432	-0.5133584979
Processing industry	C	0.399991	1.48049	1.0805	1.709159807	1.1117458760	-0.5974139307	0.088029	1.10576	1.01773	0.28427710270	0.7618268349	0.4775497322
Electricity and Gas Procurement	D	0.576030	2.18288	1.60685	2.461376564	1.6391943820	-0.8221821823	0.834685	2.86617	2.03149	2.6955003630	1.974680788	-0.7208195755
Water Supply, Waste Management, Waste and Recycling	E	0.149873	1.19874	1.04887	0.6404056772	0.9001704738	0.2597647967	0.328128	1.43632	1.10820	1.0596428870	0.989571406	-0.0700714807
Construction	F	0.223737	1.28687	1.06314	0.956028367	0.9663528604	0.0103244934	0.074865	1.09672	1.02185	0.24176744350	0.7555939046	0.5138264611
Wholesale and Retail Trade; Car and Motorcycle Repair	G	0.143172	1.19344	1.05027	0.6117732095	0.8961925231	0.2844193136	0.260432	1.32991	1.06948	0.8410300650	0.9162544307	0.0752243655
Transportation and Warehousing	H	0.218252	1.29206	1.07381	0.9325906705	0.9702506580	0.0376599874	0.307691	1.38284	1.07515	0.9936445943	0.952722095	-0.0409224993
Provision of Accommodation and Food and Beverages	I	0.365499	1.46035	1.09485	1.561777636	1.0966228030	-0.4651548336	0.254644	1.30699	1.05235	0.8223368593	0.9004684968	0.07813163756
Information and Communication	J	0.283605	1.40941	1.1258	1.211845114	1.0583663930	-0.1534787201	0.438426	1.6382	1.19978	1.41583613200	1.128656985	-0.2871791467
Financial Services and Insurance	K	0.128778	1.16636	1.03758	0.5502667653	0.8758554127	0.3255886474	0.639245	1.90262	1.26337	2.0643545500	1.310830724	-0.753523826
Real Estate	L	0.148958	1.19316	1.04421	0.6364967388	0.8959826174	0.2594858785	0.246131	1.31966	1.07353	0.79484531750	0.9091953747	0.1143500572
Corporate Services	MN	0.215944	1.28829	1.07234	0.9227284815	0.9674148786	0.0446863970	0.774849	2.0521	1.27725	2.5022694820	1.413817732	-1.08845175
Government Administration, Defense and Compulsory Social Security	O	0.216766	1.29687	1.0801	0.9262402031	0.9738582007	0.0476179975	0.052180	1.07542	1.02324	0.1685083469	0.7409251539	0.572416807
Educational Services	P	0.150162	1.20223	1.05206	0.6416402035	0.9027878827	0.2611476792	0.024696	1.03186	1.00716	0.07975077921	0.7109098215	0.6311590423
Health Services and Social Activities	Q	0.216474	1.29234	1.07586	0.9249946324	0.9704538756	0.0454592431	0.065177	1.08431	1.01913	0.21047861810	0.747045668	0.5365670499
Tourism services	RSTU	0.265849	1.35307	1.08722	1.135973163	1.0160595820	-0.1199135803	0.148007	1.19515	1.04714	0.4779696627	0.8234115899	0.3454419272

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