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#### Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics  
Düsternbrooker Weg 120  
24105 Kiel (Germany)  
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)  
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# Economic Growth and Development of a Minapolitan Area Based on the Utilization of Renewable Energy, Takalar Regency, South Sulawesi, Indonesia

**Batara Surya<sup>1\*</sup>, Agus Salim<sup>2</sup>, Seri Suriani<sup>3</sup>, Firman Menne<sup>4</sup>, Emil Salim Rasyidi<sup>5</sup>**

<sup>1</sup>Department of Urban and Regional Planning, Faculty of Engineering, University Bosowa Makassar City, Indonesia, <sup>2</sup>Department of Regional Planning, Faculty of Engineering, University Bosowa Makassar City, <sup>3</sup>Department of Financial Management, Faculty of Economic and Business, University Bosowa Makassar City, <sup>4</sup>Department of Accounting, Faculty of Economics and Business, University of Bosowa, Makassar City, <sup>5</sup>Department of Urban Planning, Faculty of Engineering, Bosowa University,

\*Email: [batara.surya@universitasbosowa.ac.id](mailto:batara.surya@universitasbosowa.ac.id)

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## ABSTRACT

Accelerated development of the Takalar Regency area towards economic growth has an impact on the productivity of the community's economic enterprises. Furthermore, the increase in the productivity of economic enterprises coupled with the development of the Minapolitan area will contribute positively to meeting renewable energy needs and improving environmental quality towards sustainable development. This study aims to analyze: (1) Economic growth and work productivity as determinants of increasing energy demand for the Minapolitan area; (2) The effect of economic growth, utilization of renewable energy, and strengthening of institutional capacity on improving environmental quality and sustainable development of Minapolitan areas. This study uses a qualitative-quantitative approach sequentially. Data obtained through observation, in-depth interviews, surveys, and documentation. The results of the study indicate that economic growth coupled with the preparation of energy infrastructure in the development of the Minapolitan area has a positive contribution to increasing the productivity of community economic enterprises. The effect of total economic growth, utilization of renewable energy, and strengthening of institutional capacity on environmental quality improvement is 63.36%. Furthermore, the residual effect or residue that was not examined on the improvement of environmental quality was 36.64%. The direct effect of increasing the quality of the environment on the sustainability of the development of the Minapolitan area is 67.73%. The remaining effect or residue is 32.27%. Thus, economic growth, renewable energy utilization, and strengthening of institutional capacity together have an effect, on improving environmental quality with a determination coefficient of 46.65%, and an increase in environmental quality affects the sustainability of the Minapolitan area development with a determination coefficient of 39.56%. This study recommends that the direction of the sustainable development of the Minapolitan area is very important to optimize the use of renewable energy towards environmental, economic, and social sustainability, followed by strengthening the institutional capacity of the government and society in ensuring a balanced development in the future.

**Keywords:** Economic Growth, Minapolitan Area, Economic Productivity, Renewable Energy, Sustainable Development

JEL Classification: O47, Q2, Q01

## 1. INTRODUCTION

Regional economic development is the process of optimal natural resource management carried out through a partnership pattern

between the government, private sector, and the community towards the creation of jobs and business fields in order, to encourage economic growth. Development policies that are oriented towards regional economic growth supported by the use,

of technology will accelerate and encourage increased productivity of economic enterprises on the one hand and on the other hand the excessive use of natural resources will have an impact on environmental damage (Fu et al., 2020; Surya et al., 2021). The emphasis on regional development basically refers to optimizing the use of natural resources based on the development of regional economic base sectors. Furthermore, the implementation of a bottom-up development policy will accelerate regional development (Howaniec and Lis, 2020). Adisasmita (2008), states that regional development is a function of the potential of natural resources, manpower and human resources, capital investment, infrastructure and facilities, transportation and communication, industrial composition, technology, economic situation and trade between regions, funding capacity and regional development financing. This means that regional economic development is a process of managing resources through a partnership between the government, the private sector, and the community. The regional development orientation basically refers to the principles of an inclusive economy towards sustainable development (van Niekerk, 2020). Economic development is a process that includes the formation of institutions, industrial development, improvement of the capacity of the workforce to produce products and services for economic growth (Arsyad, 1999).

Regional economic growth through the use, of natural resources is aimed at boosting people's income and economic competitiveness. Simultaneous optimization of the utilization of natural resources with human resource development contributing positively to economic growth (Saleh et al., 2020). Furthermore, an increase in regional income is related to economic growth by referring to the contribution of the economic activity sector and remuneration for regional production factors. Development policies that are oriented towards economic growth have contributed positively to increasing regional income and regional growth (Surya et al., 2021). The prosperity of an area is closely related to the amount of added value that is created and how much is the transfer payment, namely the share of income that flows out of the region or gets a flow of funds from outside the region (Richardson, 1991). This means that the development of a region will contribute to the development of the surrounding area in the form of sector demand and is a complementary relationship. The factors that affect the production of the area and the lifestyle of the community are reciprocal in nature and affect the development of the surrounding area (Zhou et al., 2017; Lin et al., 2019). Thus, economic growth has a direct link with strategic economic efforts and energy needs towards sustainable regional development.

Sadono (1985), states that economic growth is a change in the level of economic activity that applies from year to year. Five factors affect economic growth, namely (i) the very fast rate of population and product per capita growth, (ii) the development of community productivity, (iii) rapid structural growth, (iv) high urbanization rates, (iv) expansion in developed countries, and (v) there are flows of goods, capital, and people in various countries (Simon, 1955). Thus, the use of natural resources through entrepreneurship is the motor of economic growth in the direction of sustainable regional development (Stoica et al., 2020; Hernita et al., 2021). The progress of an economy is determined

by the amount of growth shown by changes in national output. Furthermore, the optimization of economic growth is developed to create new business and job opportunities, save material costs, reduce price volatility, increase supply security, while reducing environmental stresses and impacts (Kalmykova et al., 2018; Surya et al., 2020). Thus, economic growth coupled with the use of renewable energy will boost the productivity of community businesses and improve the quality of the environment towards sustainable regional development. This means that energy management is needed through a process of coordination between public-private institutions in relation to meeting energy needs and sustainable regional development (Arroyo and Miguel, 2020; Surya et al., 2020).

Indonesia has the potential for renewable energy sources (RE) which is quite large and varied, namely mini/micro hydro of 450 MW, 50 GW of Biomass, 4.80 kWh/m<sup>2</sup>/day of solar power, 3-6 m/s of wind power and nuclear energy of 3 GW. The national energy policy that is wanted to be achieved in 2025 for the national primary energy mix is 17% with a composition of biofuels by 5%, geothermal by 5%, biomass, nuclear, water, solar and wind by 5%, and coal which is disbursed by 2%. The strategic steps taken by the Government of Indonesia to achieve these targets include: (1) Increasing the installed capacity of micro hydro power plants to 2.846 MW; (2) Increase the installed capacity of biomass by 180 MW; (3) Increase the installed capacity of wind power plants by 0.97 GW; (4) Solar energy is 0.87 GW and nuclear energy is 4.2 GW. Furthermore, the total investment required for the development of renewable energy by the end of 2025 is projected at 13.197 million USD (Dewan Energi Nasional, 2019). The expansion of renewable energy sources (RESs) is a viable solution to tackle energy security and climate change, while the gradual replacement of fossil fuels with RESs promotes a sustainable energy economy (Ntanos et al., 2018; Surya et al., 2021).

Takalar Regency is designated as the center of economic growth and a National strategic area in South Sulawesi Province. Furthermore, the developing economic activity sector and its contribution to the Gross Regional Domestic Product (GRDP) of Takalar Regency include: (1) Agriculture, fisheries and forestry with a contribution value of 3,072.89 billion; (2) Wholesale trade, retail and repair of motorbikes with a contribution value of 935.77 billion; (3) construction services, with a contribution value of 453.33 billion; (4) Information and communication with a contribution value of 302.93 billion; (5) Government administration with a contribution value of 445.52 billion; (6) Educational services with a contribution value of 96.13 billion; (7) Processing industry with a contribution value of 358.77 billion; (8) Mining and quarrying with a contribution value of 106.41 billion; (9) Financial and insurance services with a contribution value of 90.10 billion; (10) Real estate with a contribution value of 383.44 billion; and (4) Health services with a contribution value of 19.84 billion (BPS Kabupaten Takalar, 2020). Furthermore, the potential for renewable energy that can be utilized to support the development of the Minapolitan area in Takalar Regency includes: (1) Water energy originating from the Pamukulu River with a potential discharge of 1.32-24.7 m<sup>3</sup>/s; (2) Wind energy capable of producing energy with an electric capacity of 100-200 MW to

meet electricity needs; (3) Solar energy through the construction of a solar power plant of 260 KW, and (4) Biogas is sourced from livestock manure located in 11 districts in Takalar Regency.

The contribution of the economic activity sector developed in Takalar Regency confirms that accelerating regional development towards economic growth will require support for the use of renewable energy. Public policies that are oriented towards natural resources and energy saving, followed by optimization of industrial management will encourage an increase in regional income and an increase in environmental quality (Giampietro, 2019; Surya et al., 2020). Furthermore, economic growth coupled with the use of renewable energy will have an impact on the productivity of economic enterprises, increasing regional income, meeting energy needs, opening new jobs, and improving the quality of the environment. The concept of sustainable development is oriented to meeting the needs of the present generation without sacrificing the ability of future generations (United Nations, 2003), meaning that economic growth, social inclusion, and environmental protection are the three main pillars of sustainable development (Wichaisri and Sopadang, 2017). Minapolitan area is part of an area covering production centers, processing, marketing of fishery commodities, services, and other supporting activities. Furthermore, fishing ports, landing sites, and associated processing facilities provide significant employment and economic benefits to coastal communities (Ababouch and Fipi, 2015).

The development of the Minapolitan Area of South Galesong District, Takalar Regency is part of the government's efforts to encourage economic growth towards improving the welfare of the community. Furthermore, the dominant economic business potential is developed by the community, including: (1) Capture fisheries with a production value of 10,267 tons/year; (2) Aquaculture pond with a production value of 49,788.09 tons/year; and (3) seaweed cultivation with a production value of 325,068.8 tons/year. Furthermore, identified support for the preparation of energy infrastructure and strengthening the capacity of government institutions will hamper the stability of economic business and the sustainable development of the Minapolitan area. This means that the development of the Minapolitan area of South Galesong District is very important and strategically implemented to encourage increased business productivity towards regional economic growth and improvement of community welfare. Thus, the focus of this study (Figure 1) is aimed at answering research questions, namely: (1) How do economic growth and business productivity work as determinants of increasing energy demand in Minapolitan areas; (2) How big is the influence of economic growth, renewable energy use, and strengthening of institutional capacity on improving environmental quality and sustainable development of Minapolitan areas.

## 2. MATERIALS AND METHODS

This study uses a qualitative-quantitative approach sequentially. The case studies in this study were selected with the following considerations: (1) The developer of the Minapolitan area of South Galesong District is complex in terms of spatial use; (2) Characteristics of cases have a prominent pattern, consistency, and

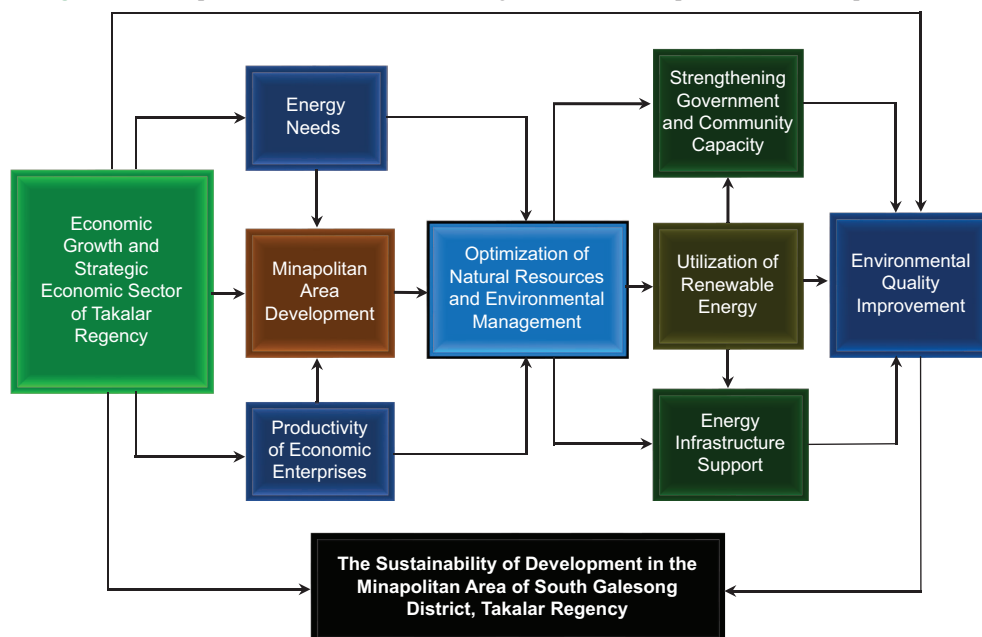
sequence; and (3) The nature of the case is intended to describe the development pattern of the Minapolitan area in relation to the use of renewable energy and improvement of environmental quality. Furthermore, qualitative data in the study is used to describe the situation and characteristics of the development of the Minapolitan area in South Galesong District, Takalar Regency in relation to the use of renewable energy. Meanwhile, quantitative data obtained through a questionnaire to describe the situation and characteristics of the respondent, then analyzed using descriptive statistics and path analysis. The combination of qualitative-quantitative approaches is presented in Figure 2.

### 2.1. Study Area

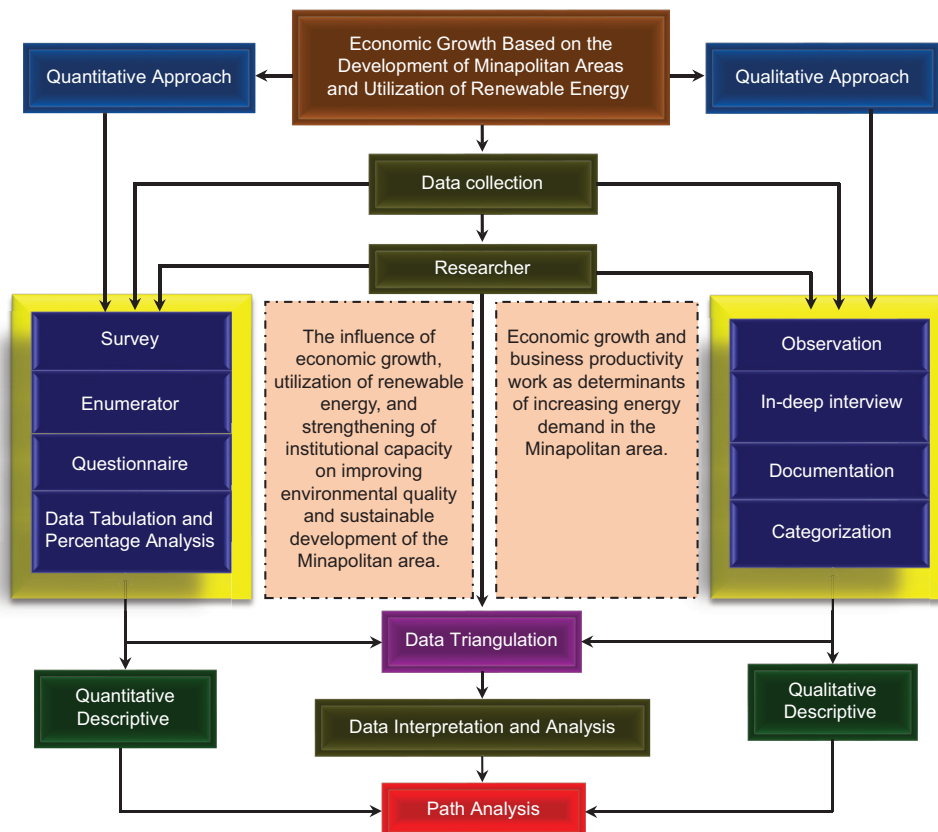
This study was established in the Minapolitan area of Galesong Selatan Subdistrict, Takalar Regency, which was carried out from August to December 2020. The Minapolitan area located in South Galesong District has the potential to stimulate economic growth and increase the productivity of the community's economic enterprises. Furthermore, the selection of research locations (Figure 3), which carried out the following considerations: (1) The potential of the minapolitan area of South Galesong District is quite prominent in relation to the development of the strategic economic sector in Takalar Regency; (2) The minapolitan area of South Galesong District has not been developed optimally as a unit of economic development, (3) The potential for capture fisheries, aquaculture and seaweed cultivation has not been marketed optimally and integrated as a single economic system, (4) Increased productivity Community economic efforts require support for the use of renewable energy towards sustainable development, and (5) The productivity of community economic enterprises is not yet optimal in terms of increasing income, community welfare, and economic growth in Takalar Regency. The study location of the minapolitan area of South Galesong District is presented in Figure 3.

### 2.2. Method of Collecting Data

The data in this study were divided into two categories, namely (1) Primary data, namely data obtained through observation, in-depth interviews, and questionnaires; and (2) Secondary data, which can be obtained through agencies and study results related to the Minapolitan area in the form of documents. The collection in this study was carried out in several stages, including: First, observations in this study were used in data retrieval, namely (i) types of socio-economic activities in the Minapolitan area, (ii) land use, (iii) types of economic enterprises being developed. community, (iv) supporting facilities and infrastructure for economic enterprises, and (v) marketing business products. Furthermore, the instruments used in the observation, namely base maps, cameras, field notes, periodic notes, and checklists. This instrument is used to observe the situation and characteristics of the minapolitan area in relation to economic potential and the use of renewable energy. Second, in-depth interviews, the main subjects of in-depth interviews in this study are the local government and communities located in the minapolitan area of South Galesong District, Takalar Regency. In-depth interviews in this study were used for data retrieval, namely (i) mechanisms and procedures for the management of the minapolitan area, (ii) types of superior commodities developed by the community,

**Figure 1:** Conceptual framework for economic growth and development of the Minapolitan area

Source: Author's elaboration

**Figure 2:** Sequential qualitative-quantitative approaches

Source: Author's elaboration

(iii) the ability of production businesses, (iv) processing centers and potential market access. The instruments used in in-depth interviews in this study, namely a tape recorder, a map of the field situation, and an interview guide equipped with freelance notes, a checklist, and a score scale.

Third, the questionnaire in this study is used for two functions, namely (i) descriptive, and (ii) measurement. The purpose of using the questionnaire is to provide an overview of the community's perspective in relation to the development of Minapolitan areas and the use of renewable energy. The questionnaire in this study was



**Figure 3:** Minapolitan area of South Galesong District, Takalar Regency as research object

Source: Author elaboration and Google Map@, 2020

used in data retrieval, including: (1) Economic growth, measured by indicators, namely the potential of the economic activity sector, the basic economic sector, and the income level of the population. (2) Utilization of renewable energy is measured by indicators, namely energy availability, energy distribution, energy demand, and energy service coverage. (3) Strengthening the institutional capacity of government and society is measured by indicators, namely institutional function, institutional role, leadership, and community participation. (4) Environmental quality is measured by indicators, namely water quality, air quality, and land cover. (5) The sustainable development of the Minapolitan area is measured by indicators, namely environmental sustainability, economic sustainability, and social sustainability. Furthermore, the measurement of the questionnaire result data in this study used an ordinal scale. The

results of the data obtained through the questionnaire were then given a scoring score, namely (i) a score of 5 for the very supportive category, (ii) a value of 4 for the supportive category, (iii) a value of 3 for the sufficiently supportive category, (iv) a score of 2 for the less supportive category, and (v) the value 1 for the category not supportive. The questionnaire in this study was distributed to the minapolitan area of South Galesong District, Takalar Regency. The reason the researchers determined the location was based on the condition of the Minapolitan area's development which was quite intensive and had the potential to support the economic growth of Takalar Regency. Furthermore, the criteria for the actors who filled out the questionnaire (respondents) were local people located in the minapolitan area, had an economic business, had a family, participated in the development of the minapolitan area.

Fourth, the documentation used in this study includes: (1) Takalar Regency economic growth data, obtained through the Central Bureau of Statistics of Takalar Regency; (2) Data on the development profile of the Minapolitan area, obtained through the Regional Development Planning Agency; (3) The profile of the community's economic business is obtained through the District Office; and (4) Takalar Regency Spatial Planning, obtained through the Takalar Regency Spatial Planning Office. The four documents are used to support the data from observations, in-depth interviews, and the results of the research questionnaire.

### 2.3. Research Informants and Respondents

The qualitative data in this study were obtained through informants. Informants are determined by the snowball method. This means that informants are determined based on information from the local government, community leaders, and economic entrepreneurs who can provide good information regarding the use of renewable energy. Furthermore, informants were also identified from several respondents who had been previously interviewed. The consideration is to explore the results of the previously obtained questionnaire but still requires a more detailed explanation. Furthermore, quantitative data in this study were obtained from respondents or research samples using a questionnaire instrument. The research sample in this study was determined using purposive sampling determined by the researcher based on certain characteristics. Sampling refers to Taherdoost (2016). The formulations used in determining the sample are as follows:

$$n = p(100 - p)z^2 / E^2$$

Where  $n$  is the required sample size,  $p$  is the percentage occurrence of state or condition,  $E$  is the percentage maximum error required,  $z$  is the value corresponding to level confidence required.  $Z$  is the statistical value corresponding to the level confidence is needed. The confidence level used was 95 percent (0.05:  $Z$  value equals 1.96) or 99 percent (0.01:  $Z = 2.57$ ). The 95 percent confidence level implies that 95 out of 100 samples will have actual population values within the specified margin of error ( $E$ ). The number of samples in this study was 300.

### 2.4. Data Analysis Method

The analytical method used in this study refers to the objectives to be achieved in this study. To answer the first research question, namely how economic growth, and business productivity work as determinants of increasing energy demand in the minapolitan areas. In order, to answer this question, the analysis methods used include: (i) shift-share analysis, (ii) location quotient (LQ) analysis, (iii) analysis of per capita income, and (iv) spatial distribution analysis of its relationship to meeting energy needs. The results of the analysis are then linked to the use of renewable energy in the Minapolitan area. Shift-share analysis uses the following formulations:

$$\begin{aligned} D_{ij} &= N_{ij} + M_{ij} + C_{ij} \quad N_{ij} = E_{ij} \cdot r_n \\ M_{ij} &= E_{ij} \cdot (r_n - r_{in}) \quad C_{ij} = E_{ij} \cdot (r_{in} - r_{in}) \\ D_{ij} &= E_{ij} \cdot r_n + E_{ij} \cdot (r_n - r_{in}) + E_{ij} \cdot (r_{in} - r_{in}) \quad SN_{ij} = M_{ij} + C_{ij} \end{aligned}$$

Where  $N_{ij}$  is the change in sectors/subsectors in the Takalar Regency area caused by the influence of economic growth in the South Sulawesi Region,  $M_{ij}$  is the change in GRDP sector/subsector  $i$  in the Takalar Regency area caused by the influence of sector  $i$  growth in South Sulawesi,  $C_{ij}$  is the change in sector/subsector GRDP/subsector  $i$  in the Takalar Regency area caused by the competitive advantage of sector  $i$  in the Gowa Regency area,  $E_{ij}$  is the GRDP sector/subsector  $i$  in the Takalar Regency area at the beginning of the year,  $E_{in}$  is the GRDP sector/subsector  $i$  in the South Sulawesi region,  $E_n$  is the total GRDP South Sulawesi at the beginning of the year,  $E_{ij, t}$  is the GRDP sector/subsector  $i$  in the Takalar Regency area,  $E_{in, t}$  is GRDP of sector/sub-sector  $i$  of South Sulawesi region,  $E_n$  and  $t$  is total GRDP of South Sulawesi region. If  $M_{ij} + C_{ij}$  is greater than 0, then the growth of the  $i$ -th sector in the  $j$ -region is included in the progressive (advanced) group. If  $M_{ij} + C_{ij}$  is less than 0, then the  $i$ -th sector in the  $j$ -region is included in the slow growth category. If  $M_{ij}$  is smaller than 0, then sector  $i$  in Takalar Regency has a slow growth rate. If  $M_{ij}$  is greater than 0, sector  $i$  is growing rapidly. If  $C_{ij}$  is greater than 0, then sector  $i$  has high competitiveness compared to other regions. If  $C_{ij}$  is less than 0, then sector  $i$  has low competitiveness. If  $SN_{ij}$  is greater than 0, the sector under study has a progressive growth. If the  $SN_{ij}$  is smaller than 0, the sector under study shows a growth that is not progressive. Furthermore, the location quotient (LQ) analysis uses the following formulation:

$$LQ_{ij} = \frac{X_{ij} / RV_{ij}}{X_i / RV} \quad \text{or} \quad LQ_{ij} = \frac{X_{ij} / X_i}{RV_i / RV} \quad DLQ_{ij} = \frac{1 + g_{ij} / 1 + g_j}{1 + G_i / 1 + G}$$

Where  $LQ_{ij}$  is the location quotient sector  $i$  index/coefficient in Takalar Regency,  $X_{ij}$  is the GRDP sector  $i$  in Takalar Regency,  $X_i$  is the GRDP sector  $i$  in the South Sulawesi Province,  $RV_i$  is the total GRDP of Takalar Regency, and  $RV$  is the total GRDP of South Sulawesi Province.  $DLQ$  is the dynamic location quotient index,  $g_{ij}$  is the average growth rate of the subsector  $i$  in Takalar Regency,  $g_j$  is the growth rate in Takalar Regency,  $G_i$  is the average growth rate of the subsector in South Sulawesi Province, and  $G$  is the growth rate at the Provincial level South Sulawesi. Furthermore, the per capita income analysis uses the following formulation:

$$GRDP_{pk} = GRDP / \sum p \times 100\%$$

Where  $GRDP$  is the final expenditure component for sectors of economic activity,  $pk$  is the income received by each resident, and  $\sum p$  is the number of residents in, a given location. Furthermore, analysis of spatial distribution in meeting renewable energy needs in support of regional development in Takalar Regency, using analysis methods of nearest neighbors, entropy index, and concentration-deconcentration and distribution index. The analysis used for these three methods used the following formulations:

$$\begin{aligned} T &= J_u / J_h \quad J_u = (\sum J / \sum N) \quad J_h = 1/2 \sqrt{P} \quad P = (\sum n / L) \\ IE &= (-\sum P_i \ln P_i) / \ln K \end{aligned}$$

$$C = \frac{\sum n(X_i - Y_i)}{2}$$

$$DQ = (Y_i - X_i) D = (C2 - C1)$$

$$L = 100 - \frac{\sum n(X_i - Y_i)}{2}$$

Where T is the index of the spread of the nearest neighbor, Ju is the average distance measured between one point of the nearest neighbor, Jh is the average distance obtained by a random pattern  $1/2\sqrt{P}$ , and P is the density of points per km<sup>2</sup>, namely the number of points (N) divided by the area in km<sup>2</sup> (A), so that it becomes (N/A). Furthermore, IE is the entropy index,  $P_i$  is the percent value of the object, transferred in the form 0-1,  $\ln P_i$  is the natural logarithmic of the value  $P_i$ , and  $\ln K$  is the natural logarithmic of the number of objects (regions). C is the concentration index,  $X_i$  is the percentage area of sub-region i,  $Y_i$  is the percentage of total activities contained in sub-region i, n is the number of sub-regions, and DQ is the quotient distribution. Furthermore, D is deconcentration, in this case the deconcentration is done by subtracting the value of C at a time (C2) with the value at the previous time (C1). L is the association, n is the number of sub-regions,  $X_i$  is the percentage of the number of first activities in sub-region i,  $Y_i$  is the percentage of the number of second activities in sub-region i. Furthermore, to answer 2 s research questions, namely how much influence economic growth, renewable energy use, and strengthening of institutional capacity on improving environmental quality and sustainable development of the Minapolitan area, using the path analysis method. The case in this study shows a relationship or correlation between economic growth variables ( $X_1$ ), ( $X_2$ ) renewable energy utilization, ( $X_3$ ) strengthening institutional capacity (there is a relationship between variables  $X_1$ ,  $X_2$ , and  $X_3$ ). The path analysis model is presented in Figure 4.

$$\begin{aligned} Y &= p_1 X_1 + p_2 X_2 + p_3 X_3 + \epsilon_1 \\ X_3 &= p_{31} X_1 + p_{32} X_2 + \epsilon_1 \\ Y &= p_{Y1} X_1 + p_{Y2} X_2 + p_{Y3} X_3 + \epsilon_2 \\ Z &= p_{Z1} X_1 + p_{Z2} X_2 + p_{Z3} X_3 + \epsilon_3 \end{aligned}$$

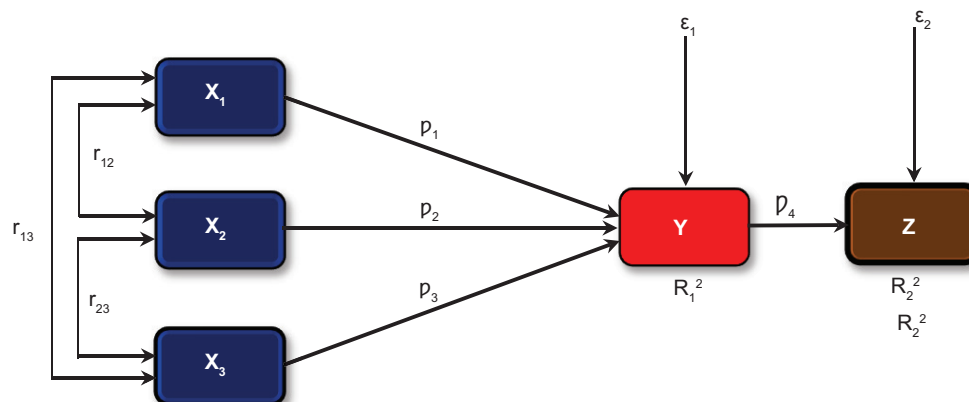
Path analysis requires a relationship expressed by the correlation coefficient ( $r_{12}$ , ( $r_{13}$ ), and ( $r_{23}$ ), ( $r_{12}$ ) is the correlation or relationship between  $X_1$  and  $X_2$ , ( $r_{13}$ ) is the correlation or relationship between  $X_1$  and  $X_3$ , ( $r_{23}$ ) is the relationship or correlation between  $X_2$  and  $X_3$ . The variables  $X_1$ ,  $X_2$ , and  $X_3$  act as independent variables that affect the dependent variable (Z) through the intervening variable (Y). That is,  $X_1$ ,  $X_2$ , and  $X_3$ , against Z not directly but through intermediary or intervening Y. Thus,  $X_1$ ,  $X_2$ , and  $X_3$  affect Y, then Y affects Z. Three, things can be explained in this regard, namely (i) the independent variable  $X_1$  and the intervening variable Y are connected by the regression coefficient ( $p_1$ ), (ii) the independent variable  $X_2$  and the intervening variable Y are connected by the regression coefficient ( $p_2$ ), and (iii) the independent variable  $X_3$  and the intervening variable Y are connected by the regression coefficient ( $p_3$ ). The direct effect of  $X_1$  on Y is the square of the regression coefficient ( $p_1^2$ ), the direct effect of  $X_2$  on Y is the squared of the regression coefficient ( $p_2^2$ ), the direct effect of  $X_3$  on Y is the squared of the regression coefficient ( $p_3^2$ ). Furthermore, the coefficient of determination ( $R^2$ ) represents the value of the total effect of the independent variables under study on the dependent variable.  $R_1^2$  is the total effect (both direct and indirect)  $X_1$ ,  $X_2$ , and  $X_3$  on Y,  $R_2^2$  is the total effect of Y on Z. The coefficient of determination uses the following formulation:

$$R_1^2 = [p_1^2 + p_2^2 + p_3^2] + [(p_1 r_{12} p_2) + (p_2 r_{12} p_1)] + [(p_1 r_{13} p_3) + (p_3 r_{13} p_1)] + [(p_2 r_{23} p_3) + (p_3 r_{23} p_2)]$$

$$R_2^2 = p_4^2$$

Where  $R_1^2$  is the total effect (direct effect + indirect effect)  $X_1$ ,  $X_2$ , and  $X_3$  on Y. [ $p_1^2 + p_2^2 + p_3^2$ ] is the direct effect of  $X_1$ ,  $X_2$ , and  $X_3$  on Y. ( $p_1 r_{12} p_2$ ) is the indirect effect of variables  $X_1$  through  $X_2$  on Y. ( $p_2 r_{12} p_1$ ) is the indirect effect of  $X_2$  through  $X_1$  on Y. ( $p_2 r_{13} p_1$ ) is the indirect effect of  $X_1$  through  $X_3$  on Y. ( $p_3 r_{13} p_1$ ) is the indirect effect of the variables  $X_3$  through  $X_1$  on Y, ( $p_2 r_{23} p_3$ ) is the indirect effect of the variables  $X_2$  through  $X_3$  on Y. ( $p_3 r_{23} p_2$ ) is the indirect effect of  $X_3$  through  $X_2$  on Y.  $R_2^2$  or  $p_4^2$  is the direct influence of Y on Z. Furthermore, epsilon ( $\epsilon_1$  and  $\epsilon_1$ ) states the residual effect, namely the magnitude of the influence of other variables that can

**Figure 4:** The relationship between the variables  $X_1$ ,  $X_2$ , and  $X_3$ . The magnitude of the relationship is expressed by the correlation coefficient ( $r_{12}$ ), ( $r_{13}$ ), and ( $r_{23}$ )



Source: Author's elaboration



affect the intervening variable and the dependent variable but is not examined.

### 3. RESULTS AND DISCUSSION

#### 3.1. Economic Growth and Development of the Minapolitan Area

The economic development of Takalar Regency is inseparable from the function and position of its territory and its hinterland area. Regional development is basically aimed at providing employment opportunities, creating investment opportunities, and developing economic potential for development needs (Surya, 2015; Domi'nczak et al., 2020). Economic growth is basically related to the social, political, and technological environment that is used as a means, to support increased regional productivity. Thus, regional economic growth is a process of increasing production capacity in relation to the distribution of flow of goods and services (Kuznet). Furthermore, the development of the Takalar Regency area is marked by the existence of strategic economic activity sectors as the motor of economic growth. Economic activity sectors that trigger economic growth in Takalar Regency are presented in Table 1.

Table 1 shows the sectors of economic activity based on business fields in Takalar District. Interpretations that can be proposed for these results include: First, the dominant component of economic growth that contributes to the increase in income of Takalar Regency, namely (i) agriculture, forestry and fisheries with a contribution value of 47.21%, (ii) wholesale trading business, retail, auto repair shops and motorbikes with a contribution value of 14.33%, (iii) government administration with a contribution value of 6.74%, (iv) construction services business with a contribution value of 6.93%, and (v) real estate business with a contribution value by 5.84%. Second, the components of proportional growth that are dominant in the absorption of labor: (i) the agriculture, forestry, and fisheries sector, (ii) the shoreline trade, retail, auto repair shops and motorbikes sector, (iii) the

construction services sector, (iv) government administration services, and (v) the processing industry. Third, the economic competitiveness of Takalar Regency is dominantly influenced by sectors, namely (i) construction services, (ii) wholesale, retail, car, and motorcycle repair shops, (iii) information and communication services, (iv) service services. government, and (vi) health services. Fourth, changes in regional income of Takalar Regency are influenced by the following sectors: (i) agriculture, forestry and fisheries businesses with a contribution value of 47.76%, (ii) wholesale, retail, car repair shops and motorbikes trading businesses with a contribution value of 14.11%, (iii) the construction service business sector with a contribution value of 7.01%, (iv) the government administration services business sector with a contribution value of 6.59%, and (v) the processing industry business sector with a contribution value of 5.37%. These results confirm that the economic business sector in Takalar Regency has the potential to stimulate regional economic growth. Thus, the development of regional economic potentials will boost the productivity of community economic enterprises in a sustainable manner (Jayaratne et al., 2019; Surya et al., 2020). Furthermore, the basic economic sector and dynamic location quotient index in Takalar Regency are presented in Table 2.

Table 2 shows the basic economic sector and dynamic location quotient index in Takalar Regency. The interpretations that can be proposed for these results include: (1) Superior commodities that are predominantly developed in Takalar Regency and have the potential to be marketed outside the region, namely agriculture, forestry, fisheries, and construction; (2) Commodities whose management needs to be optimized are procurement of electricity and gas, transportation and warehousing, real estate, and government administration; (3) Commodities that need to be improved in the future to encourage economic growth, namely mining and excavation, processing industry, water supply, waste management, and waste and recycling, wholesale, retail, and repair of cars and motorcycles, provision of accommodation, food, and drink, information and communication, financial services

**Table 1: Economic growth in Takalar Regency based on business fields.**

Business Field	Takalar Regency (Rupiah)			
	Growth component	Proportional growth	Economic competitiveness	Income change
Agriculture, forestry, and fisheries	3,326,049.22	3,243,303.90	(121,903.90)	204,649.22
Mining and excavation	110,235.05	107,632.04	(4,132.04)	6,735.05
Processing industry	389,418.22	356,447.46	9,952.54	23,018.22
Procurement of electricity and gas	12,195.65	11,569.42	(69.42)	695.65
Water supply, waste management, and waste and recycling	3,624.27	3,568.28	(168.28)	224.27
Construction	488,158.52	449,402.37	8,697.63	30,058.52
Wholesale, retail, and repair of cars and motorcycles	1,009,651.38	929,784.70	19,415.30	60,451.38
Transportation and warehousing	219,133.00	215,830.11	(9,830.11)	13,133.00
Provision of accommodation, food, and drink	24,681.99	23,363.83	(163.83)	1,481.99
Information and communication	291,796.59	264,023.53	10,276.47	17,496.59
Financial services and insurance	89,948.63	86,734.29	(2,334.29)	5,548.63
Real estate	411,367.85	391,565.88	(5,465.88)	25,267.85
Company services	428.38	385.22	14.78	28.38
Government administration	474,651.12	434,489.18	12,310.82	27,851.12
Education services	98,006.86	91,991.37	8.63	6,006.86
Health services	77,371.99	71,822.14	777.86	4,771.99
Other services	17,996.44	16,455.53	444.47	1,096.44

Source: Analysis results

and insurance, company services, education services, and health services. These results confirm that the basic economic sector still needs good governance and increased productivity to support regional economic growth in Takalar Regency. This means that government policies are needed to maximize the potential of basic economic sectors and strengthen institutional capacity towards increasing the productivity of community economic enterprises (Maksum et al., 2020; Surya et al., 2020). Furthermore, the economic activity specialization index in Takalar Regency is presented in Table 3.

Table 3 shows the economic activity specialization index in Takalar Regency, which is  $62.94/2 = 31.46$  with a scale of 0-1 of 0.31. Furthermore, if it refers to the boundary, the basic sectors in Takalar Regency have a tendency, to be evenly distributed. Interpretations that can be carried out on these results include: (1) Five economic business sectors that contribute positively to the economy of Takalar Regency, namely agriculture, forestry, and fisheries,

procurement of electricity and gas, transportation and warehousing, real estate, and government administration; (2) Sectors that have a negative contribution to the economy of Takalar Regency, namely mining and excavation, processing industry, water supply, waste management, and waste and recycling, wholesale, retail, and repair of cars and motorcycles, provision of accommodation, food, and drink, information and communication, financial services and insurance, company services, education services, and health services (3) The basic sectors that have the highest contribution to support the economic growth of Takalar Regency are agriculture, forestry, and fisheries. These results confirm that the agriculture, forestry, and fisheries sectors have strategic potential to support economic growth, create employment opportunities, business fields, and increase the income of the people of Takalar Regency. Furthermore, it is necessary to optimize the use of natural resources integrated with strengthening the capacity of human resources towards sustainable regional development. Thus, optimizing the use of natural resources through the support of sustainable

**Table 2: Basic economic sector and dynamic location quotient index**

Business Field	Growth (%)	Location quotient value	Indeks dynamic location quotient	Information
Agriculture, forestry, and fisheries	-1.55	2.32	4.28	Prospective basis sector
Mining and excavation	2.77	0.31	-4.13	The non-base sector is not prospective
Processing industry	-2.07	0.42	-0.42	The non-base sector is not prospective
Procurement of electricity and gas	2.44	1.84	-1.27	Basic sector, not prospective
Water supply, waste management, and waste and recycling	8.63	0.46	-1.68	Non-base sector, not prospective
Construction	-1.03	0.54	0.02	Base sector, prospective
Wholesale, retail, and repair of cars and motorcycles	-1.41	0.94	-0.27	Non-base sector, not prospective
Transportation and warehousing	-3.91	1.05	-0.19	Basic sector, not prospective
Provision of accommodation, food, and drink	-7.10	0.25	-0.74	Non-base sector, not prospective
Information and communication	10.41	0.58	-1.28	Non-base sector, not prospective
Financial services and insurance	6.69	0.39	-2.97	Non-base sector, not prospective
Real estate	-0.69	1.64	-0.09	Basic sector, not prospective
Company services	-4.44	0.02	-0.50	Non-base sector, not prospective
Government administration	-0.30	1.54	-0.97	Basic sector, not prospective
Education services	4.46	0.25	-1.08	Non-base sector, not prospective
Health services	10.05	0.54	-1.32	Non-base sector, not prospective
Other services	-9.73	0.18	-1.05	Non-base sector, not prospective

Source: Analysis results

**Table 3: Specialization index of the economic activity sector in Takalar Regency**

Business field	Takalar regency		South Sulawesi Province		X-Y	X-Y (absolut)
	(Rupiah)	X (%)	(Rupiah)	X (%)		
Agriculture, forestry, and fisheries	3072.89	46.73	66064.12	20.13	26.60	26.60
Mining and excavation	106.41	1.62	17274.28	5.26	-3.65	3.65
Processing industry	358.77	5.46	42850.48	13.06	-7.60	7.60
Procurement of electricity and gas	11.77	0.18	318.67	0.10	0.08	0.08
Water supply, waste management, and waste and recycling	3.65	0.06	394.15	0.12	-0.06	0.06
Construction	453.33	6.89	41875.48	12.76	-5.87	5.87
Wholesale, retail, and repair of cars and motorcycles	935.77	14.23	49799.33	15.17	-0.94	0.94
Transportation and warehousing	197.97	3.01	9424.21	2.87	0.14	0.14
Provision of accommodation, food, and drink	21.58	0.33	4325.23	1.32	-0.99	0.99
Information and communication	302.93	4.61	25869.89	7.88	-3.28	3.28
Financial services and insurance	90.1	1.37	11457.26	3.49	-2.12	2.12
Real estate	383.44	5.83	11703.74	3.57	2.27	2.27
Company services	0.43	0.01	1355.8	0.41	-0.41	0.41
Government administration	445.52	6.78	14416.91	4.39	2.38	2.38
Education services	96.13	1.46	19465.08	5.93	-4.47	4.47
Health services	79.84	1.21	7382.8	2.25	-1.04	1.04
Other services	15.22	0.23	4215.38	1.28	-1.05	1.05

Source: Analysis results

human resource (HR) management is oriented towards several principles, namely concern for the environment, profitability, labor participation, external partnerships, flexibility, cooperation, justice, and equality (Stankeviciute and Savanevičiene, 2018; Stofkova and Sukalova, 2020). The level of community income in Takalar Regency is presented in Table 4.

Table 4 shows the per capita income of the population in Takalar District. Interpretations that can be proposed for these results include: (1) Seven sub-districts in Takalar Regency with the category of per capita income level with the middle to lower category, namely Mangarabombang District, South Polombangkeng District, North Polombangkeng District, South Galesong District, North Galesong District, Pattalassang District, and Galesong District; (2) Districts that have a population with per capita income in the low category, namely the Mapakasunggu District, Sanrobone District, and Tanakeke Islands District areas; (3) The district with the highest per capita income category is located in North Polombangkeng District, while the one with the lowest per capita income category is located in the Tanakeke Islands District. These results confirm that the differentiation of people's income is closely related to the potential of natural resources, employment opportunities and economic enterprises developed by the community. Optimization of natural resource management followed by the creation of entrepreneurship will encourage increased productivity of economic enterprises and employment opportunities towards a balance between development and ecology (Gibb, 1993; Surya et al., 2020). Furthermore, the distribution of socio-economic activities in Takalar Regency is presented in Table 5.

Table 5 shows the distribution of socio-economic activities in Takalar District. Interpretations that can be put forward for these

results include: (1) Eight sub-districts in Takalar Regency have a distribution pattern of socio-economic activities in grouped categories, namely in Mangarabombang, Mapakasunggu, South Polombangkeng, North Polombangkeng, South Galesong, North Galesong, Pattalassang, and Galesong Districts; and (2) Areas that have an uneven distribution pattern of socio-economic activities are in the Sanrobone District and the Tanakeke Islands. These results confirm that services for socio-economic activities in Takalar Regency are not evenly distributed across districts and indicate service disparities in terms of distance and regional accessibility. Thus, it is very important to create reciprocal and interactive relationships between urban and rural areas that are reciprocal and mutually beneficial towards the distribution of services for socio-economic activities and support for the preparation of adequate infrastructure (Surya, 2015; Mayer et al., 2016). Furthermore, the entropy index of socio-economic activities in Takalar Regency is presented in Table 6.

Table 6 shows the spatial entropy index of socio-economic activities in relation to the distribution of the population in Takalar Regency. These results indicate that the entropy index for Takalar Regency has an inK value = 2.30. This means that the absolute entropy index value (IE) is  $2.47/2.30$ , or the entropy index value is 1.07. Thus, the entropy index value in Takalar District shows that the distribution of the population tends to be evenly distributed across all sub-districts. This result confirms that the relationship between regional resources and the environment as well as human activities plays an important role in sustainable regional development (Surya, 2015; Bao et al., 2020). Furthermore, the industrial activity concentration and deconcentration indexes are presented in Table 7.

**Table 4: Per capita income of the population in Takalar Regency**

District area	Total population (Person)	Income Per capita (Rupiah)	Information
Mangarabombang	41.085	21,991,796.69	Middle down
Mapakasunggu	9.461	5,064,242.14	Low
South Polombangkeng	29.237	15,649,851.76	Middle down
North Polombangkeng	50.255	26,900,273.64	Middle down
South Galesong	26.985	14,444,411.19	Middle down
North Galesong	41.311	22,112,768.96	Middle down
Pattalassang	39.275	21,022,947.91	Middle down
Galesong	41.003	21,947,904.09	Middle down
Sanrobone	15.257	8,166,699.33	Low

Source: Analysis results

**Table 5: The distribution pattern of socio-economic activities in Takalar Regency**

District area	Area/ km <sup>2</sup> (A)	Socio- economic activities (N)	Inner point density km <sup>2</sup> (p)	Average distance between points (Ju)	Average distance of random pattern points (Jh)	Nearest NEIGHBORING SPREAD INDEX (T)	Information
Mangarabombang	100.5	18	0.18	1.33	0.21	0.35	Cluster
Mapakasunggu	15.12	7	0.46	0.64	0.34	0.27	Cluster
South Polombangkeng	88.07	18	0.20	1.42	0.23	0.35	Cluster
North Polombangkeng	212.25	24	0.11	2.17	0.17	0.54	Cluster
South Galesong	24.71	10	0.40	0.84	0.32	0.26	Cluster
North Galesong	15.11	12	0.79	0.82	0.45	0.15	Cluster
Pattalassang	25.31	22	0.87	0.78	0.47	0.08	Cluster
Galesong	25.93	17	0.66	0.89	0.40	0.13	Cluster
Sanrobone	29.36	5	0.17	0.91	0.21	0.88	Random

Source: Analysis results

Table 7 shows the industrial activity concentration-deconcentration index in Takalar Regency. Interpretations that can be proposed for these results include: (1) Six districts that have an even distribution of the industrial sector, namely Mangarabombang, South Polombangkeng, North Polombangkeng, Galesong, Sanrobone, and Tanakeke Islands. (2) areas that have a distribution of industrial locations in a concentrated category are located, in the districts of Mapakasunggu, South Galesong, North Galesong, and Pattalassang. Thus, the developing processing industry in Takalar Regency is the driving force for economic growth and increased productivity in the Minapolitan area. Thus, the use of renewable energy is an important element in supporting regional development towards increasing industrial productivity and sustainable community economic efforts (Zhang and Wu, 2021).

The development of the minapolitan area in Takalar Regency has two main elements, namely (i) the development of the marine and fisheries sector based on the optimization of regional potentials, and (ii) the optimization of economic development by optimizing the potential for marine and fisheries as prime commodities. Furthermore, the development concept is oriented towards three basic principles, namely (i) economic democratization, (ii) community economic empowerment, and (3) strengthening institutional capacity. The Minapolitan area of South Galesong District, Takalar Regency is oriented towards optimizing the mining business. This means that the pattern of handling the minapolitan area is developed in the direction of optimizing the processing of commodities from upstream to downstream including procurement, production, processing, and product marketing activities. Furthermore, customer networks, products,

cost pressures in production, logistics, and supply chains are challenges for increasing business productivity towards a sustainable business economy (Teodorescu and Korchagina, 2021). These miniseries activities are marked by the existence of production centers and marketing of fishery products within the framework of encouraging economic growth in Takalar Regency. Furthermore, the Minapolitan area is aimed at increasing the productivity of economic enterprises, production systems, trade, services, and health services. Thus, the allocation of spatial use in the minapolitan area of the South Galesong District of Takalar Regency is developed to support: (1) increasing production, productivity of fishery cultivation and processed products; (2) opening work and business fields; (3) developing superior commodities; (4) increase in income and community welfare. The space utilization of the Minapolitan area is presented in Table 8.

Table 8 shows the spatial use of the minapolitan area of South Galesong District, Takalar Regency. Several things can be explained related to the use of space, among others: (1) Four dominant land use categories in the Minapolitan area of South Galesong District, namely housing, rice fields, moor, and aquaculture ponds; (2) Utilization of land for agricultural activities and supporting activities is 66.59%; and (3) Utilization of space for aquaculture ponds is 9.31%. These results illustrate that the optimization of land resource potential is very potential to be developed in order, to encourage the development of the minapolitan area in Takalar Regency. The development of the agricultural sector based on the development of the Minapolitan area is the backbone of sustainable development due to limited land resources (Said et al., 2020)

**Table 6: Spatial entropy index for socio-economic activities in Takalar Regency**

District area	Total population (person)	%	Pi	Pi ln Pi
Mangarabombang	41085	13.66	0.14	-0.20
Mapakasunggu	9461	3.14	0.03	-0.35
South Polombangkeng	29237	9.72	0.10	-0.23
North Polombangkeng	50255	16.70	0.17	-0.18
South Galesong	26985	8.97	0.09	-0.24
North Galesong	41311	13.73	0.14	-0.20
Pattalassang	39275	13.05	0.13	-0.20
Galesong	41003	13.63	0.14	-0.20
Sanrobone	15257	5.07	0.05	-0.30

Source: Analysis results

### 3.2. Business Productivity and Use of Renewable Energy

Utilization of natural resource potential in relation to optimizing the development of the Minapolitan area of South Galesong District towards increasing the productivity of community economic enterprises is oriented towards several principles, namely (1) fostering business management, (2) empowering the community's economy, (3) increasing business competitiveness, (4) access to potential markets, and (5) utilization of renewable energy. These four things require the support of government policies towards increasing the economic competitiveness of the minapolitan region and improving the welfare of the people. This means that the support of industrial policies and the fulfillment of

**Table 7: Index of concentration-deconcentration of industrial activities in Takalar Regency**

District area	Area		Number of industries		X-Y	X-Y (Absolut)	DQ	Information
	Km <sup>2</sup>	X (%)	Unit	Y (%)				
Mangarabombang	100.5	17.74	9	0.33	17.41	17.41	0.02	Equally
Mapakasunggu	15.12	2.67	215	7.94	-5.27	5.27	2.98	Concentrated
South Polombangkeng	88.07	15.55	137	5.06	10.49	10.49	0.33	Equally
North Polombangkeng	212.25	37.47	615	22.72	14.75	14.75	0.61	Equally
South Galesong	24.71	4.36	133	4.91	-0.55	0.55	1.13	Concentrated
North Galesong	15.11	2.67	1069	39.49	-36.82	36.82	14.81	Concentrated
Pattalassang	25.31	4.47	501	18.51	-14.04	14.04	4.14	Concentrated
Galesong	25.93	4.58	25	0.92	3.65	3.65	0.20	Equally
Sanrobone	29.36	5.18	3	0.11	5.07	5.07	0.02	Equally

Source: Analysis results



energy needs will encourage increased economic competitiveness and social welfare (Aiginger and Böheim, 2015). Furthermore, public perceptions in relation to economic growth to increase business productivity in the Minapolitan area of South Galesong District are presented in Figure 5.

Figure 5 shows economic growth towards increasing business productivity and increasing population income in Minapolitan areas. Interpretations that can be proposed for these results include: (1) Economic growth to increase the productivity of the community’s economic enterprises illustrates that 54.33% is in the supportive category, 18% is in the supportive category, and 27.67% is in the not supportive category; (2) Economic growth towards the improvement of people’s welfare shows that 53.33% is in the supporting category, 17.34% is in the supporting category, and 29.33% is in the not supportive category. These results confirm that the economic growth coupled with the optimization of the potential of business activity sectors in Takalar Regency will boost the productivity of economic enterprises and increase the welfare of the community. In general, an increase in the economy means that the area’s innovative power increases and the average person involved in the production process increases the added value of the economy and sustainable economy policies and strategies have allowed for a reduction in the pressure on the environment (Herr and Zeynep, 2017; Segura 2020). Furthermore, increasing the productivity of economic enterprises through the use, of renewable energy is presented in Figure 6.

**Table 8: Utilization of space in the minapolitan area of South Galesong District, Takalar Regency**

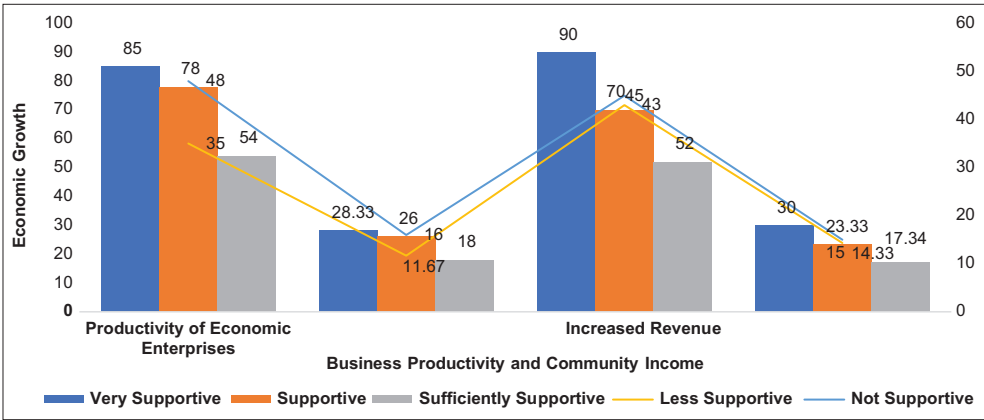
Space utilization	Area (hectares)	Percentage
Housing and socio-economic activities	104.97	5.40
Aquaculture pond fisheries	180.83	9.31
Field	196.71	10.13
Rice fields	1293.41	66.59
Empty land	9.67	0.50
River	8.33	0.43
Shrubs	21.49	1.11
Plantation	117.7	6.06
Sand dunes	8.59	0.44
Meadow	0.58	0.03

Source: Analysis results

Figure 6 shows the productivity of economic enterprises in relation to the use of renewable energy. Interpretations that can be proposed for these results include: First, the productivity of economic enterprises in the Minapolitan area in relation to energy availability gives an illustration of 56.67% in the supportive category, 21.33% in the sufficiently supportive category, and 22% with the not supportive category. Second, the productivity of economic enterprises in relation to energy needs shows that 61% are in the supportive category, 18% are in the sufficiently supportive category, and 21% are in the not supportive category. Third, the productivity of economic enterprises in relation to the distribution of energy needs shows that 21% are in the supportive category, 15% are in the sufficiently supportive category, and 64% are in the not supportive category. Fourth, the productivity of economic enterprises in relation to energy services gives an illustration of 22% with the supportive category, 17.33% with the supporting category, and 60.67% with the not supportive category. These results confirm that support for the use of renewable energy in terms of distribution of energy services causes the productivity of the minapolitan area of the South Galesong District to not be optimal in supporting the economic growth of Takalar Regency. The use of renewable energy is very important and strategic, due to the limited resources of fossil energy that cannot be renewed, and which damages the environment (Sasmaz et al., 2020).

The distribution of the use of renewable energy as an alternative to fossil energy in support of increasing the productivity of the economic business in the Minapolitan area of Takalar Regency will require government policy support to utilize various potential energy sources, including: (1) Water energy to meet electricity needs, agricultural irrigation and water needs for pond fishery cultivation activities; (2) Wind energy for Bayu Power Plant, to produce electrical energy; (3) Utilization of solar energy through the construction of solar power plants, by converting sunlight into heat or electricity to meet household energy needs and energy needs for fishery product processing industries, and (4) Biogas as an alternative to replacing gas which has been used for it is widely used by people in the production process and a source of electrical energy. Furthermore, the use of renewable energy is oriented towards several interests, namely (i) reducing soil and water pollution through recycling of waste produced by the

**Figure 5: Economic growth to increase business productivity and increase community income.**



Source: Primary data

community, (ii) making organic fertilizers for plant supplements and substituting for chemical fertilizers, (iii) utilizing livestock manure to produce biogas for electrical energy needs, (iv) the use of biogas from compost to reduce air pollution towards clean energy management. Thus, the use of renewable energy in addition to increasing the productivity of the community's economy, also has an impact on improving the quality of the environment in the Minapolitan area. Renewable energy sustainability has been assessed using the most commonly, used dimensions of this concept: economic, environmental, social, and institutional dimensions (Cîrstea et al., 2018).

### 3.3. Strengthening Institutional Capacity and Enhancing Environmental Quality

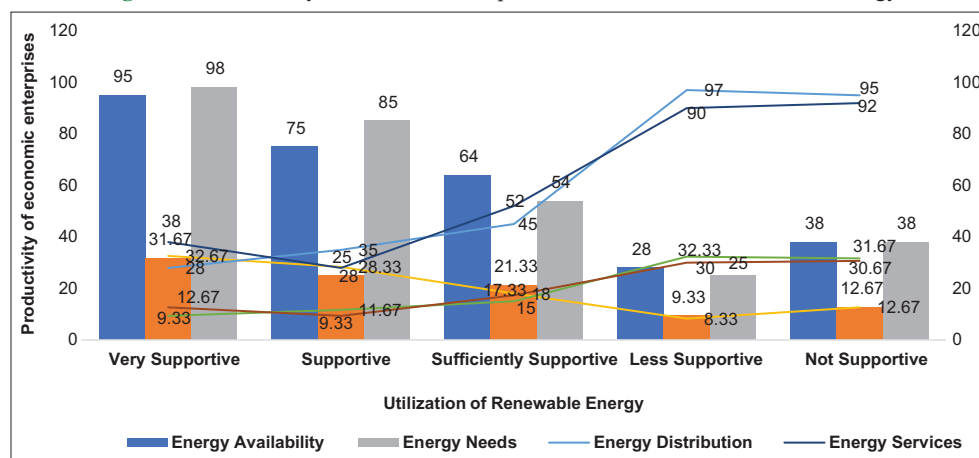
The role of government is very important and strategic to support the improvement of service quality and the independence of the community's economic enterprises towards improving environmental quality. This means that the role of government is very important to encourage increased output and productivity of economic enterprises towards increasing welfare and reducing poverty (Burger et al., 2015). The challenges of the government and society in the future are limited natural resources and scarcity of fossil energy which can be used to encourage an increase in the productivity of community economic enterprises in a sustainable manner. Energy production has the potential to affect land productivity, land cover, human migration, and other factors involved in running an energy production system (Avtar et al., 2019). Thus, a strategy to strengthen the institutional capacity of the government and society is needed to optimize the use of natural resources and use of renewable energy. Utilization of renewable energy will encourage the effectiveness and efficiency of natural resource utilization towards economic, social, and environmental sustainability (Garrido et al., 2020). Furthermore, the management of natural resources and environmental services will require synergy between the government, the private sector, and the participation of the community. Government institutional capacity and community participation in the development of the Minapolitan area is presented in Figure 7.

Figure 7 shows the institutional capacity and community participation in the development of the Minapolitan area of South

Galesong District, Takalar Regency. The interpretations that can be proposed for these results include: (1) The function of government institutions in relation to the development of the Minapolitan area shows that 19.67% is in the supportive category, 16% is in the sufficiently supportive category, and 64.33% is in the not supportive category; (2) The role of government institutions in relation to the development of the Minapolitan area illustrates 24.33% in the supportive category, 10.34% in the sufficiently supportive category, and 65.33% in the not supportive category; (3) Leadership in the management and development of the Minapolitan area illustrates 34.66% in the supportive category, 16.67% in the sufficiently supportive category, and 48.67% in the not supportive category; (4) Community participation in the development of the Minapolitan area gives an illustration of 33.33% in the supportive category, 14.67% in the sufficiently supportive category, and 52% in the not supportive category. These results confirm that the functions and roles of government institutions and support for community participation are not yet optimal, causing the Minapolitan region's contribution to economic growth has not yet been maximized in promoting community welfare. Thus, government policies are very important in encouraging economic growth, increasing business productivity, and improving people's welfare (Bilan et al., 2020). Furthermore, the role of community participation in the development and utilization of renewable energy has a positive contribution to increasing economic productivity in the Minapolitan area. This means that the role and participation of the community is very important in the use of renewable energy to encourage local economic growth, is socially inclusive, and the use of environmentally friendly technology (Acosta et al., 2018).

The strategic steps required in optimizing the functions and roles of the government in encouraging increased economic productivity in the Minapolitan area include: (1) Strengthening the capacity for implementing development through formal training and education processes; (2) Increasing capabilities and skills in managing strategic programs; and (3) Strengthening the competence of human resources in the formulation, implementation and evaluation of development policies; and (4) Increase the capacity of regional government officials in building cooperation between the government and the private sector in managing regional investment. These four things will encourage

Figure 6: Productivity of economic enterprises and utilization of renewable energy.



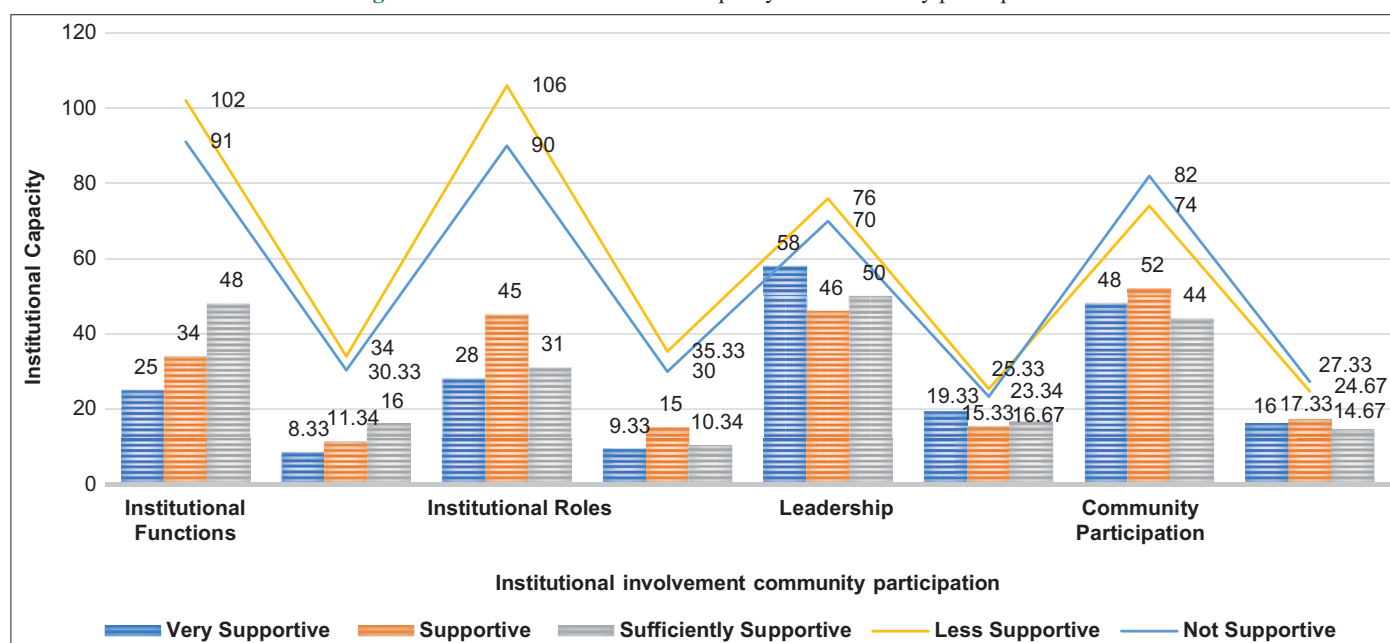
Source: Primary data

the acceleration of the development of the Minapolitan area in the direction of improving the welfare of the community. Thus, human capital is believed to have a positive relationship with economic growth and the acceleration of regional development (Ali et al., 2018). Furthermore, increasing community participation in the management and development of the Minapolitan area is oriented towards several principles, namely (i) strengthening community self-reliance in developing productive economic enterprises, (ii) mentoring development management systems based on community empowerment towards independence in business management, utilization of renewable energy, and environmental sustainability; and (iii) strengthening cultural values and building public awareness towards the efficient and effective use of natural resources. Furthermore, the increase in development activities for the Minapolitan area has an impact on environmental quality

degradation. The decline in environmental quality is marked by the presence of socio-economic activities located in coastal areas and riverbanks and their impact on decreasing water quality, air quality, and reducing land cover. The source of environmental pollution in the Minapolitan area of South Galesong District is presented in Figure 8.

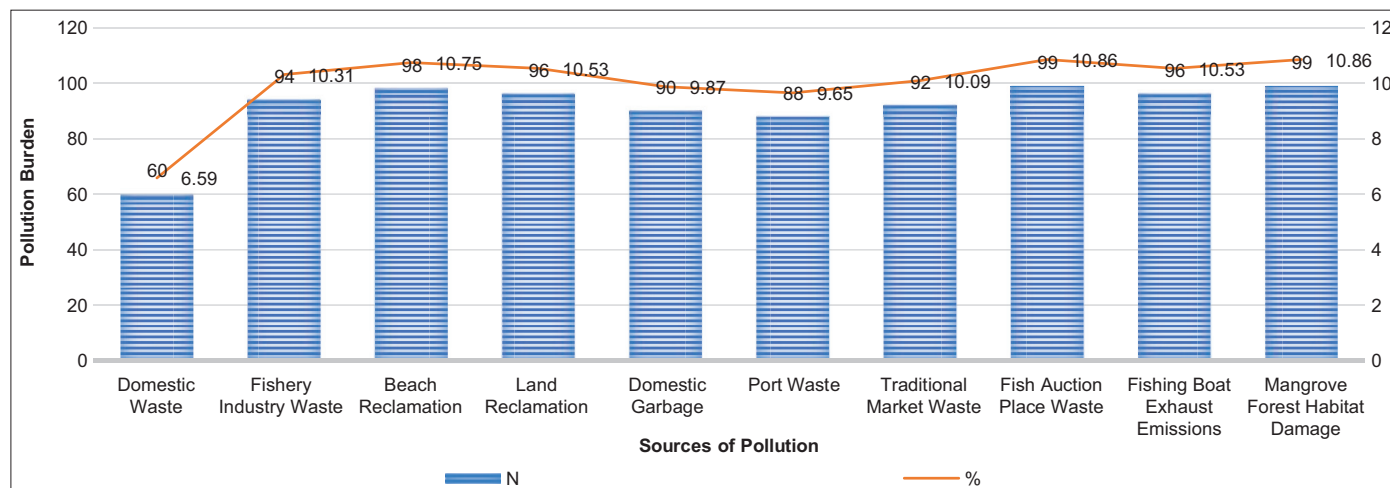
Figure 8 shows the development activities of the Minapolitan area and their effect on environmental pollution. The interpretations that can be explained include: (1) Increasing the development of minapolitan areas has an impact on the destruction of mangrove forest habitat with a contribution value of 10.86%; (2) Increasing the productivity of fisheries in the Minapolitan area to the increase in waste from fish auction activities contributed 10.86%; (3) Increasing development activities through coastal reclamation

**Figure 7:** Government institutional capacity and community participation



Source: Primary data

**Figure 8:** Environmental pollution of the Minapolitan area of South Galesong District



Source: Primary data

contributing 10.75%; and (4) Increased productivity of economic enterprises through the fishery industry contributed 10.31%. These results confirm that an increase in the development activity of the Minapolitan area is positively associated with a decrease in environmental quality. Thus, a comprehensive and integrated policy framework is needed towards a sustainable environmental management system (Guan et al., 2011). Furthermore, increasing development activities and their impact on decreasing water quality, air quality, and reducing land cover are described in Figure 9.

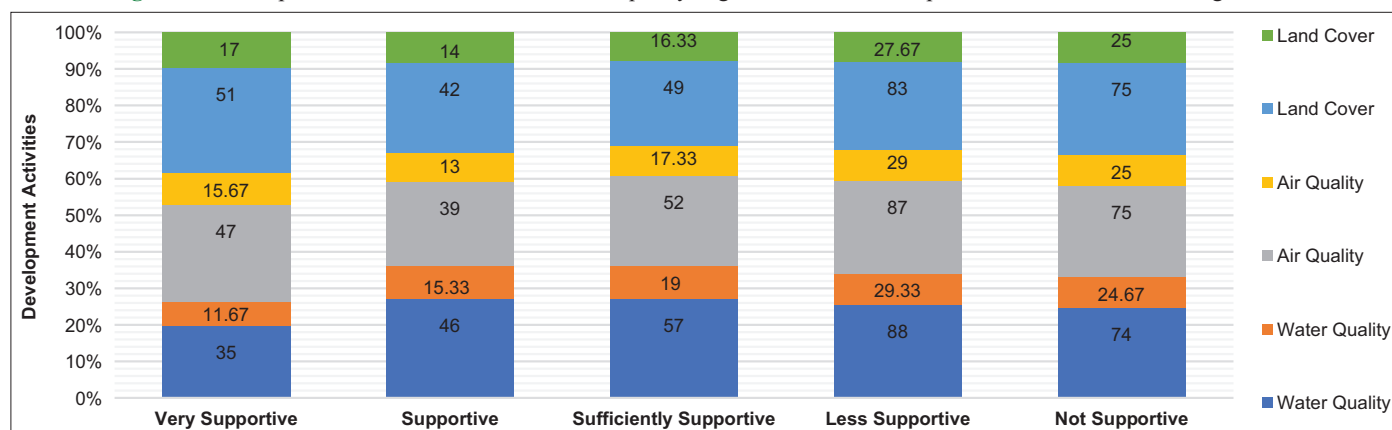
Figure 9 shows development activities and environmental quality degradation in the Minapolitan area of South Galesong Kacamatan. Interpretations that can be proposed for these results include: First, water quality pollution development activities contributed 27% in the supportive category, 19% in the sufficiently supportive category, and 54% in the not supportive category. This means that development activities in the Minapolitan area have a positive contribution to reducing water quality. Second, the minapolitan area development activities to reduce air quality obtained a picture of 28.67% with the supportive category, 17.33% with the sufficiently supportive category, and 54% with the not supporting category. This means that an increase in development activities and transportation movement systems is positively related to an increase in air pollution load. Third, the minapolitan area development activities to reduce land cover get a picture of 31%, 16.33% in the sufficiently supportive category, and 52.67% in the not supportive category. This means that the increase in development activities that are dominant in the utilization of coastal areas and water catchments has an impact on decreasing land cover and decreasing environmental quality in the Minapolitan area, South Galesong District, Takalar Regency. Human activities tend to bring about changes in land use and occupation patterns, which lead to a series of processes that change the quality of the natural environment and the built environment (Wheater and Evans, 2019; Zope et al., 2016). Furthermore, the effect of economic growth, utilization of renewable energy, and strengthening of institutional capacity on improving environmental quality and sustainable development of the Minapolitan area is presented in Figure 10.

Figure 10 can be explained, among others: First, the relationship or correlation between economic growth and renewable energy

utilization is 0.632, the relationship or correlation between economic growth and institutional capacity strengthening is 0.524, and the relationship or correlation between renewable energy use and institutional capacity strengthening is 0.526. Second, the direct effect of economic growth on improving environmental quality  $(0.346)^2 = 0.1197$  or 11.97%, the direct effect of renewable energy utilization on improving environmental quality  $(0.382)^2 = 0.1459$  or 14.59%, and the direct effect of strengthening institutional capacity on improving quality environment  $(0.207)^2 = 0.0428$  or 4.28%. Third, the indirect effect of economic growth through the use of renewable energy on improving environmental quality  $(0.346) \times (0.632) \times (0.382) = 0.0835$  or 8.35%, the indirect effect of renewable energy utilization through economic growth on improving environmental quality  $(0.382) \times (0.632) \times (0.346) = 0.0835$  or 8.35%, indirect effect of economic growth through strengthening institutional capacity on environmental quality improvement  $(0.346) \times (0.524) \times (0.207) = 0.0375$  or 3.75%, indirect effect of strengthening institutional capacity through economic growth on improving environmental quality  $(0.207) \times (0.346) \times (0.524) = 0.0375$  or 3.75%, and the indirect effect of the use of renewable energy through strengthening the capacity of moisture to improve environmental quality  $(0.382) \times (0.526) \times (0.207) = 0.0416$  or 4.16%, the indirect effect of strengthening institutional capacity through the use of renewable energy n towards the improvement of environmental quality improvement  $(0.207) \times (0.526) \times (0.382) = 0.0416$  or 4.16%.

The effect of total economic growth, renewable energy utilization, and strengthening institutional capacity on improving environmental quality  $(0.1197 + 0.1459 + 0.0428) + (0.0835 + 0.0835) + (0.0375 + 0.0375) + (0.0416 + 0.0416) = 0.6336$  or 63.36%. Furthermore, the remaining effect or residue that is not examined on the increase in environmental quality improvement is  $1 - 0.6336 = 0.3664$  or 36.64%. The direct effect of increasing the quality of the environment on the sustainability of the development of the Minapolitan area  $(0.823)^2 = 0.6773$  or 67.73%. The residual effect or residue (the influence of other variables on the sustainability of Minapolitan area development that was not studied) is  $1 - 0.6773 = 0.3227$  or 32.27%. The results of the analysis illustrate that there is a strengthening, namely the effect of X on Y by 63.36% to 67.73% or an increase of  $67.73\% - 63.36\% = 4.37\%$ . Thus, it can be concluded that economic growth, renewable

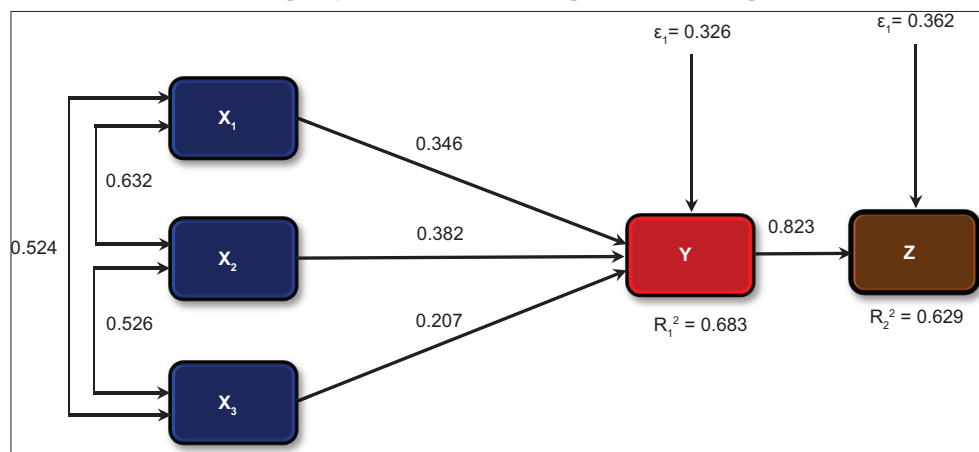
**Figure 9:** Development activities and environmental quality degradation of the Minapolitan area of South Galesong District



Source: Primary data



**Figure 10:** The influence of economic growth, utilization of renewable energy, and strengthening of institutional capacity on improving environmental quality and sustainable development of the Minapolitan area.



Source: Analysis results

energy utilization, and strengthening of institutional capacity together have an effect, on the improvement of environmental quality with a determination coefficient of 46.65%, and an increase in environmental quality has an effect, on the sustainability of the development of the Minapolitan area with a determination coefficient of 39.56%.

Furthermore, the strategic steps needed to support the improvement of environmental quality in the Minapolitan area of South Galesong Regency include: (1) Increasing the productivity of community economic enterprises that are oriented towards the use of renewable energy; (2) The management of the production business is developed on the utilization of product recycling through the use of environmentally friendly technology towards clean products; (3) Conservation of coastal areas through rehabilitation of mangrove forests to prevent coastal abrasion; (4) Control of minapolitan area spatial use through tightening licensing and application of incentives and disincentives, (5) Strengthening government institutional capacity through investment cooperation in minapolitan area management, equitable distribution of energy, and fulfillment of renewable energy needs; (6) The effectiveness and efficiency of the utilization of natural resources which is oriented towards increasing the productivity of the community's economic enterprises; (7) Supporting business economic development through community empowerment starting from the production process to product marketing; and (8) Increasing the economic competitiveness of the Minapolitan region as a driver of economic growth in Takalar Regency. In its implementation, eight principles towards the sustainability of the Minapolitan area were developed, namely environmental, economic, and social aspects. Therefore, it is very important to ensure the alignment of cross-sectoral policies between government, private and community institutions towards sustainable development (Chiripuci et al., 2020).

### 3.4. Minapolitan Area Development Sustainability

The sustainability of the development of the Minapolitan area of the South Galesong District of Takalar Regency is

developed in the direction of three basic principles, namely: First, environmental sustainability is oriented towards the stability of the natural resources of the Minapolitan area and avoids excessive exploitation of natural resources. Furthermore, strategic implementations that can be implemented include: (1) Ecology, in this case striving for the natural environment of the Minapolitan area as a source of life towards improving community welfare, (2) Protection of mangrove forest habitat to prevent abrasion and sidimentation of coastal areas 3) Maintain and ensure biodiversity, (3) Ensure community life through environmental preservation based on community participation, (4) Maximize cultural values and social capital to support the ecological sustainability of the Minapolitan area, (5) Synergize the use of natural resources towards equitable development of economic resources, (6) Encouraging community participation towards the use of renewable energy to support environmental sustainability, (7) Ensuring ecological sustainability based on sustainable fishery industrial processing, and (8) Preparation of facilities and infrastructure for the minapolitan area based on sustainability and powersupport the environment, and (9) Develop a transportation system for the Minapolitan area based on the use of renewable energy as a single system. Support for transportation infrastructure based on the use of renewable energy will encourage increased economic productivity and sustainable development (Badassa et al., 2020).

Second, the economic sustainability of the minapolitan area of South Galengsong District to be developed in the direction of several principles, namely (1) Ensuring the stability of the community's economic efforts to utilize natural resources and the environment through the principle of intergenerational justice, (2) Creating jobs and business fields to reduce unemployment and poverty in coastal communities, (3) Encouraging the productivity of economic enterprises through the use of renewable energy through efforts to provide sufficient energy when needed, (4) Raising investment from the private sector to encourage the absorption of local labor, (5) Empowering community economic enterprises through the support of business capital and access to formal financial

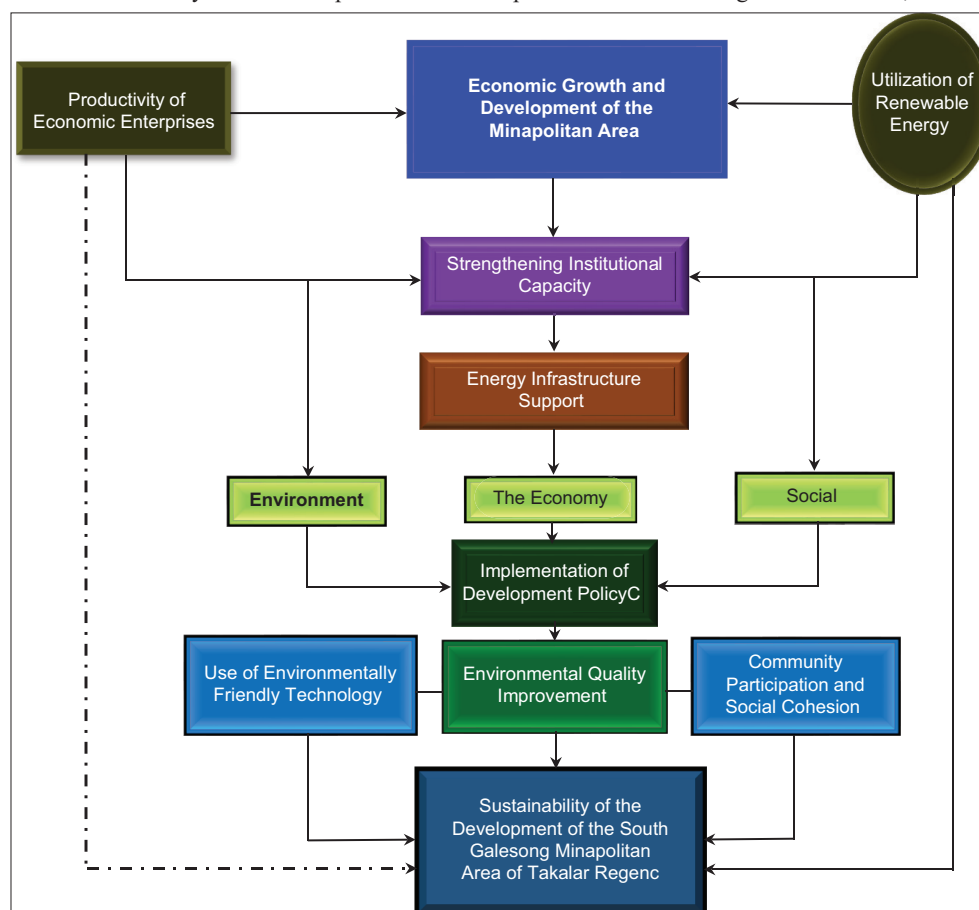
institutions, (6) Ensuring the stability of the community's economic enterprises through a continuous development process, (7) Optimizing the marketing of community fishery products through processed products that are acceptable to consumers, (8) Encouraging the marketing of community economic business products based on the use of technology to reach potential markets, and (9) Creating competitiveness of community economic business products through product innovation and business diversification. This means that product innovation and business diversification will encourage the creation of market areas and economic business stability (Ibarra et al., 2020).

Third, the social sustainability of the minapolitan area of South Galesong District, Takalar Regency, is oriented towards several principles, including: (1) Developing equality in the provision of health service facilities, education, gender equality and political accountability, (2) Equity, namely reducing socio-economic disparities between direction of balance and equality to obtain decent work and business access, (3) Facilitating economic efforts for poor families, especially fishing communities to obtain employment rights and employment, (4) Increasing community participation to ensure environmental stability towards controlling environmental pollution, (5) Optimizing the use of community social capital to live together and community trust in the development process of the minapolitan area, and (6) Creating social cohesion

in terms of utilization of natural resources and avoiding conflicts of interest in the management of the Minapolitan area. Furthermore, the sustainability of the development of the Minapolitan area of South Galesong District, Takalar Regency, is presented in Figure 11.

Figure 11 shows the sustainability of the development of the Minapolitan area of South Galesong District. Several things can be explained related to the scheme, including: (1) Economic sustainability, which is oriented to the development of a Minapolitan area that is capable, of producing goods and services continuously which is integrated with decision-making and policies from the government and avoiding sectoral imbalances that will disrupt production and fishery industry productivity; (2). Environmental sustainability is oriented towards maintaining natural resources, environmental stability, and avoiding excessive exploitation of natural resources towards environmental preservation, ensuring biodiversity, controlling water pollution, air pollution, and controlling spatial use that is not in accordance with the designation stipulated in the spatial plan; and (3) Social sustainability, oriented towards equality and inclusion based on community participation and local wisdom in order to create social cohesion towards productive cooperation and community stability. Thus, the main objective of sustainable development is to provide benefits to the environment, economy, and society (Rivera et al., 2020).

**Figure 11:** The sustainability of the development of the Minapolitan area of Galesong Selatan District, Takalar Regency.



Source: Author's elaboration

## 4. CONCLUSION

Economic growth followed by an increase in business productivity through the use, of regional-based economic sectors and integrated with good development governance will encourage job creation, business fields, and increase in community income towards sustainable regional development. Thus, optimizing the management of natural resources and environmental services followed by a service system for socio-economic activities in terms of ease of accessibility will reduce disparities between regions. Furthermore, the development of the minapolitan area which is integrated with the regional development system mechanism based on the fishery product processing industry is positively associated with economic growth towards increasing the productivity of economic enterprises, production systems, development of superior commodities and strengthening the capacity of government institutions will accelerate the development of the minapolitan area towards increasing welfare society in a sustainable manner.

Increasing the productivity of economic enterprises in the minapolitan area is oriented towards several principles, namely fostering business management, empowering the community's economy, increasing business competitiveness, accessing potential markets, utilizing renewable energy which will have an impact on improving environmental quality. Furthermore, strategic steps are needed to support the improvement of environmental quality in the Minapolitan area, namely (i) increasing the productivity of community economic enterprises oriented towards the use of renewable energy, (ii) managing production businesses through product recycling and the use of environmentally friendly technology towards clean products, (iii) conservation of coastal areas through rehabilitation of mangrove forests to prevent coastal abrasion, (iv) controlling the use of minapolitan areas through tightening permits and implementing incentives and disincentives, (v) strengthening government institutional capacity through investment cooperation in minapolitan area management, energy distribution justice, and fulfillment of energy needs; (vi) effectiveness and efficiency of natural resource utilization, (vii) support for economic business development through community empowerment from the production process to product marketing, and (viii) increasing the economic competitiveness of the minapolitan area as a driving force for economic growth.

Strategic implementations that can be carried out related to the sustainability of the Minapolitan area include: First, environmental sustainability, protection of mangrove forest habitats to prevent abrasion and sedimentation, guaranteeing biodiversity, environmental preservation based on community participation, and maximizing cultural and cultural values. social capital. community to support ecological sustainability and develop a transportation system based on the use of renewable energy as a single system. Second, economic sustainability is developed in the direction of several principles, namely ensuring the stability of community economic enterprises, creating jobs and business fields, encouraging economic business productivity through the use, of renewable energy, increasing private investment to encourage local employment, empowering community economic enterprises through support. business capital and access to formal

financial institutions, optimizing the marketing of people's fishery products through processed products that are acceptable to consumers, creating competitiveness of community economic business products through product innovation and business diversification. Third, social sustainability, oriented to several principles, namely building equality, equity, namely reducing socio-economic inequality and facilitating economic business for fishing communities, increasing community participation, optimizing the use of community social capital, and creating social cohesion and avoiding conflicts of interest in the management of the minapolitan area.

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