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MODEL OF ECONOMIC AND ENVIRONMENTAL SERVICES VALUE AROUND INDUSTRIAL ZONE

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ABSTRACT
This study is focused on efforts to find environmental problems and determine the priority of environmental programs with a systems approach. Data collection was obtained from secondary and primary data including observations and interviews. FGDs (focus group discussions) are conducted with stakeholders concerned and related to various types of environmental services. Resolution techniques for complex problems have used the concept of a dynamic system model. The model simulation approach is carried out in this method. The results of the study noted that the conversion of paddy fields, ponds and agriculture to industrial estates contributes to the loss of environmental services. Priority environmental service in an industrial area, namely the function and living space, maintenance of clean water and air quality, regulation of water flow and flooding. Prediction results of the simulation up to 2031 show that the economic value obtained after conversion maybe even smaller than the value of long-term benefits. The implication of this conclusion, especially the management of water and air quality in the industrial area, the policymakers need to conduct environmental monitoring regularly, given the simulation results show there will be an increase in land demand each year in line with the growth of the industrial sector.

KEYWORDS
Environmental services, stakeholders, dynamic system, simulation, loss of economic value

Introduction

The increase of population has implications for the availability of existing land resources. Land capacity becomes increasingly limited due to the increasing amount of land needed by humans. In addition, the decreasing quality and condition of the land has negative implications for environmental quality degradation, such as the inappropriate land use which is indicated by among others, the amount of critical land, the decreasing quality of surface water and groundwater. The increasing population has an impact to increasing rate of development in various sectors due to meet the needs of living things. One of them is for the fulfillment of raw materials as an impact of the industrial zones emergence. Kendal Regency's economy is growing rapidly in line with efforts to target infrastructure development to reduce regional inequality [1]. This can be seen from the development of infrastructure that prioritizes the construction of roads and bridges to support various industrial and domestic activities, especially the Kendal industrial allotment area, which consists of 60 companies [2]. On one hand, this situation certainly has positive impact so that it can increase the absorption of labor, both directly and indirectly contribute to the income of Kendal Regency as locally-generated revenue (*Pendapatan Asli Daerah* / *PAD*) [3]. On the other hand, this also affects the environmental condition which has decreased with the increasing water, air and soil pollution produced by various industrial activities. The decrease in environmental quality is due to the inappropriate land use which causes a lot of critical land and a decrease in both water quality and quantity [4] [5]. Hence, it takes optimal effort for water resource management to guarantee their availability and quality.

As consequence, the use of natural resources must be in harmony and balance with the function of the environment. As stated in Republic of Indonesia Law No. 32 of 2009 concerning Environmental Protection and Management. The need for provision of environmental services [6][7] in form of land for living space in industrial areas is considered important and strategic. This activity is considered to be able to take advantage of natural resources and the impacts that will occur can be reduced or eliminated (elimination). The benefits of environmental services are to calculate the real and actual value of an area's ability to utilize land resources. The purpose of this study is to find environmental problems and determine environmental program priorities through system approach.

Methodology

The scope of the environmental services study area exists around the industrial area of Kendal Regency, where exactly is in Kaliwungu sub-Regency covering living space and land use area of 1,265 ha. The data were collected from secondary data, and primary data includes data from observations and interviews.

Due to broad coverage area, the verification of results and ground check were carried out by conducting FGD (focus group discussion) with resource persons and stakeholders or other parties who are concerned and have study results related to 20 types of environmental services. Furthermore, all maps resulting from the analysis were confirmed or verified with studies and findings from opinions of resource persons and stakeholders. Implementation of FGD used the Group Model Building (CBM) method to make an inventory of agency programs related to environmental services. The results of the FGDs were then mapped and structured based on the priority of the main problems. One way to solve complex problems with system approach is to use the concept of a dynamic systems model [8]. According to Firmansyah [9], to understand the structure and behavior of system that will support the formation of formal quantitative dynamic model, it used causal loop and flow chart. Causal diagram is created by determining significant causal variables in the system and connect them by using arrows to effect variables, and these arrows can be applied both ways if the two variables influence each other.

Benefit Value of Industrial Zone

The increase of population has an impact on increasing the rate of development in various sectors. Unfortunately, this development rate has resulted a decrease of environment quality in some areas. As an illustration, land resources and land capabilities play an important role in supporting human life and other living creatures. The total population which increases will impact the availability of land resources and land capabilities due to the increasing number of living needs compared to the availability of land resources which is limited. In addition, the quality and condition of the land decreased because of human activities which do not pay attention to the sustainability aspect of the environmental function. The relationship between variables in the socio-economic model and the value of benefits is presented in Fig. 1.

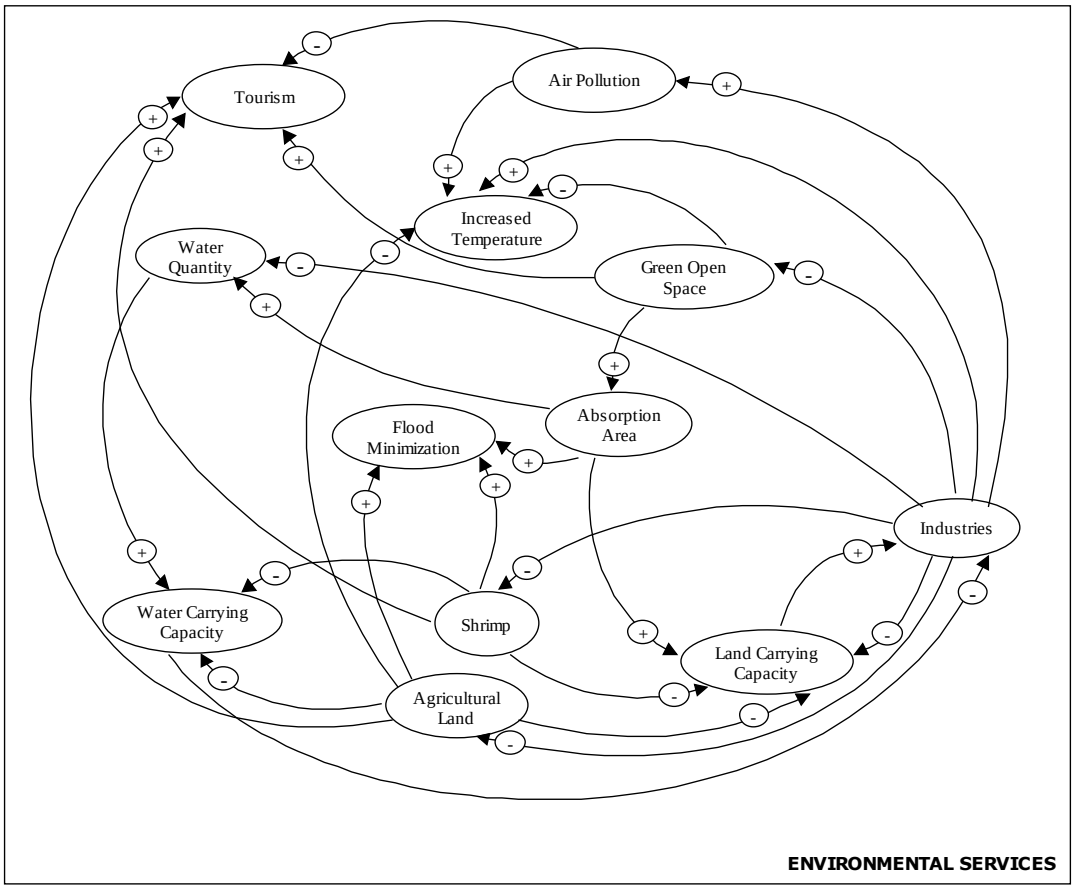

Fig. 1. *Causal Loop Diagram* (CLD) Environmental Service Model for Landuse

Result and Discussion

Environmental services that are considered include living space environmental services, environmental services for fishing such as ponds, and environmental services for agriculture such as *tegal* (edge of rice fields), gardens and fields. The location of the industrial zone is in Kaliwungu sub-Regency with an area of 1,265.32 hectares. Each land use class has direct economic and environmental service value. Hence, if the land is converted, the direct economic and environmental services value will also be lost. The economic value is obtained after land conversion may be less than the value of long-term benefits. In order to know the value in the future, it requires knowledge of the system linkages from the value of environmental services so that the long-term benefit value can be estimated [7-11]. Living space and flood-affected map is in Figure 2 and Fig. 3.

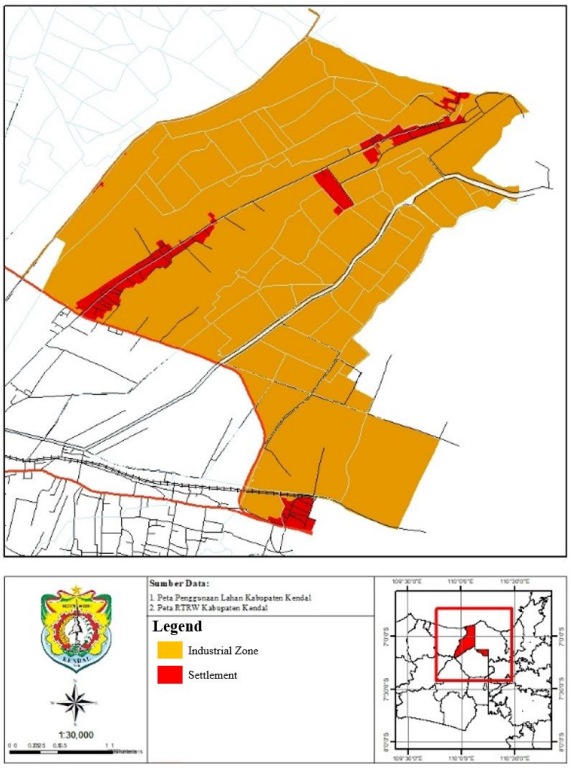

Fig. 2. Settlement Area/living space

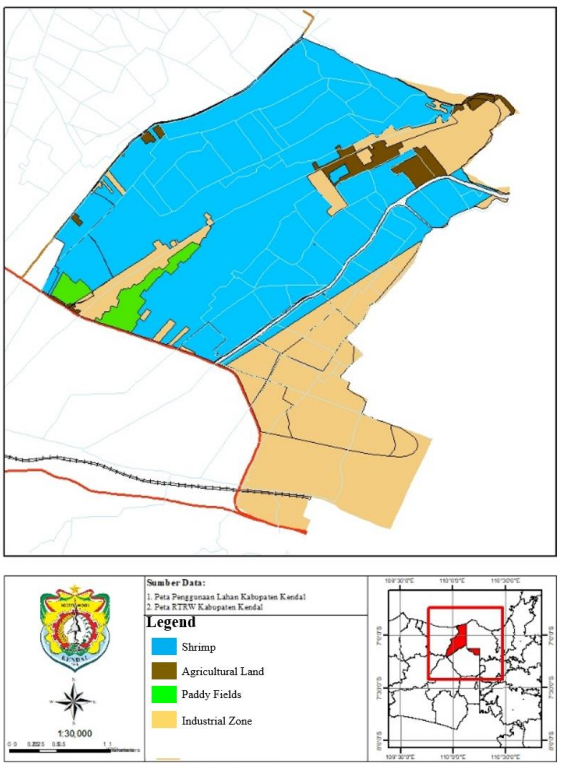

Fig. 3. Flood Affected

Benefit of Environmental Services of Living Space and Land

From total 1,265.32 Ha industrial area, there is a residential area of 65,303 Ha. The direct economic value lost due to conversion the residential area to an industrial area is IDR 3,000,000 / m^2 or IDR 30,000,000,000 / Ha. Based on the area of existing land use, it is estimated that the direct economic value lost if the residential area is converted into an industrial area is IDR 1,959,090,000,000. The residential area that will be converted into industrial area are presented in Figure 2.

The assumption of indirect economic value loss and the value of environmental services for ponds is recycling of organic waste, controlling erosion and conserving water resources. Meanwhile, the assumption of losing direct economic value and the value of environmental services for agricultural land (*tegal*, garden and field) is the conservation of water resources and an increasing temperature. [12]. Overall, the conversion of paddy fields, ponds and agriculture to industrial zone also causes the loss of environmental services value (Figure 4). In 2021, the loss value of the pond's environmental services will be IDR 7,763,756,248,046; the loss value of environmental services for paddy fields that will be IDR 1,703,198,178,000 and the loss value of agricultural environmental services (*tegal*, gardens and fields) will be IDR 215,676,111,240. It is predicted that in 2031 the value of environmental services will reach IDR 84,401,318,728,510 for ponds; IDR 18,735,179,958,000 for rice fields and IDR 2,372,437,223,640 for agricultural land (*tegal*, gardens and fields).

The carrying capacity of land for industry is still sufficient in terms of land availability and water supply. The environmental services of carrying capacity of the land in the industrial area are assessed from the value of direct benefits from residential living space, pond land, both direct and intangible economic benefits, the value of land. agriculture and rice fields both direct and intangible benefit values. The current value of environmental services from this land is IDR 81.62 billion. If the value is used sustainably, it will increase to reach IDR 27.57 trillion in 2031.

Estimation for the Economic Loss Value of Environmental Service

Around this industrial areas, there are several land uses that have lost their direct economic value and the value of environmental services, including rice fields, fishponds and dry land agriculture (*tegal*, gardens and fields). One of the reasons is when the availability of water exceeds the carrying capacity of the land, for example due to flooding. So, if there is an area that is affected by flooding, it can result in the loss of direct economic value and the value of environmental services. The loss of direct economic value for each land use is presented in Table 2, Table 3 and the value of environmental services for each land use is presented in Table 4 and prediction of environmental service in Fig 4.

Table 2. Direct Economic Value of Rice Fields, Ponds and Dry Land Agriculture

Land Use	Area (Ha)	Direct Economic Value (IDR)	Direct Economic Loss Value (IDR)
Paddy Field	148.52	40,000,000	5,940,800,000
Shrimp	954.58	11,468,184	10,947,299,082
Dry Land Agriculture	45.09	25,000,000	1,127,250,000

Table 3. Value of Environmental Services for Paddy Fields, Ponds and Dry Land Agriculture

Land Use	Area (Ha)	Economic Intangible Value (IDR)	Economic Intangible Loss Value (IDR)
Paddy Field	148.52	8,213,744,000	1,219,905,258,800
Shrimp	954.58	4,905,922,000	4,683,095,022,700
Dry Land Agriculture	45.09	5,513,494,000	248,603,444,460

Table 4. Value of Environmental Services for Rice Fields and Ponds Affected by Floods

Land Use	Area (Ha)	Economic Intangible Value (IDR)	Economic Intangible Loss Value (IDR)
Paddy Field	29.12	3,215,604,000	93,638,388,480
Shrimp	770.63		2,478,040,910,500

Environmental Service for Floods

One of the impacts when water availability exceeds the carrying capacity of the land is flooding. Likewise with land conversion, if there is an area that is affected by flooding, it will result in loss of direct economic value and environmental service value. Some land uses that are considered to lose direct economic value and environmental service value include rice fields, ponds and dry land agriculture (*tegal*, gardens and fields). The loss value of direct economic for paddy fields from a land area of 29.12 hectares and for ponds covering 770.63 hectares is IDR 3,215,604,000. Meanwhile, the indirect economic value is IDR. 93.6 billion of the rice field area and 2.48 trillion of the value of the added land area, this is calculated especially from the value of flood prevention services.

Benefit for Employment

Employment of labor is an important issue in business activity and the Indonesian economy. The labor force, the working population, and the unemployment rate are factors that affect economic growth. The population density in Kendal Regency continues to increase, and greater employment opportunities in urban areas on the island of Java are one of the factors which driving population growth from year to year. Based on data from the Central Bureau of Statistik (*Badan Pusat Statistik / BPS*) in Kendal Regency in numbers, the population in Kendal Regency has increased every year. This increasing population indirectly affects the composition of the labor force in Kendal Regency. The availability of job opportunities is relatively limited and it has not been

able to absorb job seekers, which keeps increasing every year in line with the increasing population. The social conditions of Kendal Regency in 2013-2018 are presented in Table 5 and in full until 2030 in Fig 5.

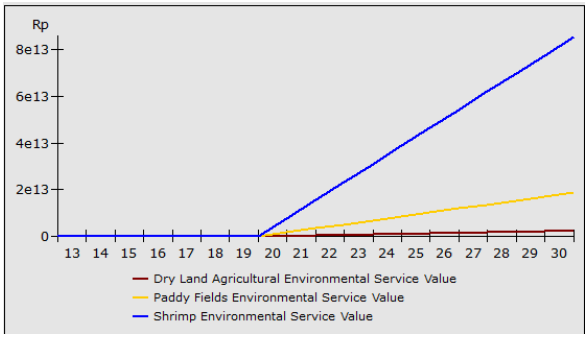

Fig. 4. Prediction of Total Environmental Services in Shrimp, Paddy Field and Dry Land Agriculture

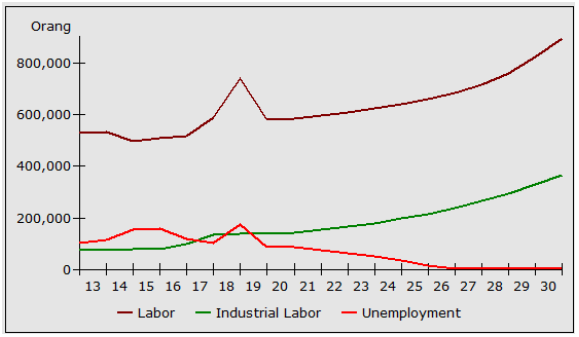

Fig. 5. Kendal Regency Social Conditions in 2013-2030

Table 5. Kendal Regency Social Conditions in 2013-2030

Social Variabel	2013	2014	2015	2016	2017	2018
Population	955,949	950,463	952,966	961,989	957,004	964,308
Labor	499,395	501,077	468,158	476,309	484,459	487,366
Unemployment	195,511	202,436	244,422	276,074	307,725	339,377
Industrial Labor	45,161	46,480	47,837	57,359	67,506	102,340

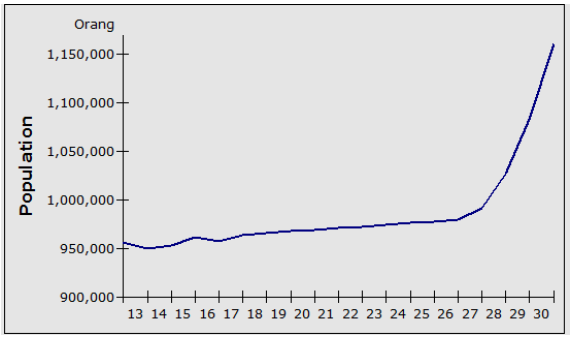

Fig. 6. Total Population in 2030

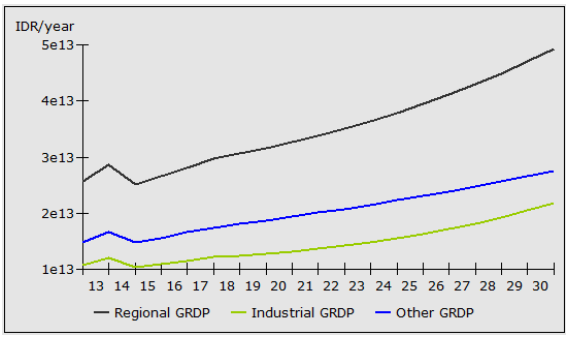

Fig. 7. GRDP Comparison

In 2013, the population of Kendal Regency who worked was 529,574 people, with total unemployment of 104,987 people and the number of industrial workers was 75,342 people. It is predicted that in 2030 the working population will be 828,920 people, with the number of unemployed will be 3,756 people and the number of industrial workers will be 333,146 people. The graph of the population until 2030 is presented in Fig. 6. In 2013, the population of Business as Usual (BAU) was 955,949 people, the prediction for 2031 the population of BAU will be 986,647 people and the rapid industry will be 1,093,250 people. The success in creating jobs cannot be separated from the role of the government. The various policies taken by the local government have greatly influenced the growth of the industrial sector and the provision of adequate employment opportunities.

Increasing Revenue

Economic growth is one measure of development outcomes. Economic growth shows the growth in the production of goods and services in an economic area and within certain time intervals. This production is measured in value added which is created by economic sectors in the concerned area which are known as Gross Regional Domestic Product (GRDP) (*Produk Domestik Regional Bruto/PDRB*. The increasing GRDP will

increase the number of workers. The comparison of regency and regional GRDP, industrial GRDP and other GRDP are presented in Fig 7. The GRDP of Kendal Regency continues to increase every year. The sector that made the largest contribution to GRDP based on current prices in Kendal Regency was the industrial sector. In 2013, the GRDP of Kendal Regency was IDR 25.7 trillion / year, for industrial GRDP was IDR 10.8 trillion / year, while other GRDP was IDR 14.9 trillion / year . The predictions for 2031 the GRDP of Kendal Regency will be IDR 48.6 trillion / year, industrial GRDP will be IDR 21.1 trillion / year, other GRDP will be IDR 27.5 trillion / year.

The prediction of the benefit (real) value of industrial zone, the value of industrial zones and the total environmental services will increase every year, in detail is presented in Fig 8. The value of industrial zones and total environmental services are predicted in 2020, the benefit value of industrial area II is IDR 18.54 trillion; industrial zone value is IDR 18.63 trillion; and total environmental services amounting to IDR 81.89 billion. The Predictions for 2031, the benefit value of industrial area II will increase in the amount of IDR 20.74 trillion; the value of industrial zone amounting to IDR. 48.32 trillion; and total environmental services of IDR 27.59 trillion. The benefit value of industrial zone in terms of contribution to the area in the form of GRDP, employment, import substitution, utilization of products for the national level can provide a benefit value of IDR 50.3 trillion. Thus, the benefit value from the existence of industrial zone is adequate good to support regency / regional development and contribute well to the national level with consideration for existing environmental services of 27.59 trillion. Management of the environment in industrial zone, especially water, will provide even greater benefit value.

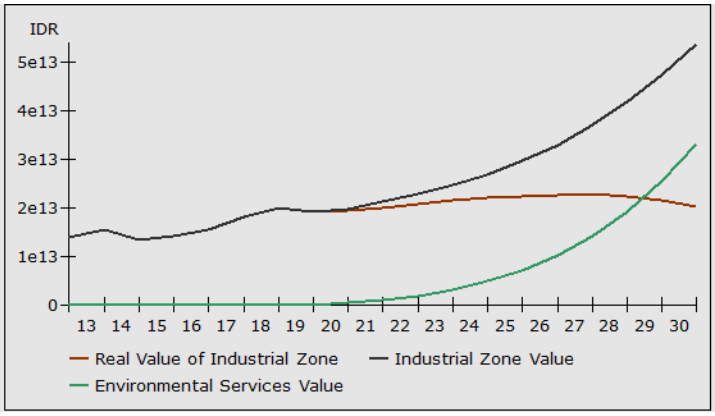

Fig 8. Industrial Zone Value

Conclusion

Based on the results of the study, it is concluded that environmental services are priority in industrial zone, namely the function and space to live / live, the provision of clean water, maintenance of air quality, and also water flow and floods system. The value of environmental services which is obtained from functional land and living / living space is very large and will continue to increase until 2031, so that it can be utilized optimally and sustainably. The value of environmental services from water [7, 13] and the air around the industrial area is very low. However, it is still in the good category. The implication of this conclusion is that the policy actors need to carry out environmental monitoring regularly, in particular the management of water and air quality in industrial zone due to the simulation shows that land demand will increase every year in line with the growth of the industrial sector. Provision of green open space in industrial zone needs to be directed at the program of planting carbon absorbing plants [10], it needs mangroves especially for flood-retaining plants, [14] to reduce the abrasion from seawater [11, 15].

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