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Dynamic Model Analysis of Raw Material Supply in Minapolitan Shrimp Agroindustry

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Abstract

Minapolitan a conception of economic development based on marine and fishery areas, based on the principles of integration, efficiency, quality and acceleration. One of the goals Minapolitan an effort to increase the production of fishery commodities. Current fisheries production stagnating and declining due to various things, disease, unfavorable climatic conditions, cultivation management, quality seeds, and others. Analysis of raw material agroindustry supply models built using dynamic models. Dynamic model of the supply of raw material supply shrimp agroindustry describe current conditions and future. Overview of the results of the model are constructed showing the current supply of raw materials at the level of 40% to 50% of the installed capacity of shrimp agroindustry. Scenarios are run on a dynamic model that shows the increase in land productivity was built to increase the supply of raw materials 84%, while the land area increased by 67%. Efforts to improve the productivity of cultivated land more positive impact than the increase in land area cultivated. Results of the analysis models were built, accelerating the achievement of goals Minapolitan should be focused on activities related to increasing the productivity of cultivated lands to supply feedstock sustainable shrimp agroindustry

Keywords: Minapolitan, Dynamic Modeling, Agroindustry, Supply Chain

1. Introduction

Minapolitan is a concept-based regional economic development and rely on fisheries and marine commodities. Minapolitan concept was first initiated by the Ministry of Marine Affairs and Fisheries in 2009 with the aim of increasing fish production and profits for all stakeholders region. Commodity shrimp aquaculture in particular, became one of the leading commodity in the development of the area cultivated Minapolitan. According to the Ministry of Marine Affairs and Fisheries in 2013, shrimp production continues to increase despite plunging in 2009. Development of national shrimp production as shown in Table 1.

Tabel 1. National Shrimp production

Years	Shrimp production(ton)
2007	352.222
2008	410.000
2009	350.000
2010	352.600
2011	399.528

Source: KKP 2013

Decline in shrimp production seen in 2009 which only amounted to 350 thousand tons, less than the previous year to reach 410 thousand tons. Production in 2009 was down from the set target of 540 thousand tons. Decline in shrimp production resulted in disruption of the supply of raw materials to the processing industry and the impact threat to the sustainability of agroindustry shrimp. Suprapto (1997) mentions that the sustainability of agroindustry-fishery related to the sustainability of raw material agroindustry supply. Lack of supply of raw materials also resulted in the loss of the opportunity to obtain value-added agroindustry sector shrimp.

Shrimp agroindustry in the region is a major industrial Minapolitan as shrimp consumers who

provide value-added areas is promising. Without the shrimp agroindustry operations, the movement will be severely disrupted the region's economic and regional development goals Minapolitan be achieved. Therefore we need a breakthrough to resolve the issue in order to enhance the role and sustainability of the Minapolitan program. Minapolitan as agroindustry-fishery development framework needs to be improved, in order to increase fishery production and the impact on economic development for the people of a region.

Dynamic system is a simulation-based approach to describe and understand the behavior of the elements in the system. Simulation of dynamic systems in pengambaran and understanding a system is done using a causal loop diagram. This modeling is affected by time, the application of feedback to obtain feedback and information system changes, thus modeling the dynamic system to be flexible and able to accommodate the values or variables used.

The ability of understanding the behavior of the system and simulated several scenarios are run, it is hoped will be able to solve the problems in the development of Minapolitan raw material supply especially agroindustry shrimp. The purpose of this study is to get an overview model of agroindustry raw material supply conditions for shrimp and strategies used to increase the supply of raw materials in the area of Minapolitan shrimp agroindustry.

2. Methods

According to Austin (1981), agroindustry is the core of an important agricultural chains commodity. Agroindustry as part of the agroindustry shrimp need a supply of quality raw materials and quantities as needed. Agroindustry shrimp supply chain in the region consists of shrimp producers Minapolitan the shrimp farmers, traders then consisting of small traders and wholesalers, and shrimp agroindustry as the main consumers of shrimp commodity. Fulfillment of the supply of raw materials for freezing shrimp industry is still low, indicated by the mean production capacity of less than half its capacity.

System dynamics is an approach that uses simulation to describe and understand the behavior of the elements in the system. Simulation of dynamic systems in pengambaran and understanding a system is done using a causal loop diagram. Dynamical systems affected by time, the application of feedback to obtain feedback and information system changes (Sushill, 1993). There are three types of variables used in the methodology of dynamic system, namely stock, flow diagrams, and auxiliary. According Muhammadi et al. (2001) represents the stock issue of concern. Flow diagram is always associated with the level and symbolized by thick arrows towards or out of stock. Auxiliary variables are more flexible and can represent a constant or a value computation. Presence of auxiliary causes dynamic systems modeling to be flexible and able to accommodate the values or variables used. Sushil (1993) explains that the auxiliary is only an auxiliary variable that represents a theoretically better policy structure and clear. Picture of the symbol variable dynamical system shown in Figure 1.

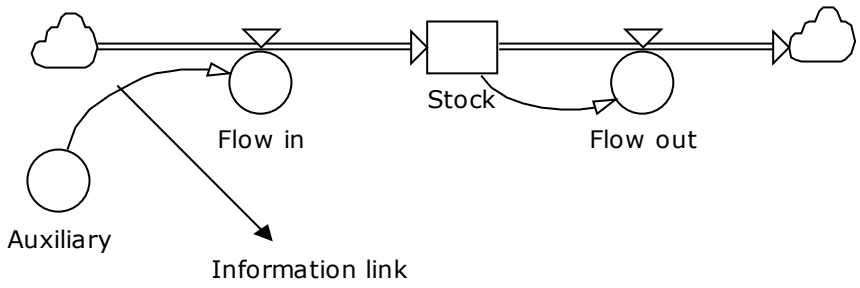

Figure 1. Symbol Variables in Dynamic Systems

3. Results and discussion

Shrimp agroindustry supply chain in the region Minapolitan consists of producers of raw materials that shrimp farmers, traders then consisting of small traders and wholesalers, and Agroindustry freezing shrimp as the main consumers of commodity shrimp. Each shrimp agroindustry supply chain actors are interdependent and involved in the transformation of goods, services, information and capital. Picture shrimp Agroindustryindustry supply chain is shown in Figure 2.

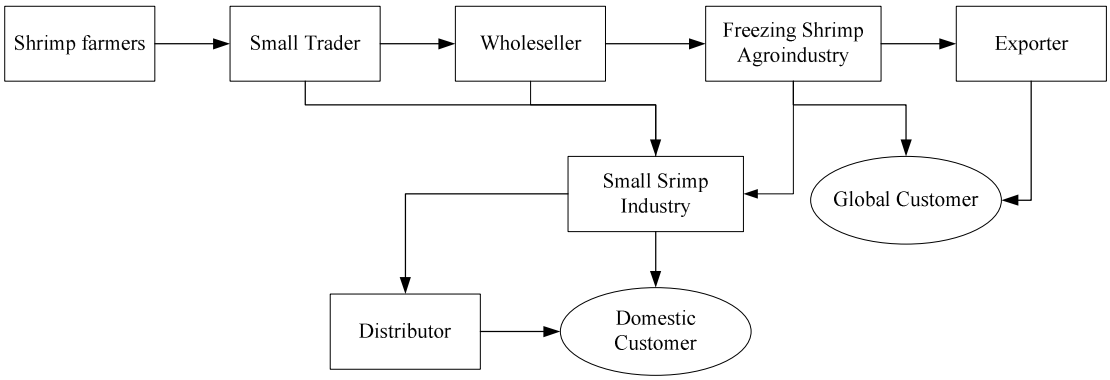

Figure 2. Shrimp Agroindustry Supply Chain

Small industries and domestic consumers are consumers outside major consumer commodity shrimp is the freezing shrimp industry. In fulfillment of its consumption, small industries and domestic consumers prefer compromising quality and low prices as an option in buying. Domestic consumer purchasing power is low and the desire to reduce the cost of raw materials for small industries to be the cause as a low prices priority selection.

Supply of raw materials is one important aspect of the sustainability of agroindustry that needs to be improved. Supply of raw materials will reduce the volume of production decreased agroindustry shrimp, and vice versa if the supply of raw materials increases, the volume of production increased agroindustry shrimp. Therefore the amount of raw material plays an important role in determining the sustainability of Minapolitan in general. Raw material supply mechanism Agroindustry shrimp Minapolitan shown in Figure 3.

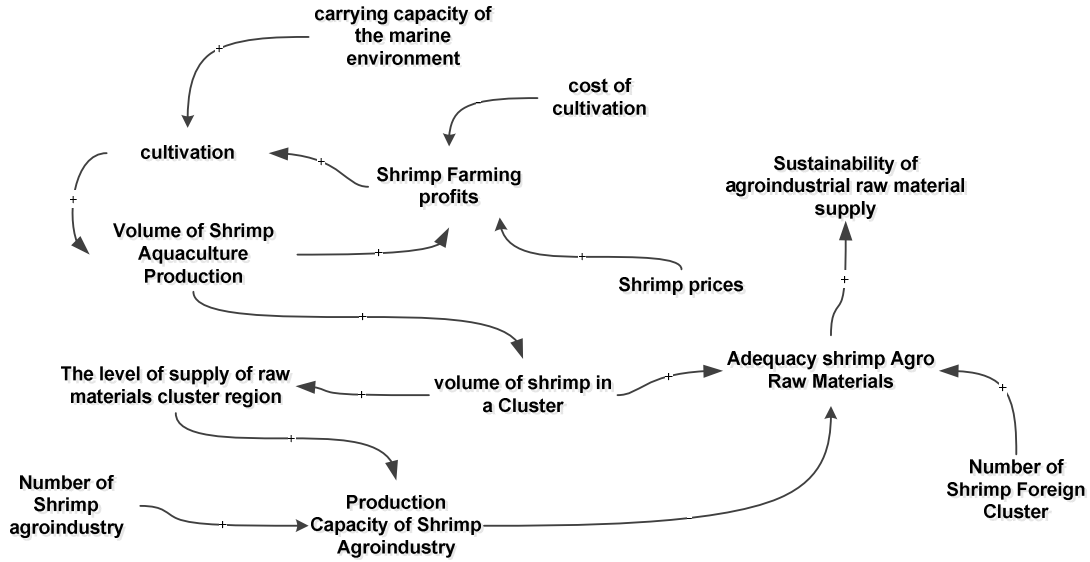

Figure 3. Causal diagrams Agroindustry Shrimp Raw Material Supply

Rate of raw material supply shrimp Agroindustry in Minapolitan shrimp supply is determined by the volume and how much production capacity in the region and quantity Minapolitan Agroindustry. If the supply of shrimp in the region declined Minapolitan, will lower the rate if the supply of raw materials and production capacity Agroindustry fixed amount. Vice versa, if the supply of shrimp and the region increased capacity and number of fixed Agroindustry, it will increase the level of supply of raw materials Agroindustry.

Sustainable supply of raw materials is determined by supply shrimp Agroindustry in the region and outside the region Minapolitan sufficient. Generally supply of raw materials in the region an advantage compared to supply from outside the region. Availability of adequate supplies of raw materials in the region will further enhance the sustainability of shrimp Agroindustry.

Model Agroindustry shrimp raw material supply in the region will generate predictions

Minapolitan shrimp supply volume in the cluster Minapolitan. The model was built using a dynamic model approach assuming that many shrimp aquaculture production volume is influenced by many factors. The area of cultivation, cultivation patterns, productivity, mortality rate, the rate of growth to the ability of the management of shrimp aquaculture farmers. Dynamic model Agroindustry shrimp raw material supply is shown in Figure 4.

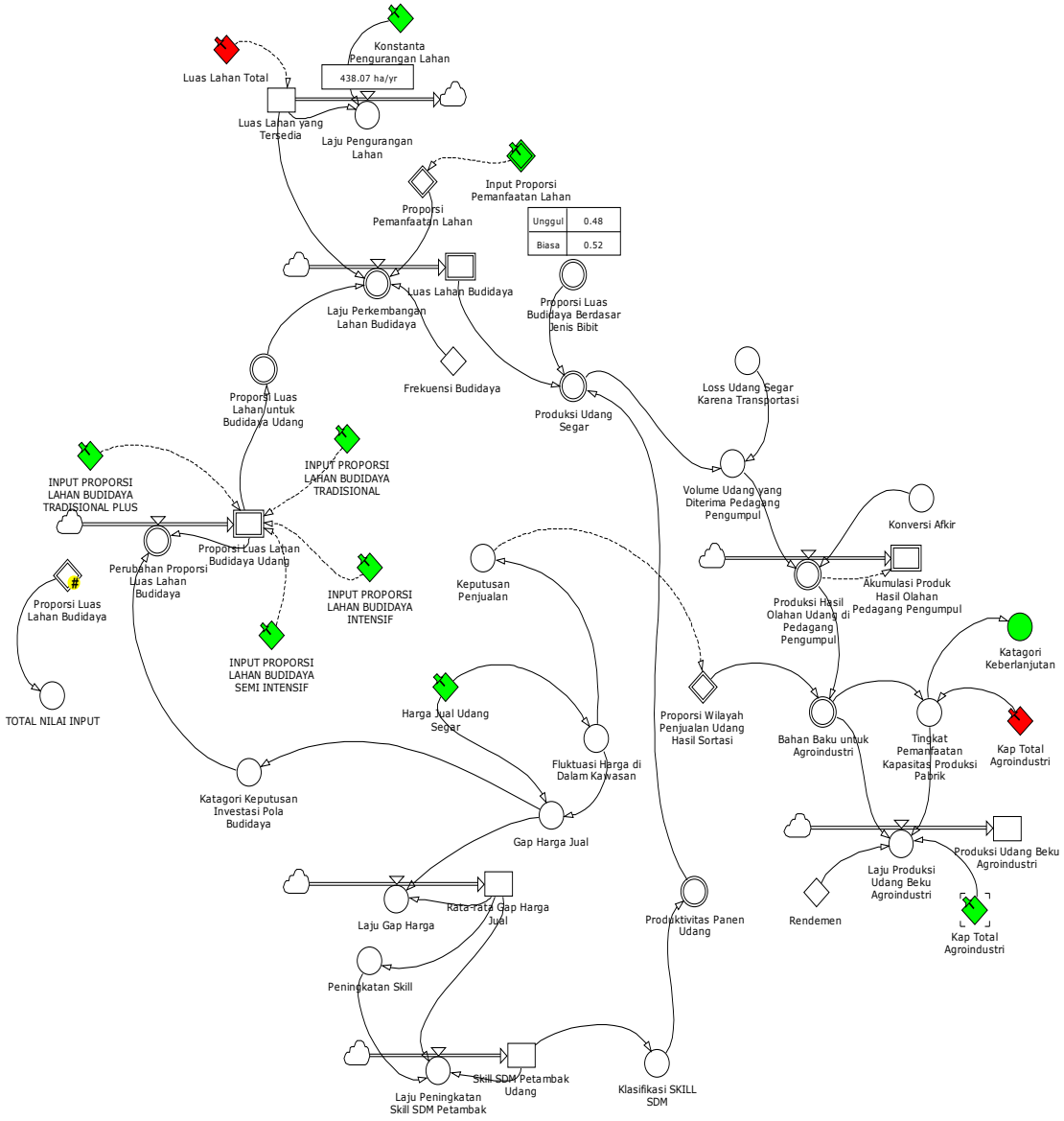

Figure 4. Raw Material Supply System Model Agroindustry Shrimp

Extent of cultivation in the region affect shrimp production volume is dynamic. Availability of land for cultivation Gresik trend of year-on-year decrease, in 2011 there was a reduction of 762 ha of land for residential and industrial needs. Land area is also influenced by the proportion of existing land use, the proportion of land area will be inputted through the user interface in a simulation program. There are four types of patterns in the production of shrimp cultivation by farmers, traditional, plus traditional, semi-intensive and intensive. Conditions in the field, there are four types of cultivation pattern with an area that is different as shown in Table 2.

Table 2. Pond cultivation pattern and extent of

No	Cultivation pattern	Area (ha)
1	Traditional	23.808
2	Traditional Plus	8.594
3	Semi Intensive	43
4	Intensive	19

Volume production of shrimp by farmers is determined by several factors. The factor is the land area of cultivation and productivity of each pattern of cultivation. Increase in shrimp production volume Minapolitan region, increase the level of supply of raw materials in the region. The increasing level of raw material supply in the Agroindustry region will improve the sustainability of shrimp. Levels of raw material supply Agroindustry shrimp are shown in Table 3

Table 3 categorization sustainable supply of raw materials

Catagories	Indicator values range	Skor
unsustainable	< 30%	1
less sustainable	30% - 50%	2
sustainable enough	50% - 70%	3
highly sustainable	>70%	4

Supply of raw material models are built Minapolitan region, aims to analyze the global volume of raw material supply to agroindustry shrimp and predict the level of sustainability of supply of raw materials in the region Minapolitan. Models are built using dynamic approach with several input factors that are dynamic. Extensive cultivation cultivated each year has fluctuated so that in the model simulated the proportion of land cultivated input. Field analysis shows that the proportion of each land use patterns of the highest cultivation is semi-intensive pattern of 80%, plus 70% traditional, 50% traditional and 10% intensive. The low proportion of intensive pattern due to high operational costs that farmers generally prefer large capital intensive pattern of semi lower operational costs. Intensive pattern executed if the predicted price situational and environmental conditions that support.

Volume production is influenced by the productivity of farm respectively cultivation patterns are used. Field analysis results showed the traditional pattern of productivity between 100 and 150 kg / ha. Traditional pattern of its shrimp farming polyculture with milkfish and tilapia, so that the level of maintenance is not intensive shrimp farming causes low productivity. Traditional patterns plus levels of productivity ranges of 350 to 400 kg / ha. Patterns of semi-intensive shrimp farming has the range of productivity levels in 2000 kg / ha, this range refers to research conducted Adiwidjaya et al. (2008) with 25 seeds ekor/m2 stocking. Productivity refers to the pattern of intensive study by Shah et al. (2008), with 50 seedlings stocking ekor/m2 capable of producing 5000-6000 kg / ha. The first simulation run refers to the above data as input dynamic model of agroindustry raw material supply in the region Minapolitan shrimp today. The first simulation shows that the volume of supply of shrimp ranged from 3900 kg to 4200 kg per year. These results demonstrate conformity with the actual conditions in which the 2009 and 2010 shrimp production Gresik Regency of 3369 kg and 4257 kg. Conditions shrimp supply volume in the region, with a production capacity of agroindustry shrimp in Gresik regency of 10,000 tons per year, the level of utilization of plant capacities ranging from 34 to 37% of installed capacity. Conditions of plant capacity utilization rate of raw material supply in the region Minapolitan, can be categorized less sustainable. Plant capacity utilization rate is low if the added supply of raw materials from outside the region will certainly be greater than that range. In 2011, according to data DKP East Java, Gresik regency able to export as much as 3,515,744 pounds with a value of U.S. $ 30,393,039. The shrimp exports if the assumed yield of raw materials by 63%, the need for raw material supply as many as 5,580,546 kg. The raw materials must be supplied from within the region and outside the region of Gresik regency, with the supply of raw materials in the region amounted to 3,416,510 kg of supplies from outside the region amounted to 2,164,036 kg. The additional supply will increase plant capacity utilization rate to 56%.

Increased utilization of plant capacity can be simulated in a dynamic model is built. Simulation is done by changing the inputs available on the program Powersim Studio 2005. The second simulation is done by increasing the proportion of land use to be 100%, which means the total land cultivation process.

Simulation results show that the supply of raw materials to agroindustry-industries in the region Minapolitan shrimp capable of reaching 5,952 tons per year. Shrimp supply to agroindustry to increase plant capacity utilization rate to 60% by volume of agroindustry-industrial production of 3,760 tons of shrimp. This condition if the supply from outside the region included the level of plant utilization will increase its capacity. In this condition the level of sustainability of supply of raw materials in the region can be considered quite sustainable. The third simulation is run with the changing scenario of the productivity level of each individual pattern of cultivation. Traditional patterns of several research productivity levels capable of producing up to 200 kg / ha. Plus traditional pattern, referring to research Efran et al (2007) plus the traditional pattern of productivity capable of reaching 835 kg / ha with a stocking tail 80000 seeds / ha. Productivity patterns semi-intensive and intensive aquaculture in the second simulation condition remains as previous simulations. The third simulation result shows the supply of raw materials from within the agroindustry shrimp are able to reach 8,360 tons by the level of sustainability of supply of raw materials at the level of shrimp agroindustry 4 highly sustainable plant capacity utilization rate of 84%.

Model of agroindustry raw material supply of shrimp in the area built with attention to the influence of the price of shrimp to supply. Traders as a supplier of shrimp to the agroindustry will certainly see the shrimp price fluctuations within and outside the region Minapolitan. If the price of shrimp in locations outside the higher the tendency of traders to market shrimp exit area and vice versa. In the fourth simulation, scenario run was to determine the effect of price on supply of shrimp to the agroindustry. Assumed to be the difference in price of shrimp Rp 10,000 higher than in the region outside the region. Simulation results show agroindustry raw material supply of shrimp in the region of 6,975 tonnes per year Minapolitan with shrimp supply sustainability levels are at level 3 is quite sustainable. However, in subsequent years the supply of merchant deteriorated to the 5th year, the supply of raw materials to agroindustry trader lived 3,856 tons. Supply of low value causes the level of sustainability of supply of raw materials to 5 years in at level 2 which means less sustainable. Summary of simulation results shrimp supply of raw materials within the region shown in Figure 5.

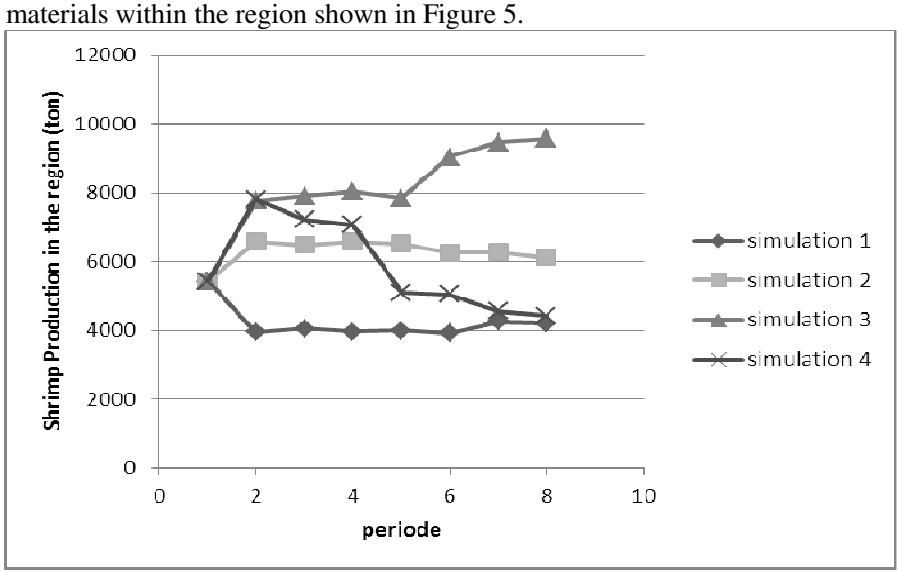

Figure 5. Shrimp production in the region Minapolitan

Minapolitan shrimp production in the region will increase along with the increase in cultivated land area and productivity of cultivated land. Increased productivity has a more positive impact than the increase in the proportion of cultivated land area. Increased productivity can increase feedstock production by 110%, while the area cultivated with the addition of productivity is currently only able to increase the production of raw materials by 58%. Tendency of declining raw material production if the price of shrimp in the lower region than outside the region is seen in the simulation han fourth run. Although the simulation to four an increase in the production of raw materials but drastic downturn.

Agroindustry capacity utilization rate is influenced by the volume of shrimp aquaculture shrimp production and the selling price of shrimp in Minapolitan region. These conditions is shown in Figure 6.

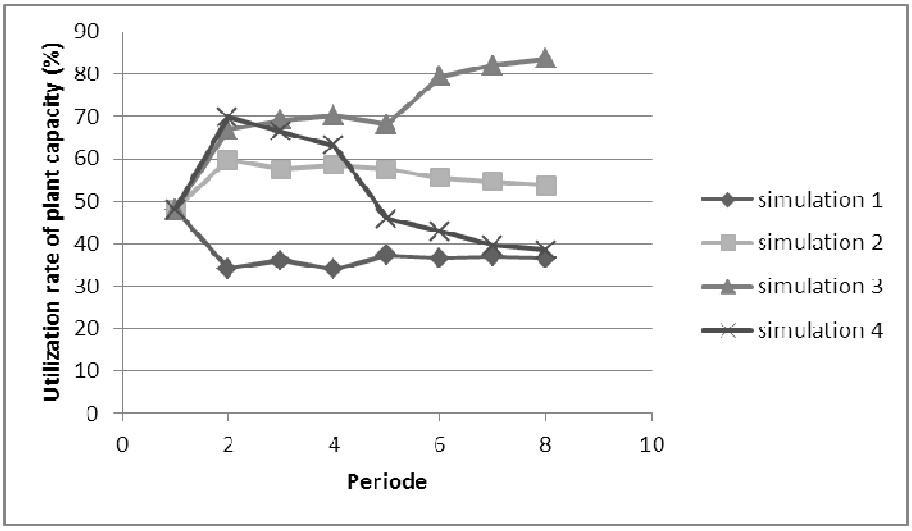

Figure 6. Agroindustry-Industry Capacity Utilization Rate

Scenarios in the simulation run showed the increased productivity of land, can increase plant capacity utilization to 80% or at the level of 4, which means a very sustainable. The level of sustainability of supply will be increased if the added supply of raw materials from outside the region Minapolitan. Increased capacity utilization of agroindustry scenario also occurs in land area, but only increase the range of 50-60% of the installed capacity. Raw material supply will be drastically reduced if there is a striking difference in price between the region and outside the region Minapolitan. The higher the price beyond the area of agroindustry raw material supply in the region will be reduced drastically. Decline in supply could even fall below 40% of installed capacity.

Increased sustainability of agroindustry raw materials such as simulated previously, can be done by increasing the land area, increasing productivity and keeping the price disparity between the region and Minapolitan outside. Increased productivity as shown in simulations that do provide a more effective impact, when compared to the scenario increased hectarage and shrimp prices. Increase in the proportion of land area from year to year will face many challenges, the need for land settlements, infrastructure and industry complicates increase in the proportion of land cultivated. Information technology and business continuity, pressing suppliers of raw materials traders toying shrimp prices. Therefore the choice of increasing the productivity of farming became a priority. However, the synergy of these three factors that influence the supply of raw materials agroindustry shrimp, is needed to improve the sustainability of agroindustry-industrial shrimp Minapolitan region.

5. Conclusion

Model raw material supply of shrimp Agroindustry are constructed using dynamical systems approach, showing the level of raw material supply shrimp to Agroindustry currently lacking in the area of sustainable Minapolitan. Supply of raw materials is influenced by several factors such as the productivity of land, and the land price fluctuations shrimp. Increased productivity effect is more positive than the expansion of shrimp cultivation. Productivity improvements to increase the supply of production by 84%, while the expansion of shrimp farming land by 60%. Strategies to increase the supply of raw materials Agroindustry shrimp should be focused on improving the productivity of shrimp farming by farmers in the Minapolitan region.

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