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ANALISIS STRATEGI PETERNAKAN UNTUK MENDUKUNG PENGEMBANGAN EKOWISATA DI KABUPATEN MALANG DENGAN MENGGUNAKAN TEORI PERMAINAN

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ABSTRACT

Pada tahun 2001, ada kebijakan desentralisasi daerah dari pemerintah untuk melepaskan Kota Batu dari Kabupaten Malang. Setelah desentralisasi Kota Batu, pada tahun 2012 Pendapatan Asli Daerah Kabupaten Malang meningkat sekitar 25,29%. Salah satu kontribusi terbesar pertumbuhan PAD adalah dari sektor pariwisata. Peran sektor pariwisata sangat diperlukan untuk meningkatkan pendapatan asli daerah Kabupaten Malang. Baru-baru ini, pengembangan pariwisata juga mempertimbangkan tentang kelestarian lingkungan. Konsep ini dikenal sebagai ekowisata. Berdasarkan Statistik Kabupaten Malang, pengembangan ekowisata di subsektor peternakan memiliki peluang tinggi untuk direalisasikan di Kabupaten Malang. Dengan demikian, penelitian ini bertujuan untuk mensimulasikan beberapa skenario kebijakan pengembangan ekowisata ternak dengan menggunakan sistem dinamik dan menentukan win-win solution untuk pemain dengan menggunakan teori permainan. Pemain yang digunakan dalam game ini adalah Dinas Pariwisata dan Dinas Peternakan Kabupaten Malang. Skenario kebijakan ditentukan dengan menggabungkan masing-masing strategi masing-masing pemain dan menggabungkan skema masing-masing variabel yang dikontrol dalam model simulasi. Pemilihan skenario terbaik diidentifikasi dengan menggunakan kriteria penilaian, yaitu Pendapatan Asli Daerah (PAD), Produk Domestik Regional Bruto (PDRB), dan gas polusi dari Kabupaten Malang. Skenario terbaik berada dalam skema tinggi jumlah promosi pariwisata, skema tinggi proporsi promosi ternak, dan skema rendah tinggi jumlah objek ekowisata ternak.

Kata Kunci: Ekowisata, Sistem Dinamik, Teori Permainan.

ANALYSIS OF LIVESTOCK STRATEGY TO SUPPORT ECOTOURISM DEVELOPMENT IN KABUPATEN MALANG BY USING GAME THEORY

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ABSTRACT

In 2001, there is a regional decentralization policy from government to release Kota Batu from Kabupaten Malang. After decentralization Kota Batu, in 2012 the own-source of Kabupaten Malang is rising around 25.29%. One of the highest contribution of own-source revenue’s growth is tourism sector. Role of tourism sector is very needed to increase the local revenue of Kabupaten Malang. Recently, tourism development is also considering about environmental sustainability. This concept is well known as ecotourism. Based on Statistics of Kabupaten Malang, ecotourism development on livestock subsector has high opportunity to be realized in Kabupaten Malang. Thus, this research is aimed to simulate some policy scenarios of livestock’s ecotourism development by using system dynamics and determine win-win solution for players by using game theory. Players used in this game are Dinas Pariwisata and Dinas Peternakan Kabupaten Malang. Policy Scenario is determined by combining each strategies of each players and combining schemes of each controlled variables in simulation model. Selection of best scenario is identified by using assessment criteria, which are Own Source Revenue (OSR), Gross Regional Domestic Product (GRDP), and gas pollution of Kabupaten Malang. The best scenario is in high scheme of number of tourism promotion, high scheme of proportion of livestock's promotion, and low-high scheme of number of livestock's ecotourism object.

Keywords: Ecotourism, System Dynamics, Game Theory.

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Author

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CHAPTER I

INTRODUCTION

This chapter explains about background, problem identification, objectives, benefits, limitations, assumptions and outline of this research.

1.1 Background

By having 33 sub-districts, Kabupaten Malang becomes the district with highest number of sub-district in East Java (Badan Pusat Statistik Kabupaten Malang, 2014). This potential enable Kabupaten Malang to increase its region own-source revenue. Tourism sector which consists of trade, hotel and restaurant, is considered to give highest contribution to own-source revenue. It is supported by a number of interested tourism objects in Kabupaten Malang. Kabupaten Malang as the tourism icon in East Java has many tourism objects like beach, bathing place, agro object, forest, historical object, cemetery and others (Badan Pusat Statistik Kabupaten Malang, 2014). Tourism objects contribute indirectly to trade, hotel and restaurant revenue by means of tourist number in all tourism objects. Thus, it gives contribution as well to Malang's Regency Gross Regional Domestic Product (GRDP).

Figure 1.1 shows that trade, hotel and restaurant sector give highest contribution to GRDP of Kabupaten Malang in 2011 and 2012. There is significant increasing of trade, hotel, and restaurant sector in 2010 and 2011. It can be shown that tourism sector also gives highest contributions to gross regional domestic product (GRDP) of East Java. There are many tourism objects in Kabupaten Malang such as Jawa Timur Park, Batu Secret Zoo, Batu Night Spectacular and other tourism objects, which support the revenues in Kabupaten Malang.

In 2001, government initiated the regional decentralization policy on East Java. The decentralization policy stated that releasing Kota Batu from Kabupaten Malang. Based on Undang-Undang Republik Indonesia No. 11 Tahun 2001 about the establishment of Kota Batu, Kota Batu is officially released from Kabupaten Malang and it became an independent region. It has three districts, which are Kecamatan Batu, Kecamatan Bumiaji and Kecamatan Junrejo (President of Republik Indonesia, 2001).

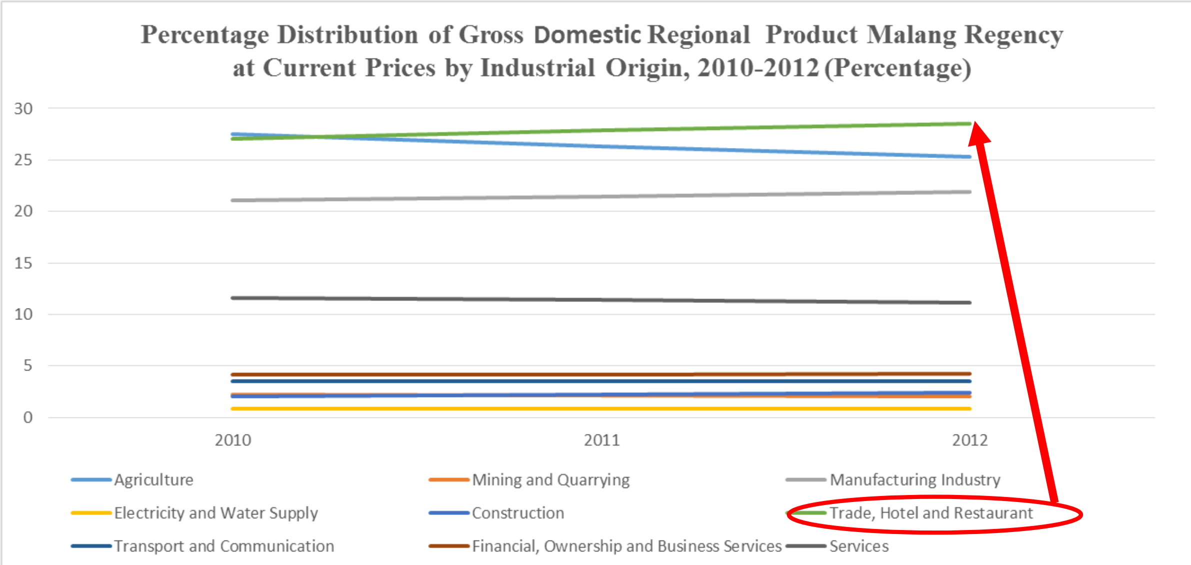


Figure 1.1 Percentage Distribution of GRDP Kabupaten Malang at Current Prices by Industrial Origin 2010-2012
Source: (Badan Pusat Statistik Kabupaten Malang, 2013)

Regional decentralization opens an opportunity on bureaucratic and political rent-seeking, which are getting funding source from central and local government (Fitrani F., 2005). Autonomous region was given to the decentralized region with sufficient natural and human resources because it will give rapid opportunity for the region to increase prosperity (Adi, 2005). However, decentralization policy will incriminate the region, which has no sufficient potential. It is because the region with no potential in funding sources will be difficult to fulfill their expenses (Bappenas, 2003). Decentralization for Kota Batu, which has a potency to develop the tourism sector will give contribution to own-source revenue so that government can give the decentralization.

The regional decentralization gives impact to the economy of Kabupaten Malang. Economy of a decentralized region can be seen from own-source revenue which is being the legal own-source revenue in exploring the funding as the decentralized region (Rahman, 2003). The regional decentralization will give economy impact to Kabupaten Malang. The economy impact on Kabupaten Malang is the lost opportunity revenue after the regional decentralization that comes from own-source revenue of Kota Batu. Own-source revenue of Kota Batu after the decentralization policy is Rp 4,958,041.59. It should be the own-source revenue of Kabupaten Malang if there is no decentralization policy. In other hand, Kabupaten Malang had own-source revenue of Rp 21,315,880,000 in 2001. After the regional decentralization in 2002, the own-source revenue of Kabupaten Malang was increasing about 25.59% and becoming Rp 26,769,608,209 (Table 1.1). By looking at this condition, Kabupaten Malang as the decentralized region has to explore its region potential. The development efforts could be seen from the increasing of regional development expenditure in 2002. The increasing of regional development expenditure in 2002 was about 50.05%. It contributed about 27.88% of total expenditure in regional consolidation development between Kabupaten Malang and Kota Batu in 2002 (Bappenas, n.d.). It showed that there is an effort of Kabupaten Malang to develop their region after decentralization policy until increasing the own-source revenue.

Table 1.1 Own-source revenue of Kabupaten Malang before and after decentralization policy in 2001 and 2002

Own-Source Revenue			Before Decentralization Policy (2001)		After Decentralization Policy (2002)	
			Rp	%	Rp	%
Total Revenue			481,047,052,251.00	100	508,713,859,517.00	100
I	Own-Source Revenue		21,315,880,000.00	4.43	26,769,608,209.00	5.26
II	Fund Balance		454,431,172,251.00	94.47	459,375,570,308.00	90.3
	1	Tax Sharing	16,492,987,653.00	3.43	17,500,000,000.00	3.44
	2	Non Tax Sharing	2,711,112,598.00	0.56	2,705,570,308.00	0.53
	3	General Allocation Fund	435,227,072,000.00	90.47	439,170,000,000.00	86.33
	4	Special Allocation Fund	-	0	-	0
	5	Post Emergency Fund	-	0	-	0
III	Regional Loan		5,300,000,000.00	1.1	22,568,681,000.00	4.44
IV	Other Legitimate		-	0	-	0

Source: (Bappenas, 2006)

In regional developments, tourism has important role as a catalyst to increase the development of other sectors gradually. Tourism can contribute to positive developments, not just negative impacts. It has the potential to promote social development through employment creation, income redistribution and poverty alleviation (United Nations Environment Programme, 2011). Competitive advantage is needed to support the tourism development like tourism object differentiation, tourism service, infrastructure, technology and human resources. The tourism differentiation can be developed by using new paradigm which called ecotourism. Ecotourism has been established for long time ago but the implementation has not been optimal. Ecotourism is the development concept that combines the tourism importance with the resource availability and it has to sustainable with the environment.

Use of natural source is one of tourism revenue to conserve the environment of Kabupaten Malang. Superior agricultural products is one of agricultural source that promising enough in Kabupaten Malang. It is supported by high number of agricultural sector contribution on GDRP at constant or current prices from 2010 to 2012, which is more than 25%. Kabupaten Malang was also noted as the highest number of agriculture's household in 2013 with the number of 328,369 of household (Badan Pusat Statistik Jawa Timur, 2014). While the Regional Long Term Development Plan (RPJD in Indonesia) which is noted in Perda No. 1 tahun 2009, stated that agriculture development is implicit on development vision of East Java, which is: "East Java as the central leading of agribusiness, defenseless global competitiveness and sustainable towards prosperous East Java. So, it can be stated that agriculture is the superior sector of Kabupaten Malang.

Agriculture sector of Kabupaten Malang is consisted of five subsectors, which are food crops, forestry, livestock, fishery and plantation. Each subsectors have their own households and superior products to develop ecotourism based agricultural resources. Ecotourism development was also pioneered by Badan Penelitian dan Pengembangan (Balitbang) Kabupaten Malang. Balitbang has series of activities in Sistem Inovasi Daerah (SIDa) Kabupaten Malang to increase own-source revenue.

The agriculture potency is very critical to be concerned by East Java Government because agriculture sector is qualified economic driver. Agricultural census 2013 noted that number of livestock's household in Kabupaten Malang is 3.3 million (second rank after food crops). It is mostly consisted of 1.9 million of beef cattle, 71 thousands of dairy cows and 10 thousands of buffalo. Besides, there are 11 livestock's industries of beef cattle and 16 livestock's industries of dairy cows in East Java. Because the largest dairy cow's industry is only in Kabupaten Malang, so Kabupaten Malang is well-known as the largest producer of fresh milk in East Java (Badan Pusat Statistik Jawa Timur, 2014).

The ecotourism development on livestock subsector has high opportunity to be realized in Kabupaten Malang. It is because there is high potency on livestock subsector in Kabupaten Malang, Ecotourism development will give impact on economy revenue of Kabupaten Malang in long term period. This research aims to model the policy of ecotourism development in Kabupaten Malang. It is used to increase the local economy that is measured by own-source revenue and GRDP of Kabupaten Malang. Role of tourism and agriculture especially livestock are needed to make the optimal policy for ecotourism development. Tourism sector in Kabupaten Malang is under the responsibility of Dinas Pariwisata Kabupaten Malang, while livestock is under the responsibility of Dinas Peternakan Kabupaten Malang. Besides, other parties can support the ecotourism development of Kabupaten Malang but they do not directly concern about livestock and tourism. Because of that, Dinas Pariwisata and Dinas Peternakan are selected to be the players in this research. First, model simulation of livestock's ecotourism development is conducted by using system dynamic to define value of each strategies. Then, by constructing the strategies for players game theory is applied to propose a solution on a cooperative game between two players, namely Dinas Peternakan and Dinas Pariwisata. Regarding the important role of Dinas Peternakan and Dinas Pariwisata in ecotourism development, this research attempts to provide recommendation about win-win strategy for Dinas Peternakan and Dinas Pariwisata to support the economy in Kabupaten Malang's ecotourism development.

1.2 Problem Formulation

Based on the aforementioned background, the problem formulation in this research is how to elicit the possible strategies for both Dinas Peternakan and Dinas Pariwisata in improving its ecotourism development, how to assess and evaluate the performance of each strategy combination, and how to propose the recommended win-win solution to such livestock's policy problem in ecotourism development by implementing game theory approach in order to increase the ecotourism financial performance in term of own-source revenue and GRDP in Kabupaten Malang.

1.3 Objectives

The objectives of this research are:

1. To construct a conceptual and simulation model of livestock ecotourism development.
2. To generate some scenarios for both Dinas Peternakan and Dinas Pariwisata based on conceptual model.
3. To determine the win-win solution for Dinas Peternakan and Dinas Pariwisata Kabupaten Malang by using game theory approach.

1.4 Benefits

The benefits obtainable from the research are:

1. Maintain a good relationship between Dinas Peternakan and Dinas Pariwisata, by having a theoretical grip in making decision related to ecotourism development.
2. Maintain a good relationship between Industrial Engineering Department, Dinas Peternakan and Dinas Pariwisata of Kabupaten Malang, by proposing link and match activity.

1.5 Research Scope

Research scope in the research is consisted of limitation and assumption that is used to limit the research because the wide of research scope.

1.5.1 Limitations

The limitations used in the research are:

1. Tourism contribution is controlled by looking the impact of regional tax and retribution to the own-source revenue of Kabupaten Malang. The regional tax is from property tax of tourism objects and the regional retribution is from admission ecotourism.
2. Players that will be used in this game are Dinas Peternakan and Dinas Pariwisata

1.5.2 Assumption

The assumptions used in this research is both Dinas Peternakan and Dinas Pariwisata aware the strategy used by each player to maximize their revenues within the game.

1.6 Outline

Outline of the research is composed of some chapters in the research and it will be explained below.

CHAPTER 1 INTRODUCTION

This chapter explains about background, problem formulation, objectives, benefits, research scope and the outline that is used in the research.

CHAPTER 2 LITERATURE REVIEW

This chapter explains about literature review by using some literature reviews in understanding the problem that can be solved by using a method. Literature review explains about definition and contribution of tourism, explanation of ecotourism, explanation of agriculture sector especially in livestock subsector, macro economy, system dynamics and game theory.

CHAPTER 3 RESEARCH METHODOLOGY

This chapter explains about research methodology used in the research. Research methodology is consisted of the sequence steps used by researcher so that the research can be systematically run. Steps of the research is started from problem formulation, problem solving and then make a conclusion and recommendation from the research.

CHAPTER 4 DESIGNING SIMULATION MODEL

This chapter explains about constructing variables system dynamics model and make an existing simulation of model

CHAPTER 5 GENERATING SCENARIO MODEL

This chapter explains about generating scenarios of each variables that will be an input for matrix payoff. Then, the next step is running model based on the scenario of each alternative strategies to get value of the game.

CHAPTER 6 SELECTING SCENARIO USING GAME THEORY

This chapter explains about inputting value of each scenarios to matrix payoff of each goals. Then, each matrixes are conducted cooperative game with non-zero sum games between two players to get benefit by using game theory. Game theory is used to define the best strategy of each players to develop ecotourism of Kabupaten Malang.

CHAPTER 7 CONCLUSION AND RECOMMENDATION

This chapter explains about final conclusion of the research and recommendation given to the players for the next research.

CHAPTER II
LITERATURE REVIEW

This chapter explains about literature review, which has been conducted and used in this research. Literature reviews used in this research are consisted of tourism, ecotourism, own-source revenue and gross domestic regional product, investment, modelling of dynamic system and game theory.

2.1 Tourism

World Tourism Organization stated that tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. These people can be called as tourists and tourism has to do with their activities, some of which involve tourism expenditure (World Tourism Organization, 2014). Consequently, tourism has implications on the economy, on the natural and built environment, on the local population at the destination and on the tourists themselves.

Based on Undang-Undang Republik Indonesia No. 10 Tahun 2009 tentang Kepariwisataan, tourism is the various kinds of tourism activities and supported by some facilities and services, which provided by society, businessman, central government and local government. Generally, ecotourism covers all activities relate with tour. Tourism not only relates with object and tourist attraction, but also it relates with service and tourism facilities. Object and tourist attraction here mean like tourism area, park, museum, historical heritage, art and culture, mountain, lake, beach, and other natural beauties. While service and tourism facilities mean like travel agent, convention, exhibition, tourist consultant, accommodation, restaurant and transportation.

2.1.1 Elements of Tourism

Elements of tourism is divided into:

1. Tourists

   Tourists are people who conducts tourism activities (Republik Indonesia, 2009). Within the meaning of that, people who conduct tourism tour with whatever destination can be called as tourists. Tourists can be divided into international and domestic tourists. International tourists are people who conduct tour overseas, while national tourists are Indonesian people who conduct tour in Indonesia outside domicile area, within period at least 24 hours or overnight except activities that can generate income in the visited place.

2. Object and Tourist Attraction

   Object and tourist attraction is the important thing in tourism which can support government to conserve national culture as assets that can be sold to tourists. According to *SK Menparpostel No. KM 98 PW. 102 MPPT – 87,* Tourism Objects are the places or natural state that have tourism source built and developed therefore it has attractiveness as the place visited by tourists (Situs Resmi Kabupaten Bone Prov. Sulawesi Selatan, 2014). Tourism objects can be a mountain, lake, beach, sea, or other buildings like museum, historical heritage and so on. While according to Undang-*Undang Nomor 10 Tahun 2009*, tourist attraction is everything that has uniqueness, beauty, natural diversity, cultural, and product of man-made that can be visited by tourists.

3. Tourism Industry

   According to *Undang Nomor 10 Tahun 2009*, tourism industry is group of tourism business related each other to generate a product or service to fulfill tourists needed in tourism. The tourism industry can be as tax source and income for the company who sells products and services to tourists.

2.1.2 Types of Tourism

A tourist has a journey because he is pushed by some motives reflected in the types of tourism. It is important for an area to study about the motive because it relates with facilities and programs that prepared to be promoted. James J. Spillane (1989) stated in Badrudin (2000) that types of tourism are consisted of (Budi, 2000):

1. Pleasure Tourism, is a tour that aims to have a holiday, looking for a new fresh air, enjoy a beautiful scenery or enjoy a holiday.
2. Cultural tourism, is a tour based on desire to expand views of life by visiting other places or overseas, study about society, habit and customs.
3. Recreation Tourism, is a tour that aims to spend a weekend for taking a rest, recover the physical fitness and spiritual, and refresh the weariness.
4. Sports Tourism, is a tour that aims to sport or sporting event, such as ski holidays or the Olympics.
5. Business Tourism, is a tour to complete a business transaction or attend a business meeting like conference and exhibition.
6. Convention Tourism, is a tour that is usually constructed to support the convention tourism like hotel and convention hall.

2.2 Agriculture

Agriculture is utilization activity of biodiversity resource (cultivation, arrest, exploitation) to produce foodstuffs, industrial raw materials, or energy resource, and manage environment. Agriculture can be define as all activities that involve use of organism (include plants, animals, and microbial) for human interest (Jawa Timur, 2014)

Agriculture is divided into five subsectors, which are food crops, plantation, livestock, forestry and fishery. Agriculture can involve some subject with the efficient reason and financial improvement, this mostly occurs on farmer who conducts a cultivation on more than one type of subsectors. Agriculture is basically economic activity, so it needs same knowledge basics. The knowledge basics include businesses management, seed selection, cultivation method, result collection, product distribution, processing and packaging, and marketing. If farmer viewed all aspects with efficient consideration to reach maximum profit, farmer can do intensive farming.

Food crops are consisted of grain, crops (corn, nut, sweet potato), and horticulture (vegetables, fruits, medicinal and decorative plants). Production approach is conducted by Dinas Pertanian by compiling data on sub-district level, data of grain and crops are through compilation on data of harvested area and horticulture data is data of through horticulture production. Data production of grain and crops are obtainable through multiple result between harvested area and productivity based on plant types.

Plantation is consisted of type of cultivation plants which can't be consumed directly and it is the raw material for processing industry like sugarcane, tobacco, coffee, tea. Plantation can be defined as smallholders, country estates and private estates. Data of plantation production can be obtained from Dinas Perkebunan in that area.

Forestry Plant is the total production of round wood, sawn wood, and rattan. The data can be obtained from Dinas Kehutanan. Forestry is mostly divided into the total of production from forest area and outside forest area. Types of forest area are mostly teak wood, firewood, wild wood, pine sap, gum resin and eucalyptus. While types of outside forest area are mostly teak wood and wood jungle.

Fishery sector involves the marine fisheries, public water, ponds, cage, and Mari culture. The production can defined all products that obtained to be sold and consumed. Aquaculture involves all other aquaculture from natural fishery resource and fishery industry. The fishery products can be defined as capture and non-capture fisheries.

2.3 Ecotourism

Definition of ecotourism has developed during period. But essentially, ecotourism is responsible travel on natural area conservation, give benefits in economy and keep social culture of local area (Fandeli, 2000). Ecotourism is a sub-component of the field of sustainable tourism. It is important to clarify that all tourism activities should aim to be sustainable.

Ecotourism is now defined as responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education (The International Ecotourism Society, 2015). This means that the planning and development of tourism infrastructure, its subsequent operation and also its marketing should focus on environmental, social, cultural, economic, and education sustainability criteria.

Ecotourism is about uniting conservation, communities, and sustainable travel. This means that those who implement, participate in and market ecotourism activities should adopt the following ecotourism principles (The International Ecotourism Society, 2015):

- Minimize physical, social, behavioral, and psychological impacts.
- Build environmental and cultural awareness and respect.
- Provide positive experiences for both visitors and hosts.
- Provide direct financial benefits for conservation.
- Generate financial benefits for both local people and private industry.
- Deliver memorable interpretative experiences to visitors that help raise sensitivity to host countries political, environmental, and social climates.
- Design, construct and operate low-impact facilities.
- Recognize the rights and spiritual beliefs of the indigenous people in your community and work in partnership with them to create empowerment.

It can be concluded that ecotourism has a definition as a journey to natural area. Although the trip is an adventure, but tourists can enjoy it. Ecotourism always keep quality, integrity, natural sustainability, and cultural by siding at society. Role of local people is very high in order to keep natural integrity. The role is started from planning, development process and supervision in utilization

2.4 Livestock

Based on Pasal 1 Undang-Undang Republik Indonesia Nomor 41 Tahun 2014, livestock is the affairs that relate with physical resources, seeds, livestock's foods, livestock's tools and machines, raising livestock, harvest, postharvest, processing, marketing, cultivation, financing, and infrastructure (President of Republik Indonesia, 2014).

Kabupaten Malang has quite big farm potential with the livestock's superior products like dairy cows, beef cattle, chicken (laying and cattle) and goats especially goats type PE (Peternakan Etawah). The livestock's superior products develop and are concentrated in area of Sentra production like Sentra dairy cows production (in East, West, and North of Malang), Sentra beef cattle production (in South of Malang), area of Sentra chicken production (in Centre of Malang), and goat PE which located in East, North, and South of Malang (Dinas Peternakan dan Kesehatan Hewan, 2015).

Development Policy of livestock and animal health are synergized with development policy direction of Kabupaten Malang which is listed in RPJMD Kabupaten Malang Tahun 2010-2015. Dinas Peternakan dan Kesehatan Hewan Kabupaten Malang in accelerating agriculture sector development which includes (Dinas Peternakan dan Kesehatan Hewan, 2015):

a. Increase of population, production, and livestock productivity.
b. Increase of farmer resources quality.
c. Increase of livestock's infrastructure.
d. Development of livestock's agribusiness.
e. Increase of controlling and eradication on animal plague and also controlling on livestock's pollution.

2.5 Macro Economy

Macroeconomic, that can be the local economy measure, is consisted of own-source revenue, local tax, local retribution and Gross Regional Domestic Product.

2.5.1 Own-source Revenue

Own-source revenue according to Undang-Undang Republik Indonesia Nomor 32 Tahun 2004 is all rights which is recognized as adding value of wealth in the related budget period (Republik Indonesia, 2009). Own-source revenue comes from revenue of local and central funding balance and also comes from self-financing, which are own-source revenue and other legal revenues.

Financial balance between central and local government according to Undang-Undang Republik Indonesia Nomor 32 Tahun 2004 is a system of finance division which is fair, proportional, democratic, transparent, and responsible in decentralization funding by considering potency, condition, regional needs, and number of deco centration funding and co-administration (Republik Indonesia, 2009).

Nurcholis stated that own-source revenue is a revenue earned by region from local tax, local retribution, local business profit, and other legitimate revenues (Hanif, 2007).

Warsito stated that own-source revenue is a revenue comes from local government. Sources of own-source revenue are consisted of local tax, local retribution, regional owned enterprise, and other legitimate own-source revenues (Warsito, 2001).

According some opinions above, it can be concluded that own-source revenue is all financial receipts of a region, which comes from the potency of region for example local tax, local retribution, and other legitimate revenues, and also the financial receipts are managed by local regulation.

Sources of own-source revenue according to Undang-Undang RI No.32 Tahun 2004 are:

1. Own-source revenue consisted of:
   - Local Tax Outcome is local charge established by region for household financing as the legal public entity. Local tax as local government charge is used to general expenditure which the service recompense is not directly given but the execution can be forced.
   - Outcome of Local Retribution is a legitimate charge to be local levy as payment of discharging or acquiring service jobs, business or belonging to the local government concerned. Local retribution has implementation of which is economic, direct rewards although it has to fulfill formal and material requirements, but there is an alternative without payment. In certain things, local retribution is repayment cost released by local government to fulfill society claim.
   - Outcome of company belonging to a region is own-source revenue which comes from net income of local business by regional development fund and budget of local expenditure distributed to local cash. So, role of local company is a unified production to add own-source revenue, provide services, organizing public benefit and develop regional economy.
   - Other legitimate own-source revenues is not including in the types of local tax, local retribution, government income. It is opened for local government to support or steadying a regional policy in a particular field.
2. Balance funds is obtained through own-source revenue of land and building tax revenue from rural, urban, mining and natural resources as well as from the transfer

of rights over land and building. Balance funds is consisted of sharing fund, general allocation fund, and special allocation fund.

3. Other legitimate own-source revenues are own-source revenue that come from other sources like third party contributions to the region and it is implemented in accordance with prevailing regulation.

2.5.2 Local Tax

According to Pasal 1 Undang-Undang Nomor 28 Tahun 2009 Tentang Pajak Daerah dan Retribusi Daerah, local tax is compulsory contributions to regional owed by private person or agency that is spatially force based on the act, by not gain the rewards directly and used for the purpose of regions for optimal public welfare. Agency refers to an integration of people and capital, whether or doing business or not that includes perseroan terbatas, perseroan komanditer, and other companies, Badan Usaha Milik Negara (BUMN), Badan Usaha Milik Daerah (BUMD), with the name of any kind (Republik Indonesia, 2009).

1. **Characteristics of Local Tax**

Asra stated that characteristics of own-source revenue is (Afifah, et al., 2013):

a. Local tax derived from original local tax and national tax given to the regions as a regional tax
b. Local Tax is collected by limited area in the authorized administrative region.
c. Outcome of own-source revenue charge is used to finance household affair or to finance the regional expenditure as legal entities.
d. Local tax is collected by the region based on strength of local regulation, thus the local tax charge can be forced on the society who is obligated to pay in authorized administrative charge.

2. **Types of Local Tax**

Based on Pasal 2 Undang-Undang Nomor 28 Tahun 2009 Tentang Pajak Daerah dan Retribusi Daerah, there are five types of tax provincial and 11 types of tax districts. It can be seen in Table 2.1.

Table 2.1 Types of Local Tax

Tax Provincial	Tax Districts
1. Motor Vehicle Tax 2. Bea from motor vehicle 3. Fuel Tax of Motor Vehicle 4. Tax of Surface Water 5. Cigarette Tax	1. Hotel Tax 2. Restaurant Tax 3. Entertainment Tax 4. Advertisement Tax 5. Street-lighting Tax 6. Nonmetallic-minerals and rocks Tax 7. Parking Tax 8. The Water Tax 9. Swallow nest Tax 10. Land and Building Tax Rural and Urban Areas 11. Acquisition of Land and Building Customs

3. Local Tax Rates

Based on Undang-Undang Nomor 28 Tahun 2009 Tentang Pajak Daerah dan Retribusi Daerah, local tax rates is divided into local tax rates provincial and districts. Table 2.2 shows about determination of tax rates provincial

Table 2.2 Tax Rates of Provincial

Tax Provincial	Tax Rates
1. Motor Vehicle Tax	1-2% (first motor vehicle) and 2-10% (second motor vehicle)
2. Bea from the motor vehicle	20% (first transfer) and 1% (second transfer and continued)
3. Fuel Tax of Motor Vehicle	5-10%
4. Tax of Surface Water	10%
5. Cigarette Tax	10%

Tax provincial that has to be paid is consisted of five, which are motor vehicle tax, customs from the motor vehicle, fuel tax of motor vehicle, tax of surface water and cigarette tax. While the determination of tax rates for districts can be seen on Table 2.3.

Table 2.3 Tax Rates of Districts

Tax of Districts	Tax Rates
Hotel Tax	10%
Restaurant Tax	10%
Entertainment Tax	35-75%
Advertisement Tax	25%
Street-lighting Tax	1,5-3%
Nonmetallic-minerals and rocks Tax	25%
Parking Tax	30%
The Water Tax	20%
Swallow nest Tax	10%
Land and Building Tax Rural and Urban Areas	0,3%
Acquisition of Land and Building Customs	5%

2.5.3 Local Retribution

According to Pasal 1 angka 10 Undang-Undang Nomor 28 Tahun 2009, retribution is local charge as payment for the services or provision of specific permissions, which is specially provided or given by local government to interests of an individual. Local retribution is consisted of three groups, which are:

- Retribution of General Service, is a retribution of services provided and given by local government for general interests and can be enjoyed by private person.
- Retribution of business Service, is a retribution of services provided by local government by following a commercial principle.
- Retribution of Specific Permission, is a retribution of certain activities from local government in order to give a permission on individual or agency which intended to coaching setting, control and supervision.

Types of Retribution General Services, Business Services, and Specific Permission can be seen in Table 2.4.

Table 2.4 Types of Local Retribution

Retribution of General Services	Retribution of Business Services	Retribution of Special Permission
1. Retribution of Healthy Service; 2. Retribution of Clean Service; 3. Retribution of Print Replacement Cost of An Identity Card and A deed of Civil Registration; 4. Retribution of Cemetery Service and Cremation 5. Retribution of Parking Service on the edge of A Public Road; 6. Retribution of Market Service; 7. Retribution of Motor Vehicle Testing; 8. Retribution of A Fire Extinguisher; 9. Retribution of Print the Replacement Cost of A Map; and 10. Retribution of Fishing Vessel Inspections.	1. Retribution of Extraction of Local Resources; 2. Retribution of Wholesale Markets and Shops; 3. Retribution of the auction; 4. Retribution of Terminals; 5. Retribution of Special Parking Lot; 6. Retribution of Lodging Place; 7. Retribution of outhouse suction; 8. Retribution of Slaughter House; 9. Retribution of Ship Port Services; 10. Retribution of A Recreation and Sports; 11. Retribution of Crossing on The Water; 12. Retribution of Liquid Waste Processing; and 13. Retribution of Sales of the Production of Regional Business.	1. Retribution of Building Permit; 2. Retribution of Permit Place Sale of Alcoholic Beverages; 3. Retribution of Disturbance Permit; and 4. Retribution of Route Permits.

2.3.4 Gross Regional Domestic Product

Development of the state economy, especially Indonesia can be measured by using Gross Domestic Product (GDP). GDP in economy sector is value of all products and services produced by a country in specific period that is usually used as a method to calculate national income (Makiw, 2005). While Badan Pusat Statistik stated that Gross Regional Domestic Bruto is total of production value of product and service produced by a region in specific period, which is one year (Statistik, 2012).

GRDP is calculated and differentiated into two, which are Gross regional domestic bruto at Current Prices and Gross regional domestic bruto on the Basis of Constant Price. Gross regional domestic bruto at Current Prices is used to know shifts and economic structure. GRDP shows income that can be enjoyed by society in a region and describe added value of product and service that are calculated by using price in every year. Gross regional domestic bruto at Current Prices shows economic sector role in a sector region that has big role in showing of economic base of a region. Thus, GRDP in aggregative shows the ability of a region to produce income on production that participate in the production process of the region. While Gross regional domestic bruto at Constant Prices is used to know economic growth in every years and show economic growth rate in each sectors every years. Data of Gross regional domestic bruto on the Basis of Constant is more describing the real production development of service and product produced by economic activities of the region.

In this research, Gross regional domestic bruto at Current Prices is used to measure development of sector in a region. Approach used to calculate GRDP is production approach. According to production approach, it is calculated from added value of all economic activities by subtracting cost between each total output and each sectors. Calculation of GRDP is as follows.

$$\boldsymbol{Output_{b,t} = Production_t \; x \; Price_t}$$

$$\boldsymbol{NTB_{b,t} = Output_{b,t} - \; Costs \; between_{b,t}}$$

$$\boldsymbol{atau}$$

$$\boldsymbol{NTB_{b,t} = Output_{b,t} x \; Ratio \; NTB}$$

Where:

$\boldsymbol{Output_{b,t}}$	= Output of bruto production bruto at Current Pricesin year t
$\boldsymbol{NTB_{b,t}}$	= Added value of bruto at Current Pricesin year t
$\boldsymbol{Production_t}$	= Quantum production in year t
$\boldsymbol{Price_t}$	= Production Price year t
$\boldsymbol{Ratio \; NTB}$	= Ratio NTB of Output (NTB/Output)

2.6 Modelling of Dynamic System

Modelling of a system is important to imitate real case problem. It needs a method to capture each components of a system especially in complex problem. One of the appropriate method for complex problem is dynamic system. Dynamic System is a method of problem analysis which is the important factor and understanding how a system can defensed from disturbance outside the system or based on purpose of system modelling that will be made (Coyle, 1996)

2.5.1 Steps of system dynamic modelling

According to dynamic system point of view, model is made to answer whole of question. Steps for modelling process are as follows (Sterman, 2004).

1. Problem Identification, is the selection on theme, variable key and concept, time, and definition of dynamics problem.
2. Hypothesis of dynamic formulation, is explaining initial hypothesis and mapping (model diagram, subsystem diagram, cause effect diagram, stock flow diagram and policy structure diagram).
3. Formulation of simulation model, is the specification of structure and rule of decision, parameter estimation, correlation between behavior and initial condition, testing for consistency with the purpose and limitation.
4. Testing, is comparing with reference, strength in extreme and sensitive condition.

2.5.2 Causal Loop Diagram

Causal loop diagrams are used to record mental models representing interrelation and feedback processes in a system (Yuen & Chan, 2010). Behdad Kiani stated that main purpose of Causal Loop Diagram is used to describe causal hypothesis, so it make the presentation of structure in the form of aggregate (Kiani, et al., 2009). Causal Loop Diagram helps user fast to communicate structure of feedback and basic assumption. It can represent how the system works. Causal Loop Diagram has long used in academia, and more commonly used in business world, it is very good for:

- Giving hypothesis description of dynamics causes.
- Giving important input trusted for a problem.
- Triggering and describing model either for individual or team.

Causal Loop Diagram is consisted of variables related with arrow to show the causal effect between variables. Causal Loop describes one of elements that impacts other elements. In order to show the feedback of related elements, CLD requires additional positive (+) and negative (-) polarities. A positive relationship is presented with "+" and a negative one with "-" as shown in Figure 2.1

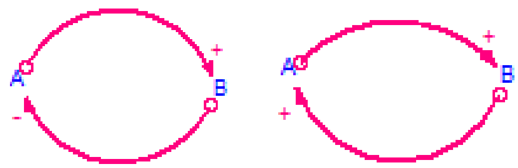


Figure 2.1 Causal Loop Diagram (CLD)

Positive relationship refers to a condition in which a casual element, A, results in a positive influence on B, where an increase of A value responds to the B value with a positive increase. Negative relationship refers to a condition in which a causal element, A, results in a negative influence on B, where an increase of A value responds to the B value with a decrease.

2.5.3 Stock Flow Diagram

Stock Flow Diagram (SFD) is a system that describes relation between variables. A model for simulating the system is used to represent condition of real system. A dynamic model is group of variables which is influencing each other in certain period (Aminullah, 2001). Each variables stated in particular quantities and in the form of numerical. Variables in simulation of dynamics system are described with symbols. Flow diagram is always related with stock symbol through thick arrow for flow process.

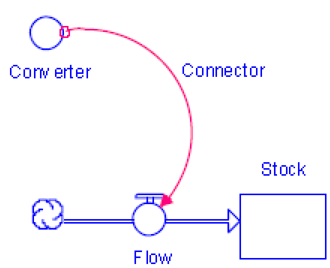


Figure 2.2 Symbol of Stock, Flow, Converter, and Connector

Stock or level is represented by rectangular symbol that states accumulation and shows condition of a system. Content of stock only can change by inflow and outflow. Without the difference on both flows, accumulation in stock will be in constant. Flow is a rate causing the changing of system condition (Sterman, 2004). The flow is used to represent activities in system. Then, the next symbol is converter. It contains equation that generates output in each periods. Converter usually takes information to be used by other variables in the model. The last symbol is connector that is used to transfer information and input used to set the flow.

2.7 Game Theory

Game theory is the name given to the methodology of using mathematical tools to model and analyze situations of interactive decision making. These are situations involving several decision makers (called players) with different goals, in which the decision of each affects the outcome for all the decision makers. This interactivity distinguishes game theory from standard decision theory, which involves a single decision maker, and it is its main focus. Game theory tries to predict the behavior of the players and sometimes also provides decision makers with suggestions regarding ways in which they can achieve their goals (Maschler, et al., 2013)

2.6.1 Pure Strategy

When playing a game in the normal form each player selects a strategy that they believe will yield the best result (Hogarth, 2006). These two strategies form a pair and can be denoted by (α_i, β_j). The example below shows how each player may go about doing this. The convention of this example is that positive amounts represent a payment from Player 1 to Player 2 and negative amounts represent a payment from Player 2 to Player 1. Player 1's possible strategies are the rows and Players 2's possible strategies are the columns. The rows and columns of the matrix are called the players pure strategies.

$$\begin{array}{c|cccc|} & \beta_1 & \beta_2 & \beta_3 & \beta_4 \\ \alpha_1 & 14 & 2 & 1 & 2 \\ \alpha_2 & -1 & 3 & 9 & 11 \\ \alpha_3 & 4 & 3 & 4 & 20 \\ \alpha_4 & 8 & 6 & 7 & 16 \end{array}$$

Figure 2.3 Matrix for pure strategies

In the example shown in Figure 2.3 it looks as if Player 2 has a rough deal as the best he can do is win £1 and that will only occur if the strategy pair (α_2, β_1) is selected.

2.6.2 Mixed Strategy

Whenever a game does not possess a saddle point, game theory advises each player to assign a probability distribution over her set of strategies. To express this mathematically, let

$x_{i:}$ probability that player 1 will use strategy i (i 1, 2, . . . , m),

y_j: probability that player 2 will use strategy j (j 1, 2, . . . , n),

Where m and n are the respective numbers of available strategies. Thus, player 1 would specify her plan for playing the game by assigning values to x_1, x_2. . . x_m. Because these values are probabilities, they would need to be nonnegative and add to 1. Similarly, the plan for player 2 would be described by the values she assigns to her decision variables y_1, y_2. . . y_n. These plans (x_1, x_2. . . x_m) and (y_1, y_2, . . . , y_n) are usually referred to as mixed strategies (Hillier & Lieberman, 2000).

2.6.3 Non Zero Sum Games

The theory of zero-sum games is vastly different from that of non-zero-sum games because an optimal solution can always be found. However, this hardly represents the conflicts faced in the everyday world. Problems in the real world do not usually have straightforward results. The branch of Game Theory that better represents the dynamics of the world we live in is called the theory of non-zero-sum games. Non-zero-sum games differ from zero-sum games in that there is no universally accepted solution. That is, there is no single optimal strategy that is preferable to all others, nor is there a predictable outcome. Non-zero-sum games are also non-strictly competitive, as opposed to the completely competitive zero-sum games, because such games generally have both competitive and cooperative elements. Players engaged in a non-zero sum conflict have some complementary interests and some interests that are completely opposed.

2.6.4 Zero Sum Games

In a Zero-sum game the profits of all players are exactly equal to the losses of the other players. In other words the total winnings minus the total losses for any set of strategies chosen in the entire game must equal zero. Poker is an example of a Zero sum game as the winner of any hand will receive an amount of money exactly equal to the sum of the losses of all the other players participating in that hand.

2.6.5 Cooperative Games

Cooperative game is a game that the interests of both sides increase or at least one party's interest's increases in the condition that the other party will not be harmed, therefore the overall interests increases. Two-person bargain is the basic problem of cooperative game, it is a problem about how to divide the interrelated gains (profit) between two players, that is to say, achieve greater co-interest and self-interest of both sides by coordinating behaviors with a contract in the situation that they have common but not entirely consistent interests (Su & Hu, 2013).

2.6.6 Solution for games

Solution for games can be determined by considering the maximin-minimax or domination strategy, graphical method, and complementary slackness.

2.6.6.1 Maximin-minimax

It is clear to see from the theories that have been so far presented, the best strategy to employ is one that minimizes your maximum possible loss (or alternatively maximizes your minimum reward). This phenomenon is the basic foundation of John von Neumann's Minimax and Maximin theorems (Hogarth, 2006). The theorems basically state that for every finite two-person zero-sum game there exists a strategy for each player such that if both players employ the strategy, they will arrive at the same expected payoff. This means that one player will lose the maximum of the minimum that he expected to lose and the other player will win the minimum of maximum he could have possibly won. In other words both players are able to employ a strategy so that Player A knows he will win an amount P at the least and Player B knows he will lose at most an amount P resulting in an equilibrium should both players employ the Maximin and Minimax theorems respectively. Minimax and Maximin theorems enforce the idea that an optimal strategy exists for each player and determining the optimal strategy is now focus of this research.

2.6.6.2 Domination

The first steps usually take when trying to find optimum strategies have to deal with dominated strategy. This is one of the early works that can be done on a matrix to work a solution. The reason, as the name implies, is that it eliminate strategies in our matrix by removing dominated strategies from a game. It can be argued that situations can be found where by only using this tool a solution can be found. By eliminating through duplication what we actually do is remove any strategies that are identical in our payoff matrix. Elimination by dominance is when we use common sense to eliminate any strategies that provide lower, weaker payoff. We say that strategy 1 of player A dominates strategy 2 when for at any given time strategy provides more payoff to player A (Figure 2.3)

A \ B	3	4
1	3	-1
2	-2	-3

Figure 2.4 Two person zero-sum game that dominated strategies exist

2.6.6.3 Graphical method

One of the solution of matrix game theory is graphical method. It supposed that Player 1 has probability p and the others is 1-p. Then, we graph the linear function of matrix game. The graphical (or geometrical) method for solving Mathematical Programming problem is based on a well define set of logical steps. Following this systematic procedure, the given Programming problem can be easily solved with a minimum amount of computational effort (Gupta, n.d.). Programming problems involving only two variables can easily solved graphically. As we will observe that from the characteristics of the curve we can achieve more information. We shall now several such graphical examples to illustrate more vividly the differences between linear and non-linear programming problems. The graphical solution is show in Fig 2.4 The region of feasible solution is shaded.

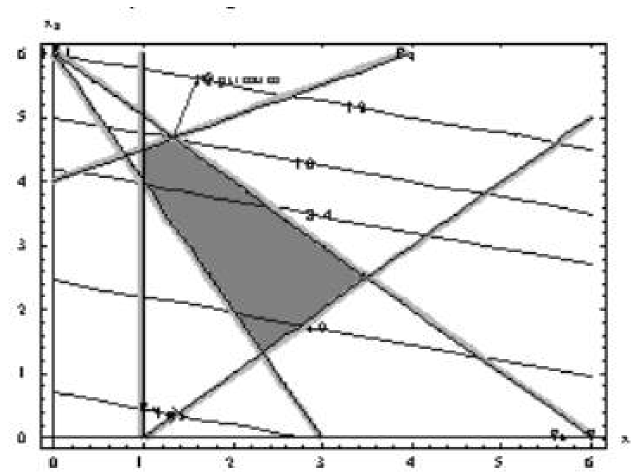


Figure 2.5 Optimal solution by graphical method
Source: (Das, 2010)

2.6.6.4 Complementary slackness

The game which has no saddle point and no dominated strategies, so we set up the row and the column players' LP's. All entries in the reward matrix are nonnegative, so we are sure that the value of the game is nonnegative. Example to calculate the optimal point and value is (Widodo, 2014):

$$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

$$X_1^* = \frac{a_{22} - a_{21}}{a_{22} + a_{11} - a_{12} - a_{21}}$$

$$X_2^* = \frac{a_{11} - a_{12}}{a_{22} + a_{11} - a_{12} - a_{21}}$$

$$V^* = \frac{a_{11} \times a_{22} - a_{12} \times a_{21}}{a_{22} + a_{11} - a_{12} - a_{21}}$$

CHAPTER III
RESEARCH METHODOLOGY

This chapter explains about steps proceeding in this research. The steps of this research are divided into four steps which are: (1) Variable Identification and Model Conceptualization Stage, (2) Model Simulation Stage, (3) Generating Strategies of Each Player Stage, and (4) Analysis and Making Conclusion Stage.

3.1 Variable Identification and Model Conceptualization Stage

This stage is consisted of player and goal identification, variable identification, and system conceptualization and data collection. It aims to give initial description on researched system and can be determined by related variables of system.

3.1.1 Player and Goal Identification

This sub-stage is conducted on stakeholders of system and it can be defined as the player of the game. Then, goal of the games can be defined as the goal of simulation model which is used to select the optimal alternative's strategy.

3.1.2 Variable Identification

This sub-stage is conducted on related variables and influenced parameter in livestock's ecotourism development in Kabupaten Malang. Related variables are limited by research scope first.

3.1.3 System Conceptualization

This stage is conducted by designing conceptual model of existing system. Designed conceptual model can be described by using input-output diagram and causal loop diagram. Input-output diagram describes desired and undesired input-output of livestock's ecotourism development system in Kabupaten Malang. The diagram is used to identify the input and output of system. While causal loop diagram describes causal loop relationship between variables in livestock's ecotourism development system of Kabupaten Malang. It is used to identify description of system from point of view relationship between systems.

3.1.4 Data Collection

This stage is conducted by collecting related data with livestock's ecotourism development system in Kabupaten Malang. Data collection is conducted on some sources to get related data with related variables in the system. Source of data collection is from related institution like Dinas Kabupaten Malang.

3.2 Model Simulation Stage

This stage is conducted by designing simulation policy strategy designing, design and simulation model formulation and policy strategy implementation.

3.2.1 Design and Simulation Model Formulation

This sub-stage is conducted by designing simulation model of system which is livestock's ecotourism development in Kabupaten Malang. After designing simulation model, the next step is formulating the model. Design and simulation model formulation uses STELLA© (*iSee System*) Software. Model is designed and formulated in systematical formulation of variables based on their relationship.

3.2.2 Policy Strategy Implementation

This sub-stage is conducted by running model simulation for each strategy's scenarios. Each scenarios has the same objectives which are to increase own-source revenue and GRDP of Kabupaten Malang. After that, model verification and validation are conducted to the model to make it valid.

3.2.3 Policy Strategy Designing

This sub-stage is conducted by determining goal of the games, which are own-source revenue and gross regional domestic product of Kabupaten Malang. Then this stage is continuing by determining decision variables of each player and designing scenario for each players.

3.3 Generating Strategies of Each Player Stage

This stage is conducted after the model can be stated as valid model. It is conducted by designing matrix payoff and using game theory approach to get strategy for each player.

3.3.1 Matrix Payoff Designing

This sub-stage is conducted by designing matrix payoff based on output of system dynamics simulation. The number of matrix payoff is determined by number of strategies in scenario's model. The number of each payoffs can be obtained after calculating formulation and simulation model in STELLA software.

3.3.2 Game Theory Approach

This sub-stage is conducted by structuring the game and find solution of the game for each players by using game theory approach.

3.4 Analysis and Making Conclusion Stage

After the strategies for each players are obtained by using game theory, then analysis and interpretation of strategy's scenario are conducted to make the result more applicable for each players. After that, the next sub-stage is making conclusions based on the objective's research.

3.4.1 Analysis and Interpretation

This sub-stage is conducted by analyzing and interpreting on output of simulation and output win-win solution for each players in game theory approach. Analysis and interpretation of the result must be based on the objective's research.

3.4.2 Making Conclusion

This sub-stage is conducted on analysis and interpretation of the result. Points of making conclusions must answer the objective's research. Besides, giving advices related with the research are needed for future research about ecotourism in Kabupaten Malang.

The stages above can be described by using flowchart of research methodology on figure 3.1 below.

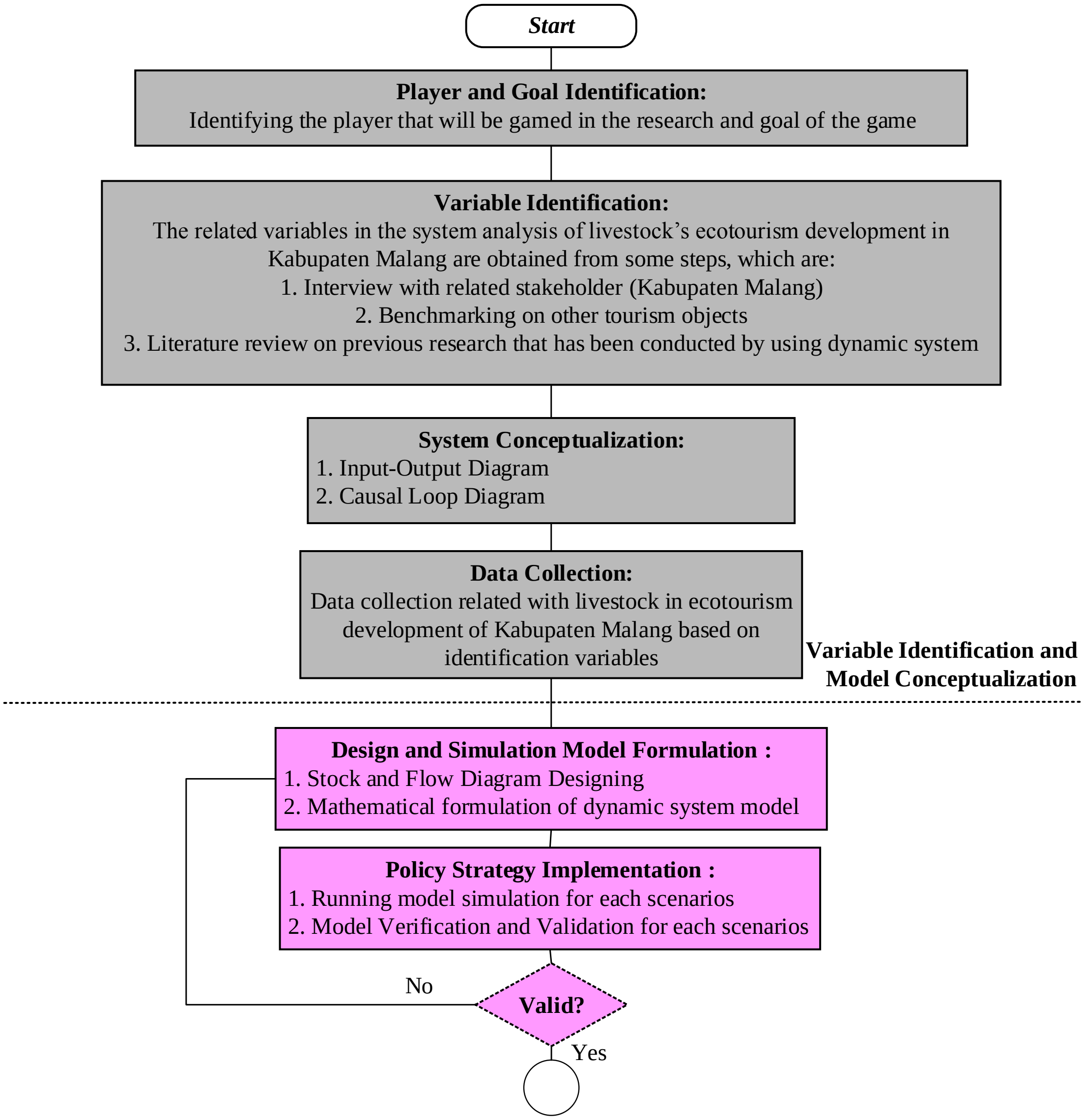


Figure 3.1 Flowchart of Research Methodology

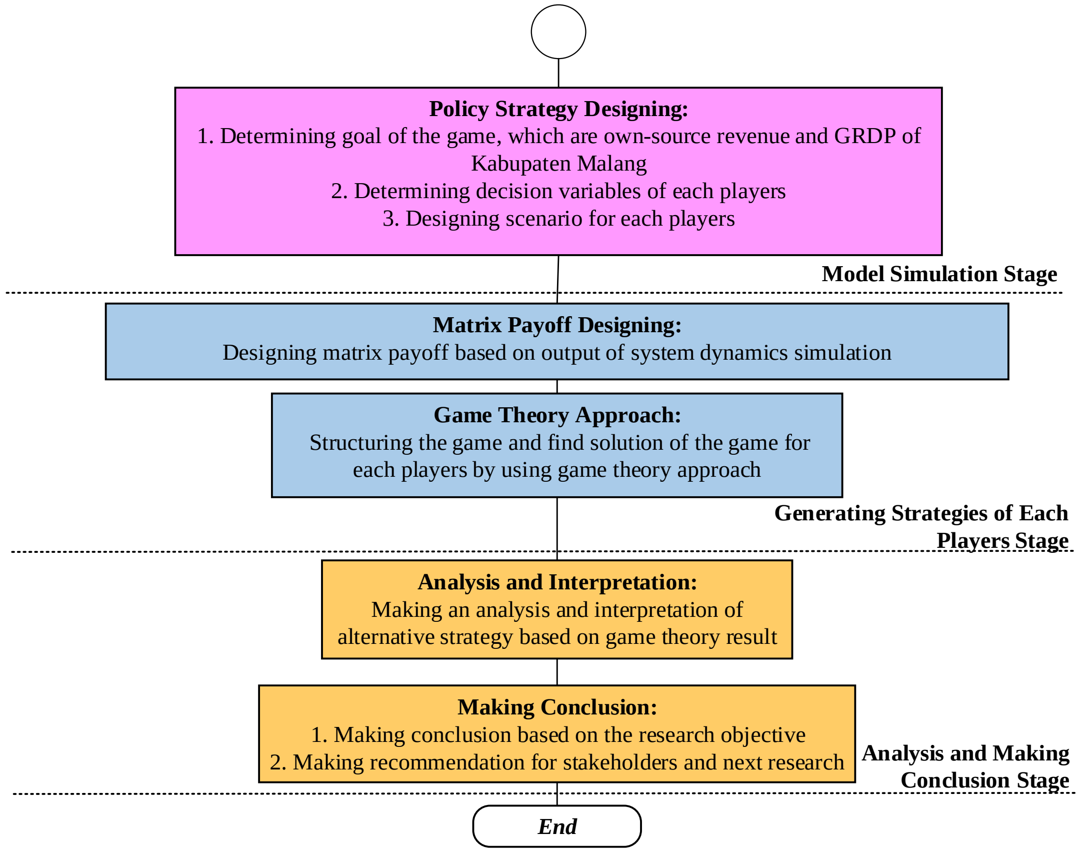


Figure 3.1 Flowchart of Research Methodology (Con't)

CHAPTER 4
DESIGNING SIMULATION MODEL

This chapter designs simulation and formulation model which describes about system on livestock's ecotourism development in Kabupaten Malang. It is started by identifying the existing system, designing and formulating model using system dynamics, validation, and verification.

4.1 System Identification

System identification is needed in order to make representative model with the existing condition. This research is conducted to determine strategies in developing livestock ecotourism in Kabupaten Malang. It is also conducted to analyze impact on economy of Kabupaten Malang by considering Own Source Revenue and Gross Regional Domestic Product. System identification is conducted on general description of Kabupaten Malang, Agriculture sector especially in livestock, tourism sector of Kabupaten Malang, Own Source Revenue and Gross Regional Domestic Product of Kabupaten Malang.

4.1.1 General Description of Kabupaten Malang

Kabupaten Malang is a regency in Eas Java and based on Peraturan Pemerintah Nomor 18 Tahun 2008, Capital of Kabupaten Malang was moved from Kota Malang to Kecamatan Kepanjen Kabupaten Malang (President of Republik Indonesia, 2008). Kabupaten Malang is located between 112º17 ', 10.90" East Longitude and 112º57', 00.00" East Longitude and between 7º44 ', 55.11' south latitude and 8º26 ', 35.45' south latitude. District administrative boundaries are as follows.

- North: Kabupaten Jombang, Kabupaten Probolinggo, Kabupaten Mojokerto and Kabupaten Pasuruan.
- West: Kabupaten Blitar and Kabupaten Kediri.
- East: Kabupaten Lumajang.
- South: Samudera Indonesia.
- Center: Kota Malang and Kota Batu.

With an area of about 3,534.86 km^2, Kabupaten Malang is located on the sequence of the second largest area after Kabupaten Banyuwangi of the 38 districts in East Java. Kabupaten Malang has 33 sub-districts which some of them are Lawang, Singosari, Turen and Kepanjen. Figure 4.1 below shows administrative map of Kabupaten Malang.

Figure 4.1 Administrative Map of Kabupaten Malang
Source: (Pemerintah Kabupaten Malang, n.d.)

Topography of Kabupaten Malang is a plateau area which is surrounded by lowland, several active and Non-active Mountain and also rivers flow throughout Kabupaten Malang. The topography condition give high impact on development process. Because Kabupaten Malang are surrounded by mountain, so the region is tend to be steep and bumpy with slopes 40%. By looking at this condition, Kabupaten Malang has a potency as protected district so that conservation of water and soil can be preserved well. Structure of land usage of Kabupaten Malang is consisted of 22.76% habitation, 0.17% industry, 13.04% farm, 23.65% dry land agriculture, 6.20%

plantation, 28.59% forest, 0.2% swamp, 0.03% pond, 0.29% meadow, 1.54% badlands, 0.26% quarry and 3.26% others.

Based of Statistics of Kabupaten Malang, Population growth of Kabupaten Malang on 2013 is 2,619,069 or 0.86% of average growth per year which is consisted of 1,306,930 (49.9%) of male and 1,312,139 (50.1%) of female with 880 soul/km^2 of average population density. While the population distribution of 2013 by age, Kabupaten Malang has the largest number of population on productive age (15-64 years old) which is about 1,647,778 people, on the age less than 15 years old is about 609,398 people and the age more than 64 years old is about 189,042 people.

4.1.2 Livestock Subsector in Kabupaten Malang

Agriculture potential in Kabupaten Malang is very diverse and almost dispersed to all sub districts. Agriculture is divided into five subsectors which are food crops, plantation, fishery, livestock, and forestry. Kabupaten Malang keep developing agriculture potential which is promising enough as one of regional revenue. It is supported by SIDa program which is classified on the agricultural region development. The region development are like Kota Malang, Kepanjen, Ngantang, Turen, Dampit and Sumbermanjing.

The potential livestock of Kabupaten Malang is consisted of large livestock, small livestock, and poultry. Commodities of large livestock are consisted of dairy cows, cows, buffaloes, and horses. The dominant growth of large livestock in Kabupaten Malang are cows and goats. While for the dairy cows is very appropriate on a hilly area or mountains with low relative temperature like in Kecamatan Kasembon, Ngantang, Pujon, Tumpang, Poncokusumo, Jabung and Wajak. The commodities of small livestock are consisted of goats, sheep, pigs and rabbits. The poultries which is cultivated on Kabupaten Malang are consisted of domestic hen, imported hen, duck, breast of chicken and quail bird. Table 4.1 and 4.2 shows livestock's population and production series of livestock of Kabupaten Malang in 2014.

Table 4.1 Number of Livestock Population Kabupaten Malang 2013

No	Livestock Type	2014
1	Dairy Cows	189,145
2	Cows	72,217
3	Buffaloes	1,394
4	Horses	614
5	Goats	12,028
6	Sheep	225,374
7	Pigs	30,392
8	Layer hen	2,920,857
9	Domestic Hen	2,141,663
10	Imported Hen	16,044,990
11	Duck	226,149
12	Breast of Chicken	92,412
13	Rabbit	36,256
14	Quail Bird	77,796

Source: (Statistic Malang Regency, 2014)

Table 4.2 Number of Livestock Production 2013

No	Production Type	Unit	2013
1	Meats	Ton	21,866.55
2	Eggs	Ton	25,080.21
3	Milks	Ton	116,033.57

Source: (Statistics Malang Regency, 2014)

4.1.3 Tourism Sector in Kabupaten Malang

Kabupaten Malang is one of tourism regency in East Java. Based on the geomorphology, Kabupaten Malang is consisted of mountains, plains and beaches so it gives beautiful natural. Kabupaten Malang has also so many historical buildings that support regional growth based on tourism and supported by natural resources and best sectors like agriculture, livestock, fishery, industry, mining and tourism. Tourism development is conducted through tourism package development, tourist track, facilities and infrastructure like hotel and lodging. Besides, the tourism development is increasing accessibility by increasing road condition and providing transportation to attraction. Table 4.3 shows the number of tourists in 2009-2013 visit to Kabupaten Malang.

Table 4.3 Number of Tourists Kabupaten Malang 2009-2013

No	Tourists	Number of Tourists Kabupaten Malang				
		2009	2010	2011	2012	2013
1	Domestic	1,876,132	1,938,066	2,101,822	2,144,334	2,362,583
2	International	3,752	4,187	9,983	33,226	21,895
TOTAL		**1,879,884**	**1,942,253**	**2,111,805**	**2,177,560**	**2,384,478**

Source: (Badan Perencanaan Pembangunan Daerah Kabupaten Malang, 2013)

By increasing number of tourists in 2009-2013, so Kabupaten Malang has showed the force to develop tourism sector. Kabupatan Malang also has many types of tourism object like natural tourism, artificial tourism, cultural tourism, special interest tourism, and agro tourism. Beside the role of Balitbang in tourism development program, so the tourism setor will increase contribution on own source revenue of Kabupaten Malang. Table 4.4 shows the number of tourism object destination owned by Kabupaten Malng in 2009-2013.

Table 4.4 Number of Tourism Objects Kabupaten Malang 2009-2013

No.	Type of tourism	Number of Tourism Object				
		2009	2010	2011	2012	2013
1	Beach	5	5	5	23	23
2	Recreational Park	7	7	7	13	13
3	Historical Heritage	16	16	16	16	16
4	Agro-tourism	2	2	2	8	8
5	Forest	6	6	6	10	10
6	Pilgrimage tours	1	1	1	6	6
7	Natural tourism	2	2	2	6	6
8	Cultural Heritage	14	14	14	14	14
TOTAL		**53**	**53**	**53**	**96**	**96**

Source: (Badan Perencanaan Pembangunan Daerah Kabupaten Malang, 2013)

4.1.4 Macro Economy of Kabupaten Malang

Regional economy can be quantified by own source revenue and gross regional domestic product of Kabupaten Malang. Regional revenue of Kabupaten Malang is consisted of three components, which are Balance Funds, Other Revenues of Kabupaten Malang, and Own Source Revenue.

1. Own Source Revenue of Kabupaten Malang

Own Source Revenue (OSR) is a regional economy generated from a region which is consisted of regional tax, regional retribution, natural resources product and other revenue of Kabupaten Malang.

Table 4.5 Own Source Revenue of Kabupaten Malang 2009-2013

No	Source of Revenue	Total of Own Source Revenue (Rupiahs)				
		2009	2010	2011	2012	2013
1	Regional Tax	33,782,874,886	39,362,653,309	64,689,653,942	71,301,888,447	95,918,841,190
2	Regional Retribution	24,512,496,389	29,861,750,121	37,145,935,538	42,775,834,435	45,314,153,760
3	Natural Resources Product	4,920,768,488	6,299,098,670	9,084,767,456	10,508,131,833	12,017,868,770
4	Other Formal Revenues	90,310,301,775	54,942,413,502	61,412,979,063	72,668,104,090	107,331,767,590
TOTAL OSR		**153,526,441,538**	**130,465,915,602**	**172,333,336,000**	**197,253,958,805**	**260,582,631,310**

Source: (Badan Perencanaan Pembangunan Daerah Kabupaten Malang, 2013)

Table 4.5 shows that OSR Kabupaten Malang is still increased until 2013, except in 2010. There is decreasing OSR Rp 23,060,525,936.07 in 2010 and still increased until 2013.

2. Gross Regional Domestic Bruto of Kabupaten Malang

GRDP is the total production of goods and services that produced in certain area and in the certain period (a year). GRDP is used to see the shifting and economic structure and show the possible revenue earned by the region, it is also used to describe value added of goods and services calculated by using price each year.

Table 4.6 GRDP at Current Prices of Kabupaten Malang 2009-2013

No.	Industrial Origin	GRDP (Billion Rupiahs)				
		2009	2010	2011	2012	2013
1	Agriculture	7,792.51	8,621.80	9,382.92	10,331.89	11,445.40
2	Mining & Quarrying	627.35	689.99	764.23	843.48	906.68
3	Manufacturing Industry	5,797.29	6,631.11	7,663.81	8,929.00	10,304.40
4	Electricity & Water Supply	235.17	262.44	296.15	330.49	377.38
5	Construction	529.87	649.25	793.08	980.34	1,178.95
6	Trade, Hotel & Restaurant	7,448.40	8,503.42	9,936.54	11,621.79	13,741.56
7	Transport and Communication	966.33	1,104.44	1,267.11	1,451.03	1,685.34
8	Financial, Owneship & Business Services	1,125.96	1,293.42	1,496.71	1,723.95	1,993.47
9	Services	3,231.51	3,634.72	4,074.45	4,551.84	5,197.57
TOTAL PDRB ADHB		**27,754.39**	**31,390.58**	**35,674.99**	**40,763.81**	**46,830.73**

Source: (Badan Perencanaan Pembangunan Daerah Kabupaten Malang, 2013)

Table 4.6 shows that GRDP of Kabupaten Malang still increases every year started from 2009 to 2013. Agriculture and trade, hotel and restaurant sector always give the highest contribution on GRDP every years. Both sectors are the leading sectors of Kabupaten Malang. Agriculture sector is supported by natural resource and climate of Kabupaten while trade, hotel, and restaurant sector is high growing sector caused by tourism sector.

4.2 System Conceptualization

System conceptualization is conducted after the system identification has been finished. This conceptualization generates output which is a conceptual model to generate general description about simulation model. This stage is started by conducting identification on related variables in the system, designing output-input diagram, causal loop diagram and stock flow diagram.

4.2.1 Variable Identification

Variable identification is conducted to get related variables in developing system of livestock ecotourism in Kabupaten Malang. Variable identification is based on interaction to related stakeholders and some literature studies.

Table 4.7 Variable Identification of Sub model Labor

Labor			
No	**Variable Name**	**Description**	**Symbol**
1	Nasality Level of Kabupaten Malang	Percentage number of nasality in Kabupaten Malang	Converter
2	Mortality Level of Kabupaten Malang	Percentage number of mortality in Kabupaten Malang	Converter
3	Migration Came Level	Percentage number of migration came in Kabupaten Malang	Converter
4	Out Migration Level	Percentage number of out migration in Kabupaten Malang	Converter
5	Rate of Nasality	Number of nasality every years in Kabupaten Malang	Rate
6	Rate of Mortality	Number of mortality every years in Kabupaten Malang	Rate
7	Rate of Migration Came	Number of migration came every years in Kabupaten Malang	Rate
8	Rate of Out Migration	Number of out migration every years in Kabupaten Malang	Rate

Table 4.7 Variable Identification of Sub model Labor (Con't)

Labor			
No	**Variable Name**	**Description**	**Symbol**
9	Population of Kabupaten Malang	Number of population in Kabupaten Malang	Stock
10	Fraction of Workforce	Percentage number of workforce population	Converter
11	Number of Workforce	Number of workforce population	Converter
12	Ratio of Unemployment	Ratio of unemployment population and workforce	Converter
13	Number of Unemployment	Number of unemployment population	Converter
14	Number of Labor Force Other Sectors	Number of labor force population on other sectors	Converter
15	Ratio of Labor Force Other Sectors	Proportion of number of labor force other sectors from workforce population	Converter
16	Number of Absorbed Labor Force	Number of population which is labor force	Converter
17	Number of Agriculture Labor Force	Number of population which is labor force in agriculture sector	Converter
18	Ratio of Agriculture Labor Force	Proportion of number of labor force in agriculture sector from number of workforce	Converter
19	Ratio of Livestock Labor Force	Proportion of number of livestock labor force from labor force in agriculture sector	Converter
20	Number of Livestock Labor Force	Number of population which is labor force in livestock	Converter
21	Number of Tourism Labor Force	Number of population which is labor force in tourism sector	Converter
22	Number of Non Ecotourism Labor Force	Number of population which is labor force of non ecotourism objects	Converter
23	Average Number of Absorbed Non Ecotourism Labor Force	Average number of labor force needs per non ecotourism object per year	Converter
24	Number of Ecotourism Labor Force	Number of population which is labor force of ecotourism objects	Converter
25	Number of Absorbed Ecotourism Labor Force Per Increasing	Number of absorbed labor force of ecotourism object when it was established	Converter
26	Number of Absorbed Ecotourism Labor Force Per Year	Number of absorbed labor force of ecotourism object every years	Converter

Table 4.8 Variable Identification of Sub model Land Usage and Tourism Object

Land Usage and Tourism Object			
No	**Variable Name**	**Description**	**Symbol**
1	Land Area of Kabupaten Malang	Land area owned by Kabupaten Malang	Converter
2	Fraction of Livestock Land	Proportion land area of livestock from land area of Kabupaten Malang	Converter
3	Livestock Land Area	Land area of livestock in Kabupaten Malang	Converter
4	Livestock Land Not for Ecotourism	Land area of livestock used not for ecotourism	Converter
5	Livestock Land for Ecotourism	Land area of livestock used for ecotourism	Converter
6	Amount of Average Livestock Land Area	Average of livestock's land area per livestock's household	Converter
7	Number of Livestock Ecotourism Object	Number of livestock ecotourism object in Kabupaten Malang	Converter
8	Increasing Number of Livestock Ecotourism Object	Increasing number of ecotourism in livestock every years	Converter
9	Increasing Number of Ecotourism Object	Increasing number of ecotourism in agriculture every years	Converter
10	Number of Ecotourism Object	Number of ecotourism object owned by Kabupaten Malang	Converter
11	Fraction of Non Livestock Land	Proportion land area of other subsectors from land area of Kabupaten Malang	Converter
12	Non Livestock Land Area	Land area of other subsectors in Kabupaten Malang	Converter
13	Non Livestock Land Not for Ecotourism	Land area of other subsectors not for ecotourism	Converter
14	Non Livestock Land for Ecotourism	Land area of other subsectors used for ecotourism	Converter
15	Amount of Average Non Livestock Land Area	Average of other subsectors’ land area per household	Converter
16	Number of Non Livestock Ecotourism Object	Number of other subsectors ecotourism object in Kabupaten Malang	Converter
17	Increasing Number of Non Livestock Ecotourism Object	Increasing number of ecotourism in other subsectors every years	Converter
18	Number of Non Ecotourism Object	Number of non ecotourism object owned by Kabupaten Malang	Stock
19	Increasing Rate of Non Ecotourism Object	Number of increasing non ecotourism object every years	Rate
20	Increasing Number of Non Ecotourism Object	Number of increasing non ecotourism object per year	Converter

Table 4.9 Variable Identification of Sub model Tourist

Tourist			
No	**Variable Name**	**Description**	**Symbol**
1	Number of Tourists Kabupaten Malang	Number of tourist travelling in Kabupaten Malang every years	Stock
2	Increasing Number of Tourists	Number of increasing tourists every years	Rate
3	Number of Tourism Promotion Per Year	Number of tourism promotion activity per year	Converter
4	Number of Increased Tourists	Number of increased tourist every tourism promotion activities	Converter
5	Number of Tourist Non Ecotourism	Number of tourist travelling to non ecotourism object per year	Converter
6	Proportion of Tourists Ecotourism	Proportion number of tourist travelling to ecotourism object	Converter
7	Number of Tourists Ecotourism	Number of tourist travelling to ecotourism object per year	Converter
8	Number of Livestock Tourists	Number of tourist travelling to livestock object per year	Converter
9	Proportion of Livestock Tourists	Proportion number of tourist travelling to livestock object	Converter
10	Number of Livestock's Customer from Tourists	Number of tourist in ecotourism object who purchases livestock's products	Converter
11	Fraction of Livestock's Customer	Proportion number of tourists as customer of livestock's products	Converter

Table 4.10 Variable Identification of Sub model Pollution

Pollution			
No	**Variable Name**	**Description**	**Symbol**
1	Pollution of Kabupaten Malang	Number of gas pollution generated by Kabupaten Malang	Stock
2	Increasing Pollution of Kabupaten Malang	Number of gas pollution production caused by tourism activity per year	Rate
3	Gas Pollution from Vehicle	Gas pollution caused by transportation	Converter
4	Gas Pollution of Ecotourism Transportation	Gas pollution caused by transportation to ecotourism object	Converter
5	Gas Pollution of Non Ecotourism Transportation	Gas pollution caused by transportation to non ecotourism object	Converter
6	CO2 Emission Factor Per Vehicle	Factor of CO2 Emission per vehicle to ecotourism and non ecotourism object	Converter
7	Number of Ecotourism Transportation	Number of vehicles go to ecotourism object	Converter

Table 4.10 Variable Identification of Sub model Pollution (Con't)

Pollution			
No	**Variable Name**	**Description**	**Symbol**
8	Number of Non Ecotourism Transportation	Number of vehicles go to non ecotourism object	Converter
9	Average Number of Passengers Per Vehicle	Average number of passengers who can	Converter
10	Gas Pollution from Waste Per Year	Gas pollution of waste per year	Converter
11	Waste Pollution of Non Ecotourism Object Per Year	Gas pollution of waste produced by non ecotourism object per year	Converter
12	CO2 Emission of Waste Pollution Per Liter	CO2 Emission per liter waste	Converter
13	Waste Pollution of Ecotourism Object Per Year	Gas pollution of waste produced by ecotourism object per year	Converter
14	Number of Liter Waste Per Non Ecotourism Object Per Day	Number of liter waste produced by non ecotourism object per day	Converter
15	Number of Liter Waste Per Ecotourism Object Per Day	Number of liter waste produced by ecotourism object per day	Converter
16	Gas Pollution from Livestock Stool	Gas pollution of livestock stool per year	Converter
17	Gas Pollution of Livestock's Stool Ecotourism Object	Gas pollution of livestock stool produced by ecotourism object	Converter
18	Gas Pollution Rate of Livestock's Stool	CO2 Emission per kg livestock stool	Converter
19	Gas Pollution of Livestock's Stool Non Ecotourism Object	Gas pollution of livestock stool produced by non ecotourism object	Converter
20	Stool Pollution of Ecotourism Object	Number of livestock stool produced by ecotourism object	Converter
21	Stool Pollution of Non Ecotourism Object	Number of livestock stool produced by non ecotourism object	Converter
22	Number of Livestock Non Ecotourism Object	Number of livestock not for ecotourism object	Converter
23	Average Number of Livestock Animals in Non Ecotourism Object	Average number of cows per non ecotourism object	Converter
24	Stool Production Per Animal Per Day	Livestock stool produced by a cow per day	Converter
25	Average Number of Livestock Animals in Ecotourism Object	Average number of cows per ecotourism object	Converter

Table 4.11 Variable Identification of Sub model Investment

Investment			
No	**Variable Name**	**Description**	**Symbol**
1	Cost Investment for Livestock Ecotourism	Investment cost needed per livestock ecotourism object	Converter
2	Total Investment of Livestock Ecotourism	Total of investment cost needed to build livestock ecotourism object	Converter
3	Total Investment of Ecotourism	Total of investment cost needed to build ecotourism object	Converter
4	Average Cost Investment for Non Livestock Ecotourism	Investment cost needed to build livestock ecotourism object	Converter
5	Total Investment of Non Livestock Ecotourism	Total of investment cost needed to build livestock non ecotourism object	Converter
6	Cost Investment of Non Ecotourism Object	Investment cost needed per livestock non ecotourism object	Converter
7	Total Investment of Non Ecotourism	Total of investment cost needed to build non ecotourism object	Converter
8	Total Investment of Other Sectors	Total of investment cost needed to build other sectors object	Converter
9	Total Investment	Total of investment in Kabupaten Malang	Converter
10	Government Investment	Total of government investment in Kabupaten Malang	Converter

Table 4.12 Variable Identification of Sub model Budget Allocation

Budget Allocation			
No	**Variable Name**	**Description**	**Symbol**
1	Budget Allocation of Kabupaten Malang	Total budget allocation of Kabupaten Malang	Stock
2	Rate of Budget Allocation Kabupaten Malang	Increasing number of revenues from balance funds, own source revenue and other revenues per year	Rate
3	Balance Funds of Kabupaten Malang	Number of balance funds revenue of Kabupaten Malang per year	Converter
4	Other Revenues of Kabupaten Malang	Number of other revenues of Kabupaten Malang per year	Converter
5	Budget Allocation of Kabupaten Malang Per Year	Total budget allocation of Kabupaten Malang per year	Converter
6	Budget Allocation Plus Investment Per Year	Total budget allocation of Kabupaten Malang after reduced by government investment per year	Converter
7	Proportion of Tourism Budget Allocation	Proportion of tourism budget allocation per year	Converter

Table 4.13 Variable Identification of Sub model Budget Allocation (Con't)

Budget Allocation			
No	**Variable Name**	**Description**	**Symbol**
8	Rate of Increasing Tourism Budget	Increasing number of tourism budget allocation per year	Rate
9	Tourism Development Budget	Total budget allocation for tourism sector	Stock
10	Tourism Development Budget Per Year	Total of tourism budget allocation per year	Converter
11	Tourism Promotion Budget	Number of tourism promotion budget per year	Converter
12	Proportion of Tourism Promotion Budget	Proportion of budget allocation for tourism promotion per year	Converter
13	Ecotourism Object Surplus	Number of remaining tourism budget per year	Converter
14	Total Cost Tourism Promotion	Total cost of tourism promotion	Converter
15	Cost Average of Tourism Promotion	Average cost of tourism promotion per activity per year	Converter
16	Rate of Agriculture Budget	Increasing number of agriculture budget allocation per year	Rate
17	Agriculture Development Budget	Total budget allocation for agriculture sector	Stock
18	Proportion of Agriculture Budget	Proportion of agriculture budget allocation per year	Converter
19	Agriculture Development Budget Per Year	Total of agriculture budget allocation per year	Converter
20	Livestock Development Budget	Total budget allocation for livestock development	Stock
21	Rate of Livestock Budget	Increasing number of livestock development budget per year	Rate
22	Proportion of Livestock Budget	Proportion of livestock development budget per year	Converter
23	Livestock Development Budget Per Year	Total of livestock development budget per year	Converter
24	Livestock Productivity Budget	Total budget allocation for livestock productivity from livestock development budget	Stock
25	Rate of Increasing Livestock Productivity Budget	Increasing number of livestock productivity budget per year	Rate
26	Proportion of Livestock Productivity	Proportion of livestock productivity budget per year	Converter

Table 4.14 Variable Identification of Sub model Budget Allocation (Con't)

Budget Allocation			
No	**Variable Name**	**Description**	**Symbol**
27	Livestock's Promotion Budget	Total budget allocation for livestock promotion from livestock development budget	Stock
28	Rate of Increasing Livestock's Promotion Budget	Increasing number of livestock promotion budget per year	Rate
29	Proportion of Livestock's Promotion	Proportion of livestock promotion budget per year	Converter
30	Livestock's Promotion Budget Per Year	Total of livestock promotion budget per year	Converter
31	Number of Livestock's Promotion Based on Budget	Number of livestock's promotion based on budget livestock's promotion	Converter
32	Average Cost of Livestock Promotion	Average cost promotion per livestock's promotion	Converter
33	Livestock Productivity	Total productivity of livestock	Stock
34	Increasing Livestock Productivity	Increasing number of livestock productivity per year	Rate
35	Fraction of Increasing Livestock Productivity	Proportion of increasing productivity per year	Converter
36	Ratio of Livestock Disease Prevention	Budget proportion of livestock disease prevention	Converter
37	Budget of Livestock Disease Prevention	Total budget of livestock disease prevention	Converter
38	Ratio of Increasing Livestock Product	Budget proportion of increasing livestock product	Converter
39	Budget of Increasing Livestock Product	Total budget of increasing livestock product	Converter
40	Ratio of Increasing Livestock Application Technology	Budget proportion of increasing livestock application technology	Converter
41	Budget of Increasing Livestock Application Technology	Total budget of increasing livestock application technology	Converter
42	Activity Cost of Livestock Disease Prevention	Average cost per activity of livestock disease prevention	Converter
43	Activity Number of Livestock Disease Prevention	Total activity number of livestock disease prevention	Converter
44	Activity Cost of Increasing Livestock Product	Average cost per activity of increasing livestock product	Converter
45	Activity Number of Increasing Livestock Product	Total activity number of increasing livestock product	Converter

Table 4.15 Variable Identification of Sub model Budget Allocation (Con't)

Budget Allocation			
No	**Variable Name**	**Description**	**Symbol**
46	Activity Cost of Increasing Livestock Application technology	Average cost per activity of increasing livestock application technology	Converter
47	Activity Number of Increasing Livestock Application technology	Total activity number of increasing livestock application technology	Converter

Table 4.16 Variable Identification of Sub model GRDP of Livestock

GRDP of Livestock			
No	**Variable Name**	**Description**	**Symbol**
1	Number of Livestock Product	Number of livestock production per year	Stock
2	Rate of Livestock Production	Number of livestock's product increased per year	Rate
3	Rate of Livestock's Product Sold	Number of livestock's product sold per year	Rate
4	Number of Livestock's Product Sold	Total of livestock product sold	Stock
5	Rate of Sale for Livestock Product	Rate of sale for livestock product per year	Rate
6	Consumption of Livestock's Product Per Capita Per Year	Number of livestock's consumption per capita in Kabupaten Malang per year	Converter
7	Demand of Livestock's Product Per Year	Number of livestock's demand per year	Converter
8	Ratio of Increasing Demand per Livestock's Promotion	Ratio of increasing demand if there is an increasing of livestock's promotion activity	Converter
9	Demand of Livestock's Product from Tourists	Number of livestock's demand from ecotourism object per year	Converter
10	Selling Price of Livestock's Product	Selling price for livestock's product	Stock
11	Rate Changes Price of Livestock's Product	Increasing rate of changes price of livestock's product	Rate
12	Rate of Price Changes	Increasing rate of price changes	Converter
13	Livestock Revenue	Total revenue of livestock	Stock
14	Increasing Rate of Livestock Revenue	Increasing number of livestock revenue per year	Converter
15	Livestock Revenue Per Year	Total revenue of livestock per year	Converter
16	GRDP of Agriculture	Total GRDP of agriculture sector	Stock

Table 4.13 Variable Identification of Sub model GRDP of Livestock (Con't)

GRDP of Livestock			
No	**Variable Name**	**Description**	**Symbol**
17	GRDP Revenue Per Year	Increasing number of GRDP agriculture per year	Converter
18	Increasing Rate of Non Livestock Revenue	Increasing number of other sectors revenue per year	Rate
19	GRDP of Agriculture Per Year	GRDP of agriculture sector per year	Converter

Table 4.17 Variable Identification of Sub model OSR and GRDP Kabupaten Malang

OSR & GRDP Kabupaten Malang			
No	**Variable Name**	**Description**	**Symbol**
1	OSR Kabupaten Malang	Total own source revenue of Kabupaten Malang	Stock
2	Other Revenues	Increasing number of own source revenue generated from natural resources product and other formal revenues	Rate
3	Natural Resources Product	Increasing number of own source revenue generated from natural resources product per year	Converter
4	Other Formal Revenues	Increasing number of own source revenue generated from other formal revenues per year	Converter
5	Tariff of Property Tax	Tariff for property tax paid per year	Converter
6	Property Revenue of Tourism	Number of property revenue from tourism sector per year	Converter
7	Property Revenue of Other Sectors	Number of property revenue from other sectors per year	Converter
8	Property Revenue	Number of property revenue per year	Converter
9	Tax Revenue of Kabupaten Malang	Increasing number of own source revenue generated from tax per year	Rate
10	Total of Other Sector Retribution	Number of regional retribution other tourism retribution per year	Converter
11	OSR Kabupaten Malang Per Year	Number of own source revenue in Kabupaten Malang per year	Converter
12	Retribution of Kabupaten Malang	Increasing number of own source revenue generated from retribution per year	Rate
13	Total of Tourism Retribution	Number of regional retribution from tourism retribution per year	Converter

Table 4.18 Variable Identification of Sub model OSR and GRDP Kabupaten Malang (Con't)

OSR & GRDP Kabupaten Malang			
No	**Variable Name**	**Description**	**Symbol**
14	Total Ecotourism Retribution	Number of regional retribution generated from ecotourism object per year	Converter
15	Total of Non Ecotourism Retribution	Number of regional retribution generated from non ecotourism object per year	Converter
16	Retribution Cost of Ecotourism	Retribution cost of ecotourism object per ticket pricing	Converter
17	Retribution Cost of Non Ecotourism	Retribution cost of non ecotourism object per ticket price	Converter
18	Ticket Price of Ecotourism Object	Ticket price go through ecotourism object	Converter
19	Ticket Price of Non Ecotourism Object	Ticket price go through non ecotourism object	Converter
20	Proportion of Tourism Retribution	Proportion of tourism retribution per ticket price of ecotourism and non ecotourism object	Converter
21	Revenue of Other Taxes	Number of regional tax other tourism and property tax per year	Converter
22	Revenue of Tourism Tax	Number of regional tax from tourism sector per year	Converter
23	Total of Ecotourism Tax	Total revenue of tourism tax from ecotourism object	Converter
24	Total of Non Ecotourism Tax	Total revenue of tourism tax from non ecotourism object	Converter
25	Tariff of Tourism Tax	Tariff of tourism tax per year	Converter
26	Revenue of Ecotourism Object	Revenue of ecotourism object per year	Converter
27	Revenue of Non Ecotourism Object	Revenue of non ecotourism object per year	Converter
28	GRDP of Kabupaten Malang	Total GRDP of Kabupaten Malang	Stock
29	GRDP Revenue	Revenue of GRDP per year	Rate
30	GRDP of Kabupaten Malang Per Year	Number of GRDP Kabupaten Malang per year	Converter
31	GRDP of Other Sectors	Number of GRDP other sectors per year	Stock
32	Increasing GRDP of Other Sectors	Increasing number of GRDP other sectors per year	Converter
33	Increasing Rate of GRDP Other Sectors	Increasing percentage of GRDP other sectors per year	Rate

4.2.2 Input-Output Diagram

Input Output Diagram is compiled to describe input and output variable of system schematically. In the input output diagram, the existing variable is classified into controlled input, uncontrolled input, desirable output, undesirable output and environment. Input Output Diagram in this research is shown at Figure 4.2 below.

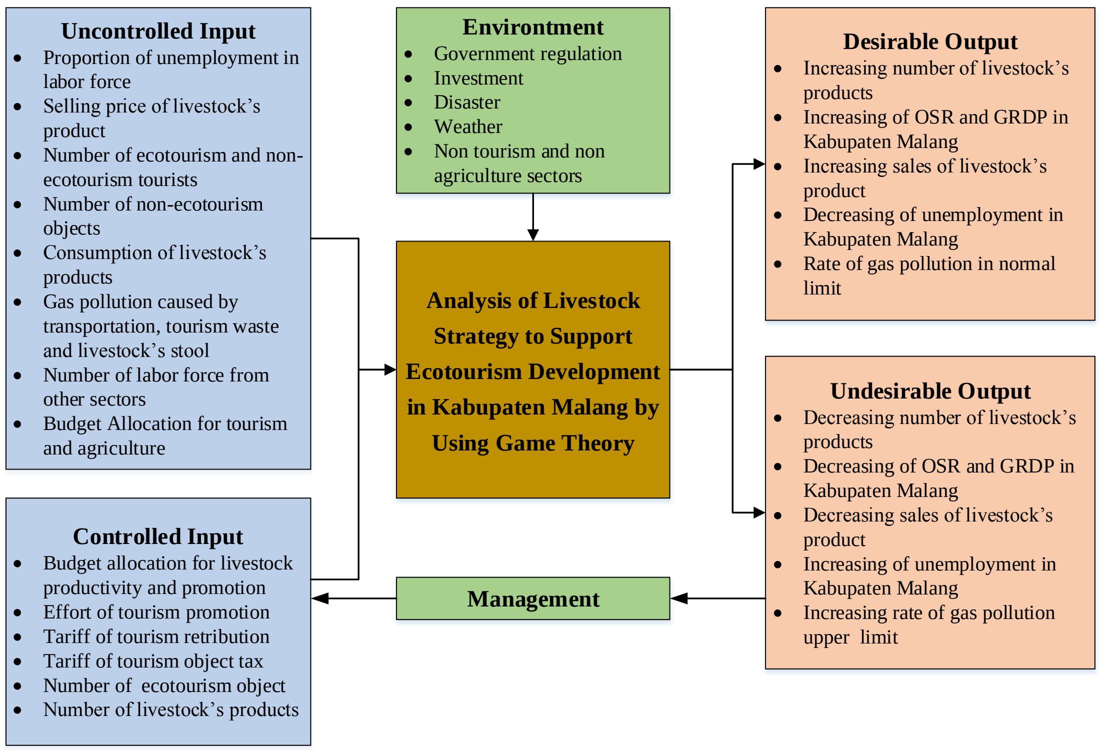


Figure 4.2 Input Output Diagram

Figure 4.2 shows the input of problem in this research and it is divided into two inputs, which are controlled and uncontrolled input. Based on government view, controlled input are input of problem that can be controlled by government, which are budget allocation of livestock development, effort of tourism promotion, tariff of tourism retribution, tariff of tourism object tax, number of livestock's ecotourism object, number of livestock's products and effort of increasing livestock productivity. While uncontrolled input are proportion of unemployment, selling price of livestock's product, number of ecotourism and non ecotourism tourists, number of non ecotourism objects, demand of livestock's product, gas pollution, number of labor force of other sectors, and budget allocation for tourism.

Hence output of this research is also divided into two, which are desirable and undesirable output. Desirable output is the increasing number of livestock's products, increasing of OSR and GRDP Kabupaten Malang, increasing number of sales livestock's products, decreasing unemployment, and rate of gas pollution within normal limit. While for undesirable output are consisted of decreasing number of livestock's products, decreasing of OSR and GRDP Kabupaten Malang, decreasing number of sales livestock's products, increasing unemployment, and increasing rate of gas pollution out of limit. The undesirable output can be minimalized by managing good maintenance on controlled input. Besides, environment can support this problem by using government regulation, investment, disaster, weather, and non tourism and non agriculture sectors.

4.2.4. Causal Loop Diagram

Causal loop diagram is used to show main variables in the model based on the identified variables before. Causal loop diagram shows causality between variables that described by using arrows. Positive arrow shows proportional relationship, which is the additional value on variable will cause additional value also on the influenced variable.

The causal loop diagram can also show how influence a variable on system behavior. All variables that give effects on the problem is involved in the model. Hence, variables that have feedback relation ship in the causal loop diagram, can be shown by using two reciprocal arrows. It will describe as stock on model simulation. Causal loop diagram of livestock ecotourism development in Kabupaten Malang is shows on Figure 4.3.

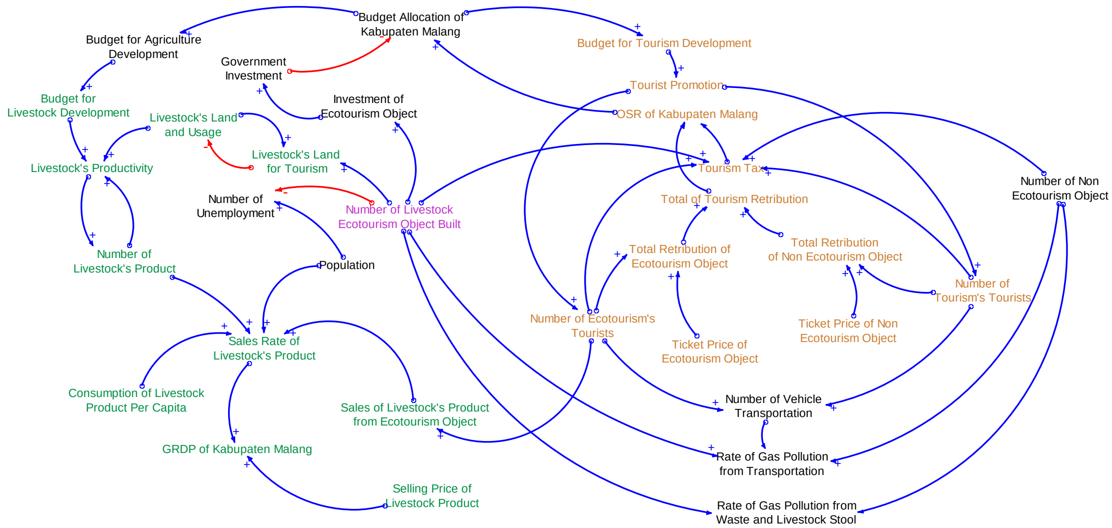


Figure 4.3 Causal Loop Diagram

Variables of Dinas Peternakan Kabupaten Malang is shown in green color, which are consisted of budget livestock development, livestock productivity, livestock's land and usage, livestock's land for tourism, number of livestock's product, sales rate of livestock's product, consumption of livestock product per capita, GRDP of Kabupaten Malang, selling price of livestock product and sales of livestock's product from ecotourism object. While, variables of Dinas Pariwisata Kabupaten Malang is shown in brown color, which are consisted of budget for tourism development, tourism promotion, OSR of Kabupaten Malang, tourism tax, tourism retribution, number of ecotourism tourist, number of tourism tourist, and ticket price. The purple one is a variable that can be controlled by Dinas Peternakan and Dinas Pariwisata Kabupaten Malang.

4.3 Stock and Flow Diagram

Stock and flow diagram is arranged based on the causal loop diagram before. Stock and flow diagram is detail explanation of system that has been explained by using causal loop diagram before. Because this diagram considers the time influence on variables relationship, so stock and flow diagram is able to show accumulation result by using stock/level variable and able to show the activity rate of system each period by using rate/flow.

4.3.1 Main Model of System

Main model of development system of livestock ecotourism in Kabupaten Malang can be shown in Figure 4.4

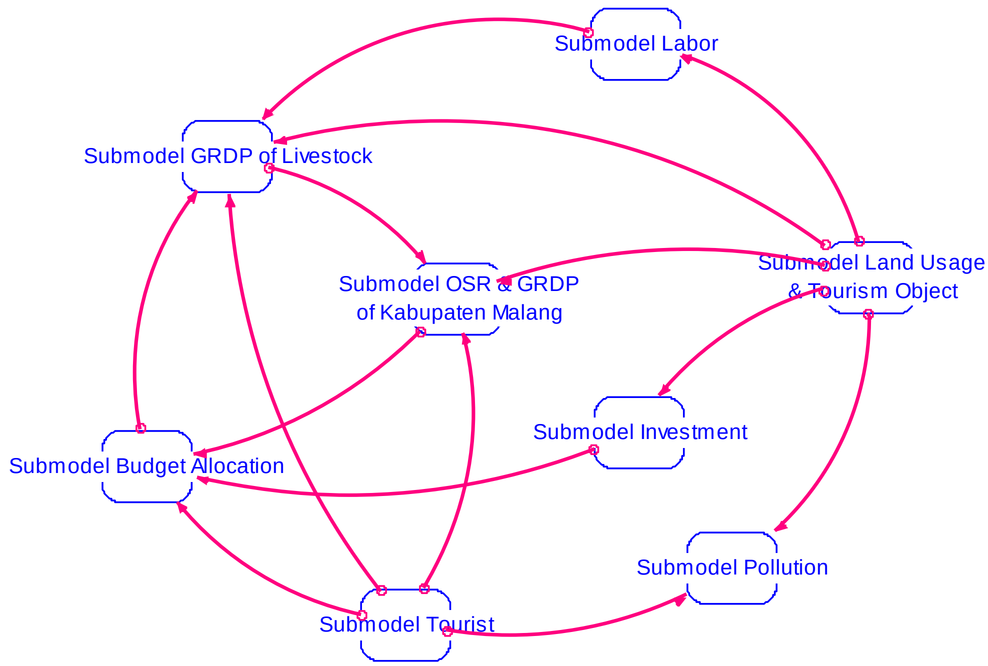


Figure 4.4 Main Model of Livestock Ecotourism Development in Kabupaten Malang

Based on Figure 4.4, main model of development system of livestock ecotourism is consisted of some sub models which are gas pollution, land usage and tourism object, labor, investment, tourists, budget allocation, GRDP of Livestock, OSR and GRDP. Each sub model has an interaction and impact on other sub models and it can be shown by using arrow between sub models.

4.3.2 Sub model Labor

This sub model shows labor on tourism development and labor from other sectors. Number of population in Kabupaten Malang which haven't had a job yet, can be calculated from number of workforce and then multiplied it with ratio of unemployment. Number of absorbed labor force comes from labor force needed by tourism, agriculture and other sectors every years. Ratio of unemployment in Kabupaten Malang can been shown from number of workforce which have no job per year. It is generated from reduction of number of workforce and number of absorbed labor force. Figure 4.5 shows sub model of labor force for livestock ecotourism development in Kabupaten Malang.

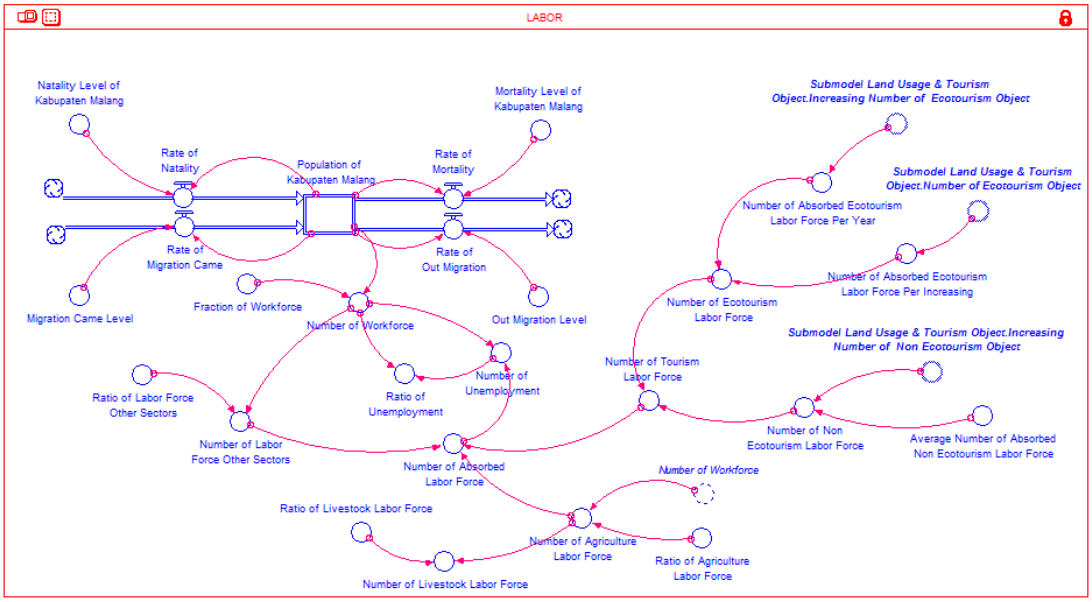


Figure 4.5 Stock and Flow Diagram of Sub model Labor

4.3.3 Sub model Land Usage and Tourism Object

Sub model land usage and tourism object shows land usage reviewed based on livestock land and number of ecotourism and non ecotourism in Kabupaten Malang. Hence, total land of Kabupaten Malang multiplied by ratio of livestock's land will generate total of livestock's land. Besides, this sub model can determine livestock's object that will be developed into ecotourism and also number of ecotourism so that it can generate livestock's land and tourism facility.

Beside that, the increasing of non ecotourism object is also calculated from historical data. Figure 4.6 shows sub model distribution of land usage and number of ecotourism and non ecotourism object to develop livestock ecotourism in Kabupaten Malang.

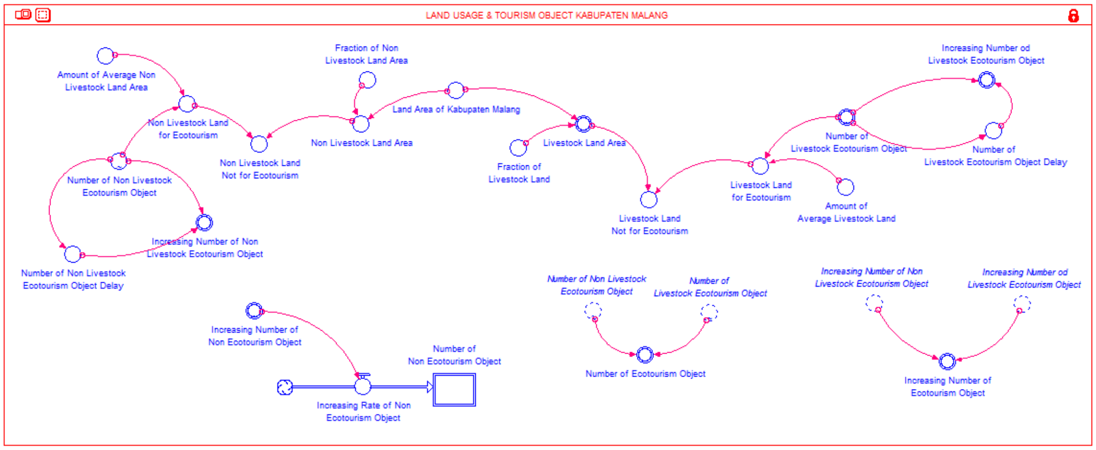


Figure 4.6 Stock and Flow Diagram of Sub model Land Usage and Tourism Object

4.3.4 Sub model Gas Pollution

Sub model gas pollution shows ecology view or environment of ecotourism development in Kabupaten Malang. It is measured by gas pollution of tourism activities. Parameter of pollution is emission of CO_2 gas generated from tourism activities. The tourism activities are divided into two, which are number of transportation visiting tourism object and waste from each tourism objects.

Number of transportation visiting ecotourism and non ecotourism object is reviewed from number of tourists each tourism objects and average number of passenger per vehicle. Then, pollution from number of transportation is multiplied gas emission CO_2 with number of transportation. While pollution which comes directly from each tourism objects is carbon emission of waste caused by tourism activities with the different number of waste between ecotourism and non ecotourism objects.

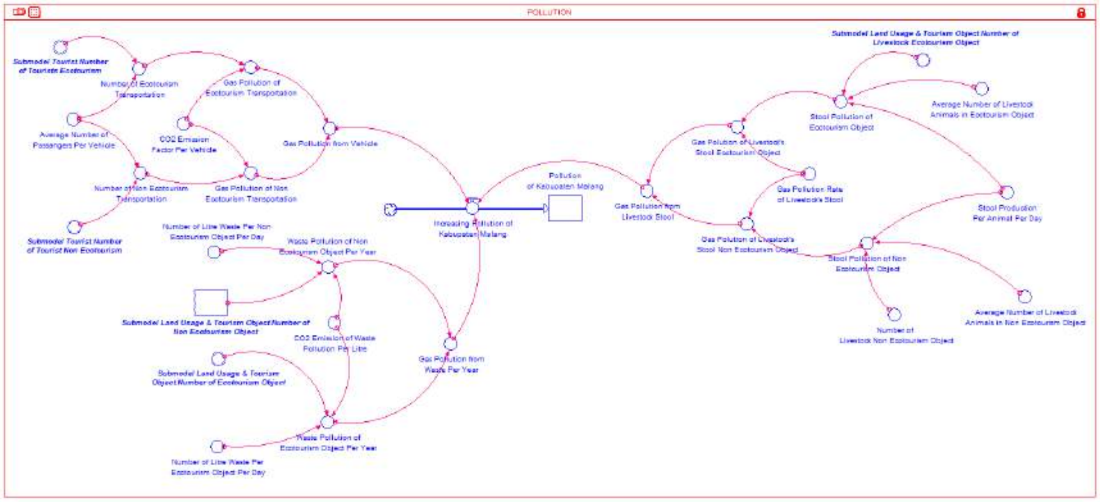


Figure 4.7 Stock and Flow Diagram of Sub model Gas Pollution

4.3.5 Sub model Tourist

This sub model shows number of tourists visit per year and come from effort of tourism object's promotion in Kabupaten Malang. The tourism promotion planned by government in some promotion activities will invite some tourists. Number of tourists per year will be divided into ecotourism and non ecotourism tourists. Figure 4.8 shows sub model number of tourists to develop livestock ecotourism in Kabupaten Malang.

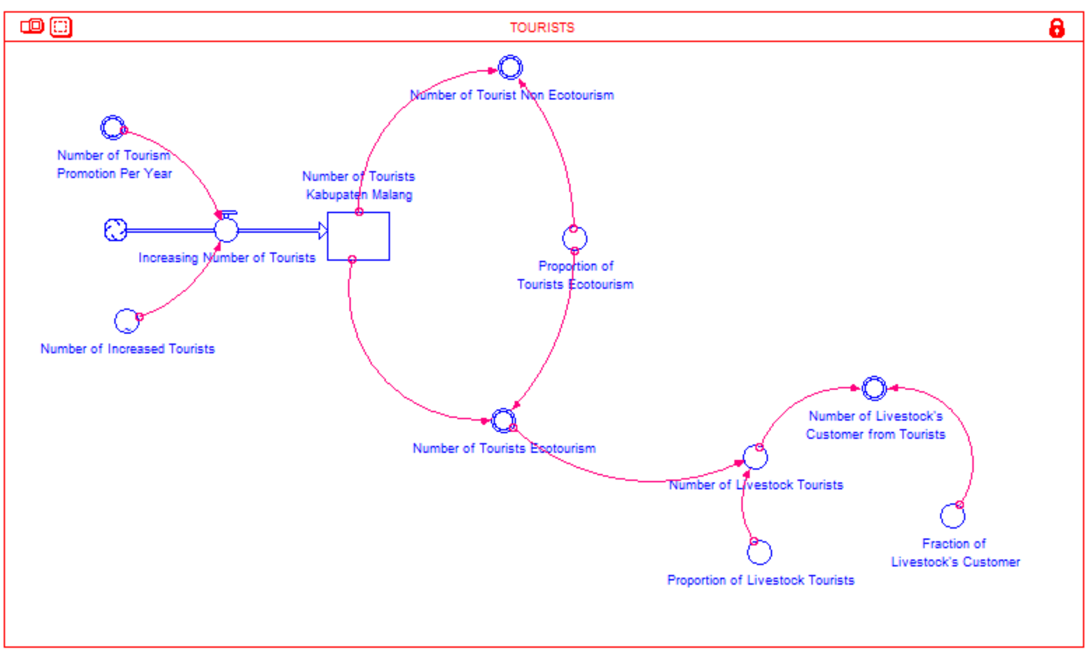


Figure 4. 8 Stock and Flow Diagram of Sub model Tourists

4.3.6 Sub model Budget Allocation

Sub model budget allocation of Kabupaten Malang is used to develop tourism and livestock sector. Budget allocation in this model is limited for two sectors, which are tourism and agriculture sector especially in livestock. Budget allocation for tourism sector is used to fund the tourism object and ecotourism development. Budget for two torism objects are based on cost of tourism promotion for marketing so that it can increase the number of tourists. Tourism sector generates Own Source Revenue as the output of tourism activity and then to be the input of Budget Allocation. So, there is financial turnover there.

Budget allocation for agriculture sector is generated from proportion of government's cost to increase productivity of each agriculture's subsectors. One of them is livestock's productivity and then it can also generate budget allocation of livestock. Livestock productivity is generated by multiplying activities to increase productivity with ratio of increasing productivity. While the number of activities are generated from division of budget and cost per activity in increasing productivity program. Figure 4.9 shows sub model of budget allocation to develop livestock ecotourism in Kabupaten Malang.

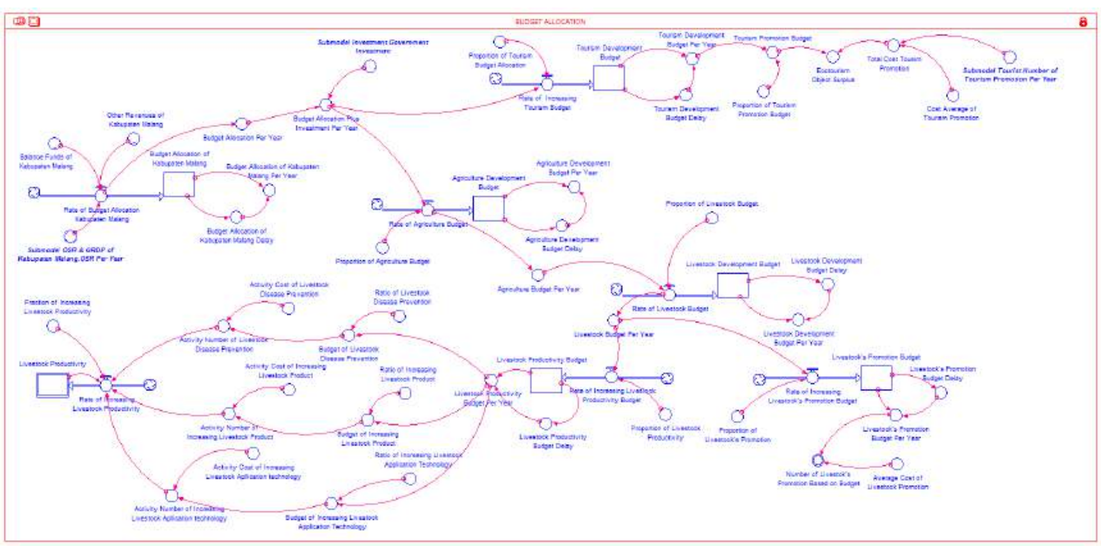


Figure 4.9 Stock and Flow Diagram of Sub model Budget Allocation

4.3.7 Sub model GRDP of Livestock

This sub model shows livestock revenue get by production of livestock's products which is then sold and to be a revenue of livestock. Production of livestock's products generated by multiplying productivity of livestock with land area of livestock. Then, number of livestock's will decrease caused by sales of products. It is generated from consumption of livestock's product per capita per year multiplied with number of population and tourists who will purchase livestock's products in tourism object. Table 4.10 shows sub model GRDP of livestock to develop livestock ecotourism in Kabupaten Malang.

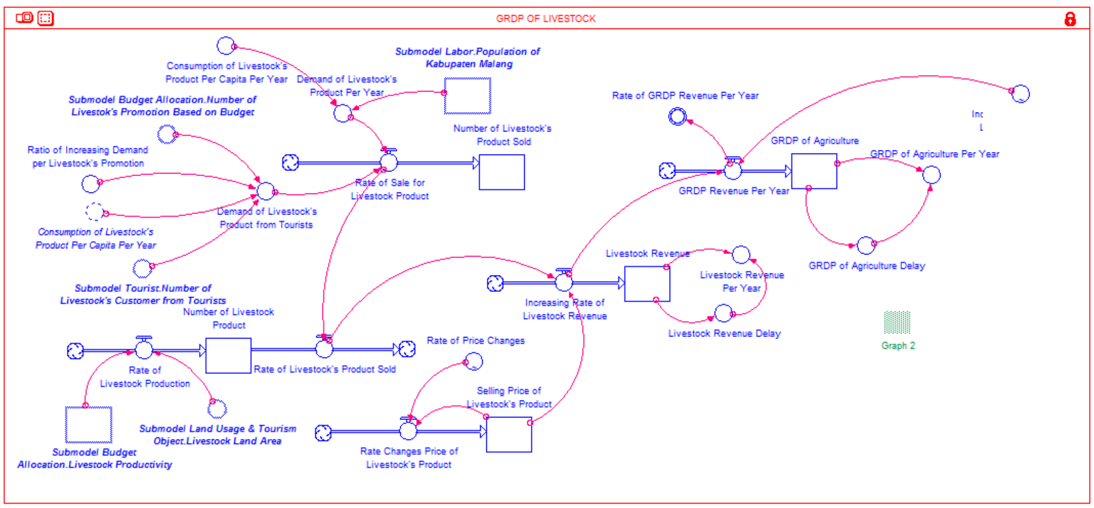


Figure 4.10 Stock and Flow Diagram of Sub model GRDP of Livestock

4.3.8 Sub model Investment

This sub model shows number of investment that must be paid by government. Every ecotourism of each sub sector have different investment. Total investment is generated from determining the number of ecotourism object that will be built and multiplied it with investment cost of ecotourism. However, investment cost of existing ecotourism is not counted because the investment cost is out of time horizon in simulation.

Total investment is calculated based on total ecotourism's investment, total non ecotourism's investment and total investment of other sectors. Then, total investment becomes government investment. Figure 4.11 shows sub model investment to develop livestock ecotourism in Kabupaten Malang.

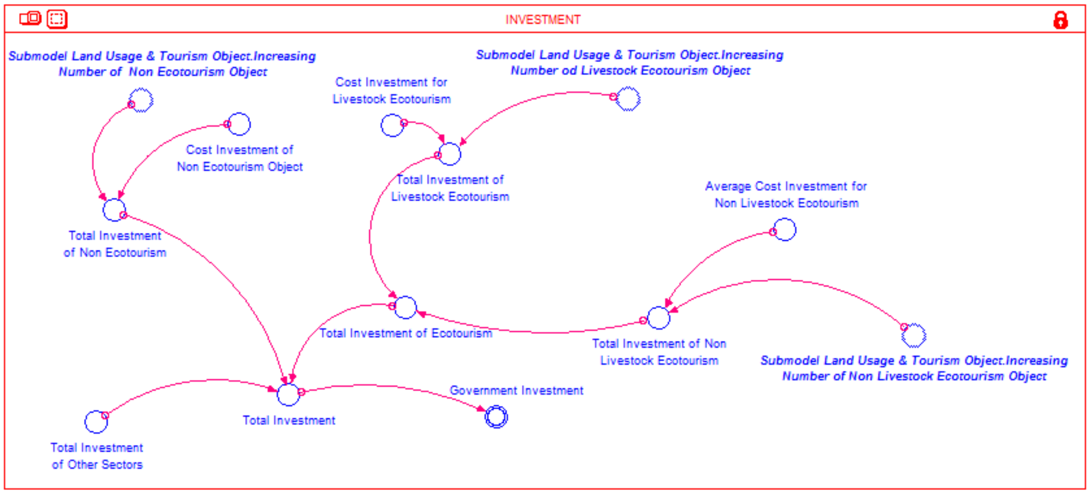


Figure 4.11 Stock and Flow Diagram of Sub model Investment

4.3.9 Sub model OSR and GRDP

This sub model shows how to generate OSR and GRDP of Kabupaten Malang. Measurement of regional economy is calculated by acquisition of tax revenue and regional retribution which is limited for property and entertainment tax. Then, it is added by other components OSR to get OSR of Kabupaten Malang.

While measurement of regional economy to calculate the revenue of livestock is calculated by calculating GRDP of livestock from agriculture sector in Kabupaten Malang. Then, GRDP of agriculture will be summed with other GRDP of other sectors and get GRDP Kabupaten Malang. Figure 4.12 shows sub model OSR and GRDP Kabupaten Malang to develop livestock ecotourism in Kabupaten Malang.

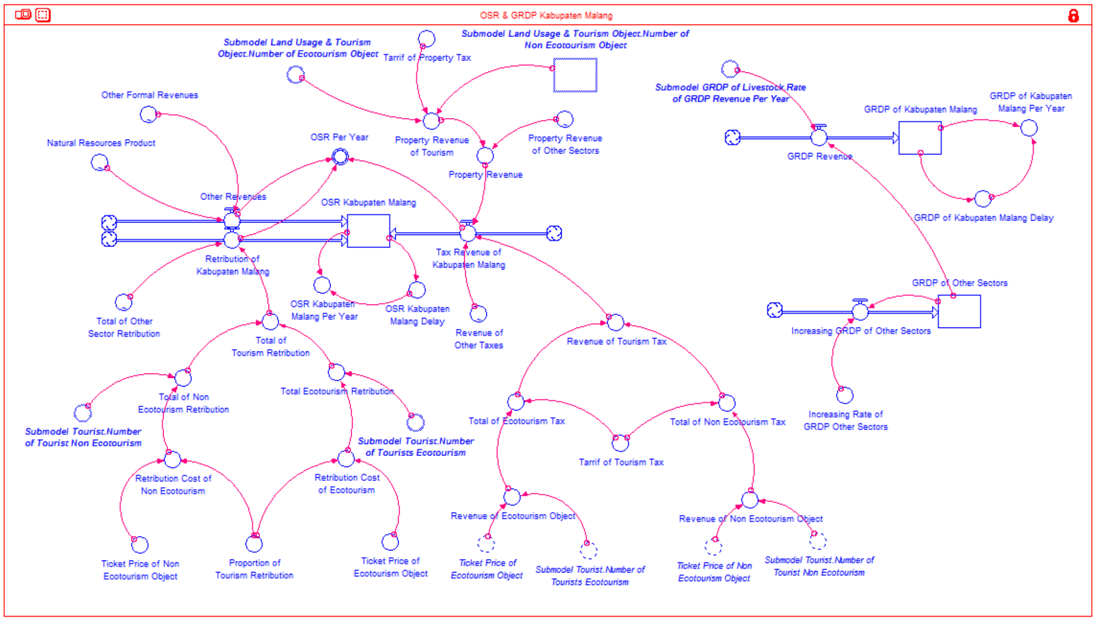


Figure 4.12 Stock and Flow Diagram of Sub model OSR and GRDP Kabupaten Malang

4.4 Verification and Validation

Verification and validation are conducted to ensure that the model can represent the real system. This step is conducted by using some mechanisms of model testing, which are model structural test, model output test, model parameter test, boundary adequacy test, extreme condition test, and model behavior test.

4.4.1 Model Verification

Model verification is the process of checking model in logic and systematically right, data used right and also ensuring consistency of expressions in model (Daellenbach & McNickle, 2005). The model simulation of system dynamics in development of livestock Kabupaten Malang is verified by checking equation and checking variable unit of model. Model simulation of this research has been verified and Figure 4.13 shows verification of unit model, Figure 4.14 shows verification of all models, and Figure 4.15 shows verification of model formulation.

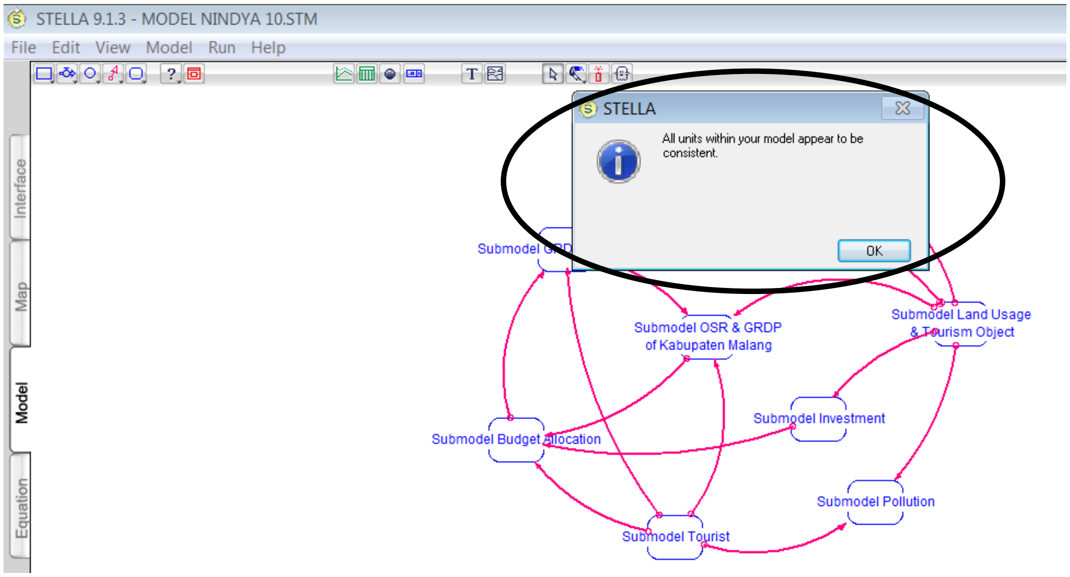


Figure 4.13 Verification of Unit Model

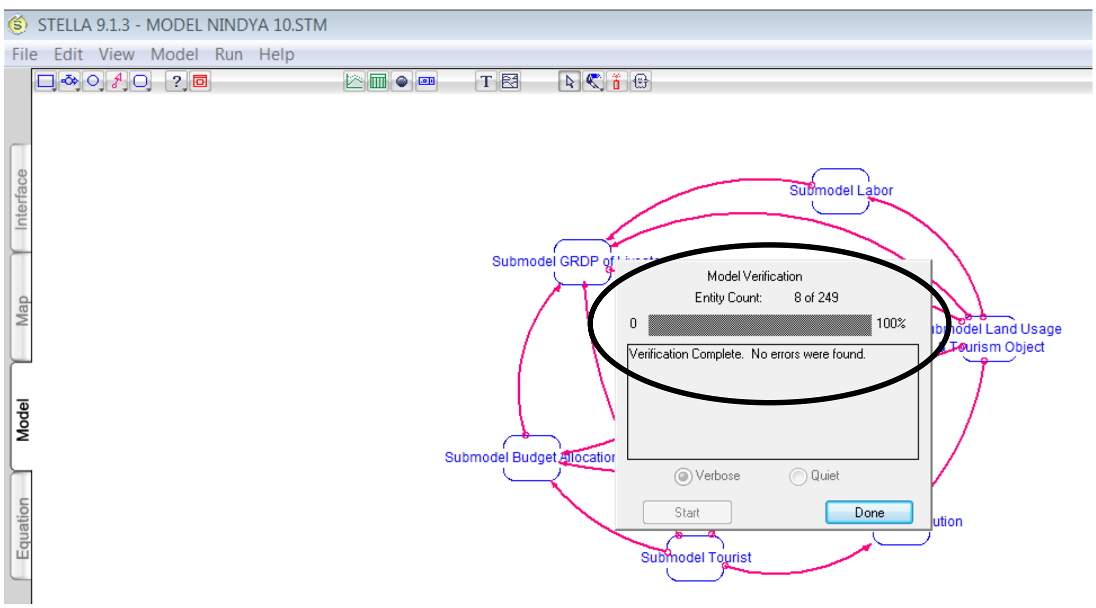


Figure 4.14 Verification of All Models

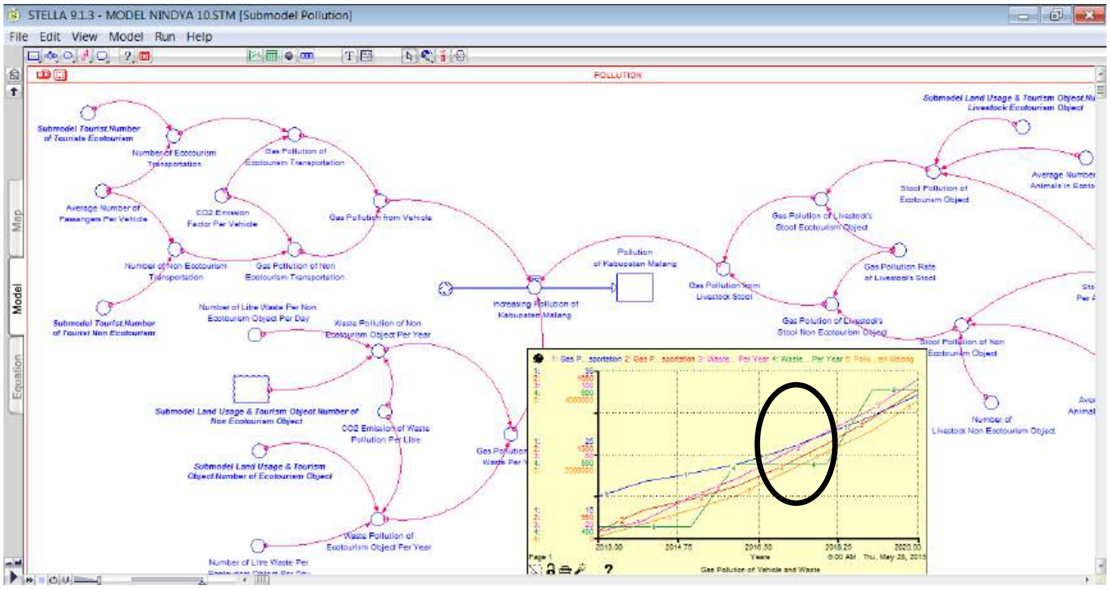


Figure 4.15 Verification of Model Formulation

4.4.2 Model Validation

Model validation is the process of testing the model represents on real condition of system or not (Daellenbach & McNickle, 2005). Model validation can be conducted by using two methods, which are white box and black box. White box method is conducted by inserting all variables and relationship between variables generated from literature and related stakeholder. While black box method is conducted by comparing average actual result to average simulation result. Series of model testing is conducted below to ensure validity of developed model.

1. Model Structure Test

Model structure test is a test which is conducted to measure how imitate structure of model simulation and real model. Validity of model structure is conducted by model development based on supporting literature of similar method or problem of ecotourism development in other regions. Besides, it is also based on group discussion or brainstorming with related stakeholder, which are Balitbang Kabupaten Malang, Dinas Pariwisata Kabupaten Malang and Dinas Peternakan Kabupaten Malang as the expert of the system.

Literature of development livestock ecotourism model is get from some journals and data from statistics of Kabupaten Malang as the input formulation of simulation model. Besides, it is get from related SKPD Kabupaten Malang like Dinas

Peternakan and Pariwisata Kabupaten Malang. Validity of model structure is based on discussion with Balitbang Kabupaten Malang, Focus Group Discussion (FGD), and question answer session with Balitbang Kabupaten Malang related with development system of livestock ecotourism in Kabupaten Malang.

2. Model Parameter Test

Model parameter test is a test to know consistency of parameter value in simulation model. Model parameter test can be conducted by validating logic of variables in model. Relationship between variables that has been described in causal loop diagram before will be tested by using graph of model simulation. Figure 4.16 below shows parameter test of each model.

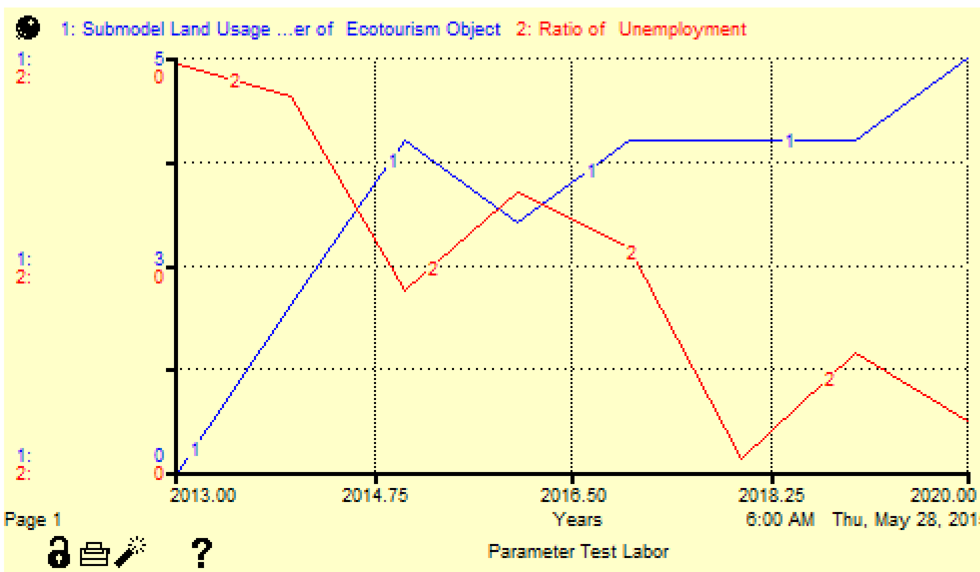


Figure 4.16 Parameter Test of Sub model Labor

Figure 4.16 shows that number of ecotourism object is inversely proportional with ratio of unemployment. If there is increasing in the number of ecotourism object, it will decrease the ratio of unemployment in Kabupaten Malang.

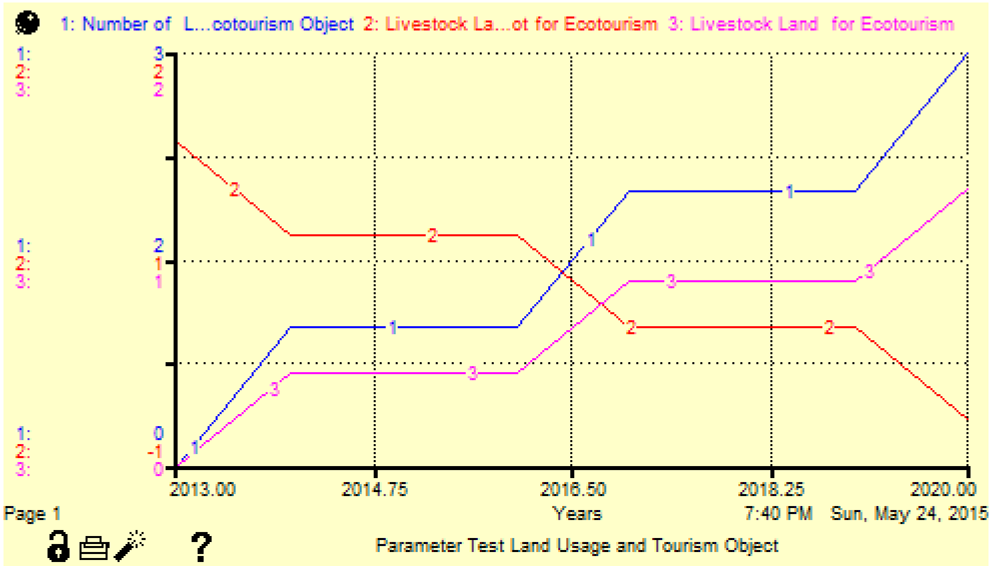


Figure 4.17 Parameter Test of Sub model Land Usage and Tourism Object

Figure 4.17 shows that number of livestock's ecotourism object is directly proportional with livestock's land area for ecotourism, but it is inversely proportional with livestock's land are not for ecotourism. If there is increasing number of livestock's ecotourism object, it will increase also increase total area of livestock for ecotourism. In other hand, it will decrease total area of livestock not for ecotourism.

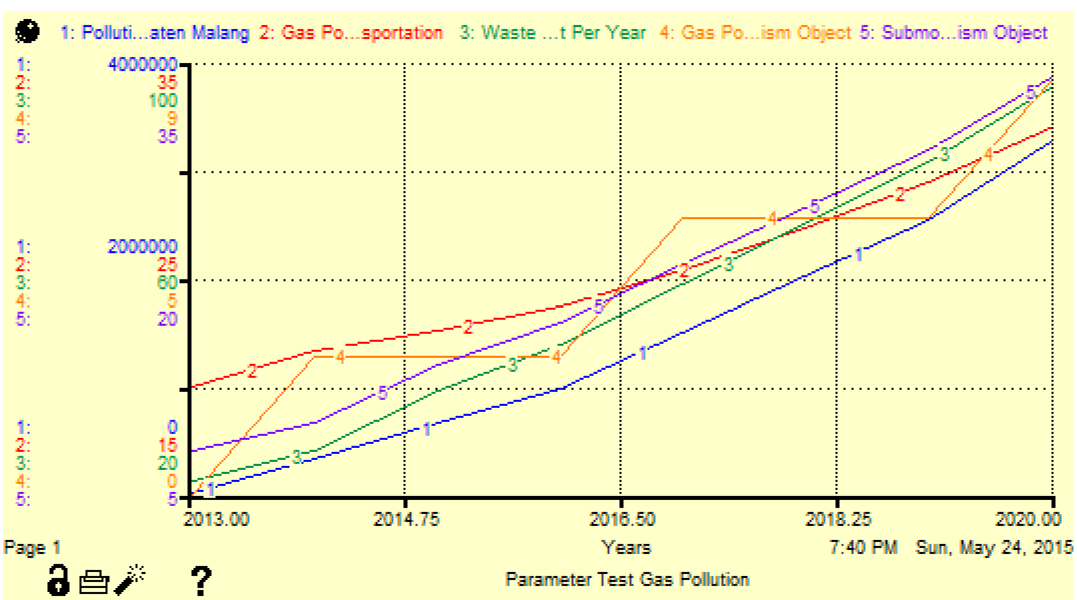


Figure 4.18 Parameter Test of Gas Pollution

Figure 4.18 shows that number of ecotourism object is directly proportional with gas pollution from transportation, waste, livestock's stool, and pollution of Kabupaten Malang. If there is increasing number of ecotourism object, gas pollution from transportation, waste, and livestock's stool will be also increased. Then, it will also increase total gas pollution of Kabupaten Malang.

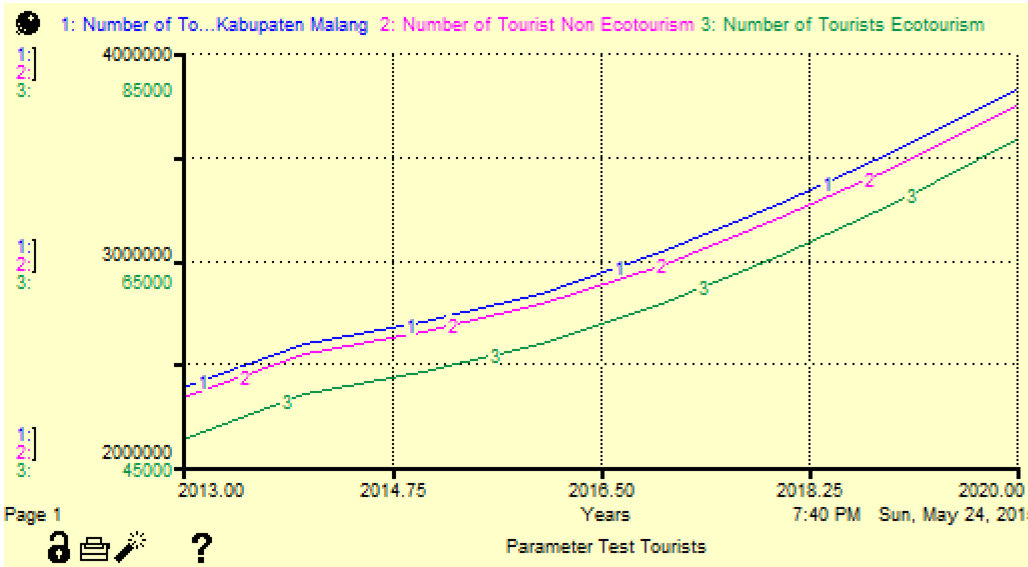


Figure 4.19 Parameter Test of Tourists

Figure 4.19 shows that number of tourist ecotourism and non ecotourism are directly proportional with number of tourist Kabupaten Malang. If the number of tourism ecotourism and non ecotourism is increased, it will also increase the number of tourist Kabupaten Malang.

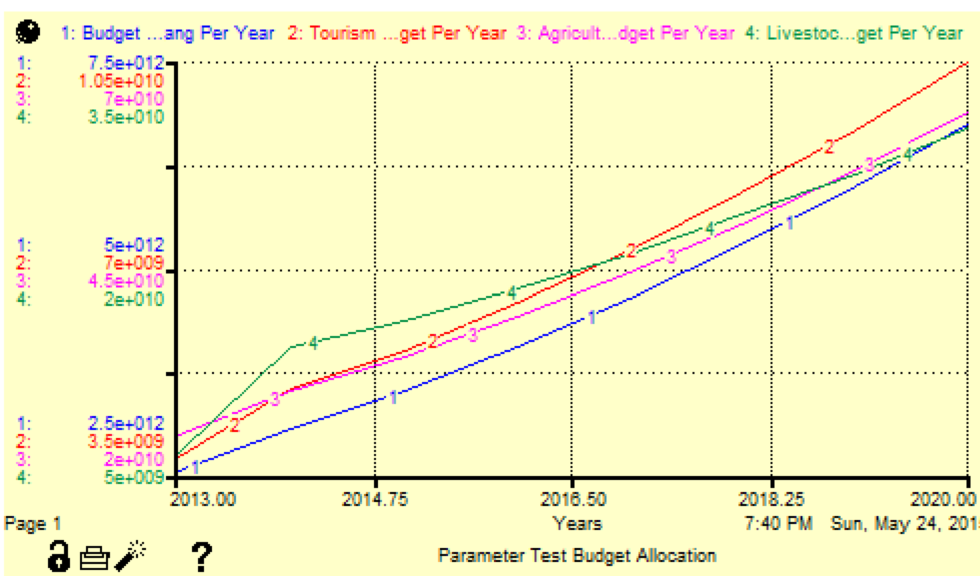


Figure 4.20 Parameter Test of Sub model Budget Allocation

Figure 4.20 shows that tourism, agriculture, and livestock budget are directly proportional with budget allocation of Kabupaten Malang. If budget allocation of

Kabupaten Malang is increased, it will also increase the budget of tourism, agriculture and livestock.

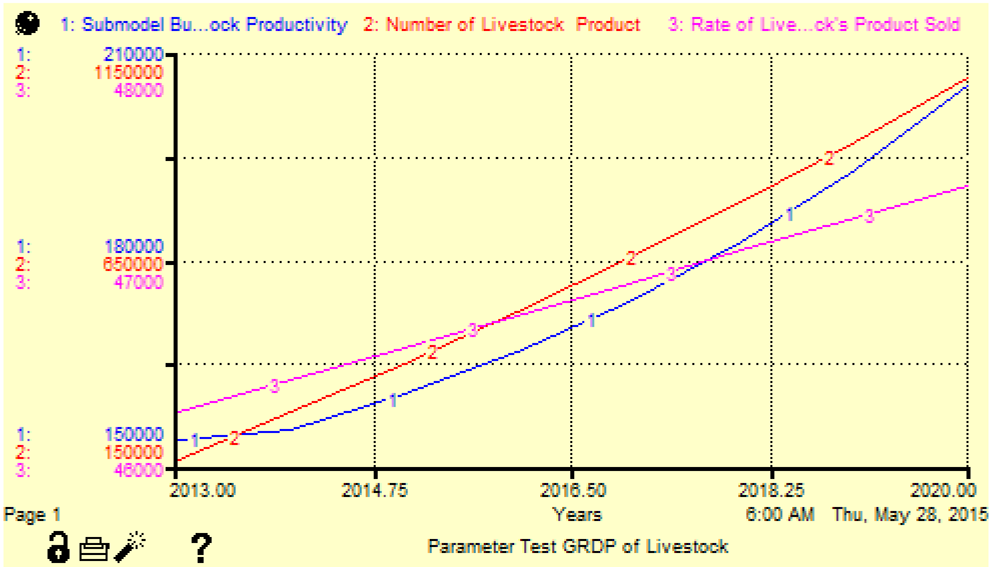


Figure 4.21 Parameter Test of Sub model Livestock's GRDP

Figure 4.21 shows that livestock's productivity is directly proportional with number of livestock product and rate of livestock's product sold. If livestock's productivity is increased, it will increase the number of livestock's product. Then the number of livestock's product will also increase rate of livestock's product sold.

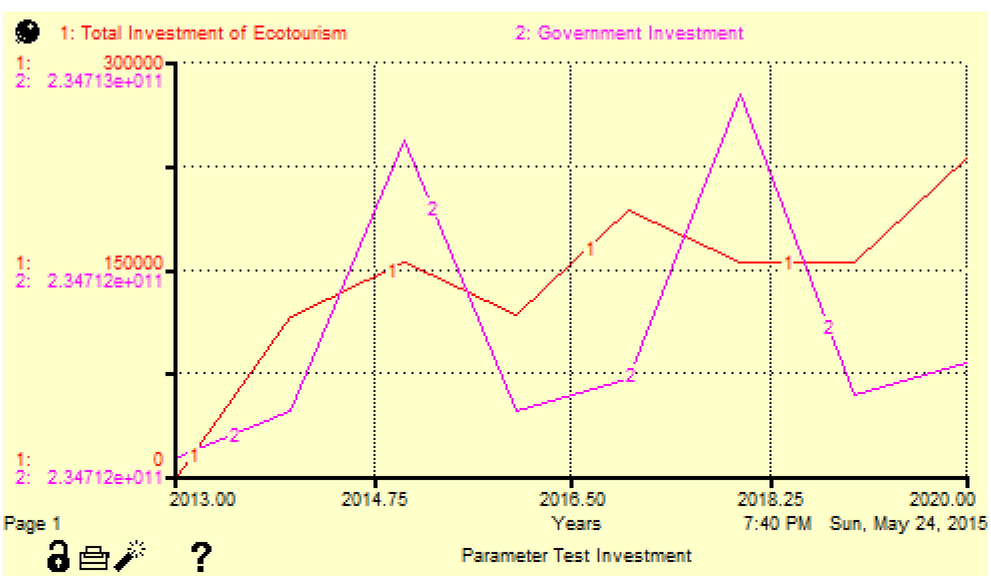


Figure 4.22 Parameter Test of Sub model Investment

Figure 4.22 shows that total investment of ecotourism is directly proportional with government investment. If total investment of ecotourism is increased, government investment is also increased.

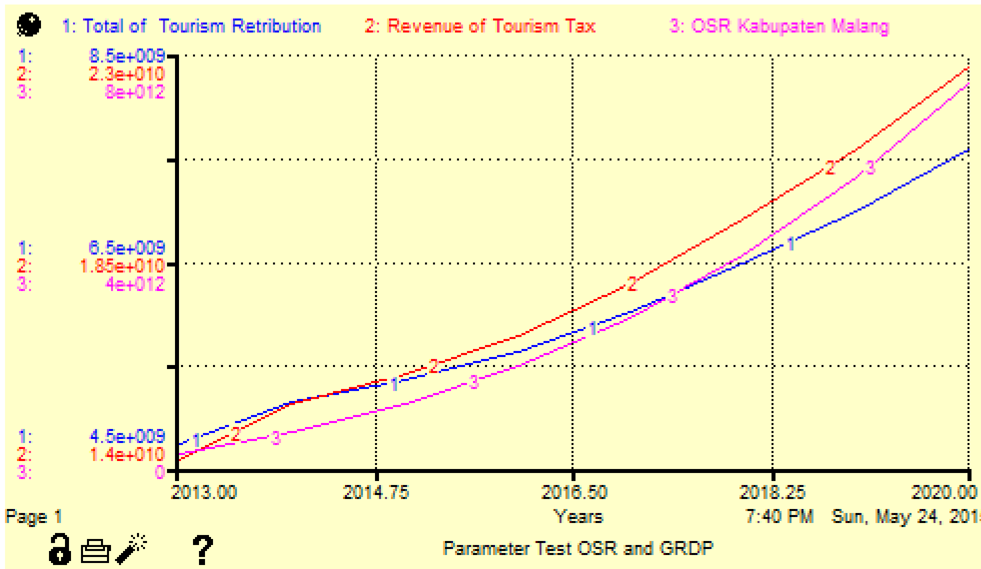


Figure 4.23 Parameter Test of Sub model OSR and GRDP

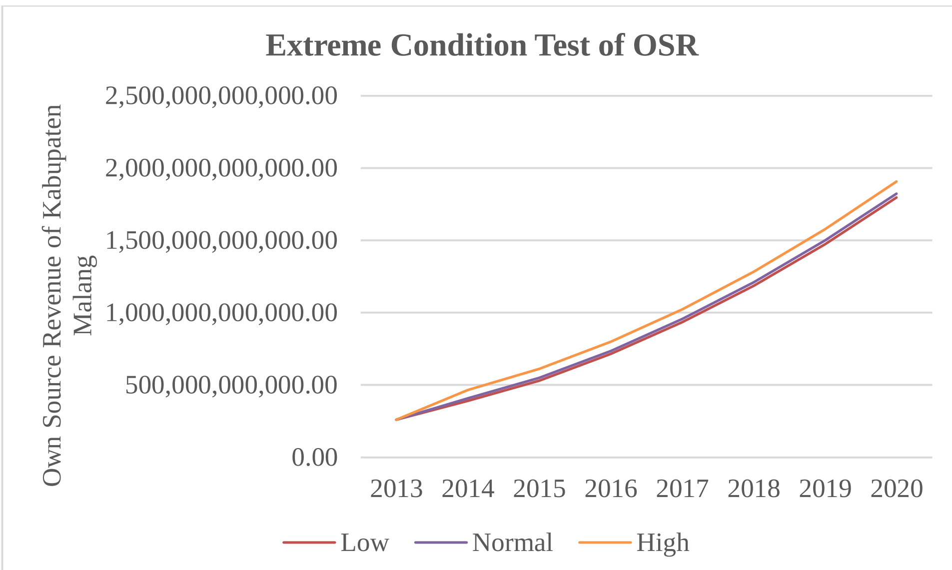
Figure 4.23 shows that tourism retribution and tax are directly increased with own source revenue of Kabupaten Malang. If the revenue of tourism retribution and tax are increased, OSR of Kabupaten Malang is also increased.

3. Boundary Adequacy Test

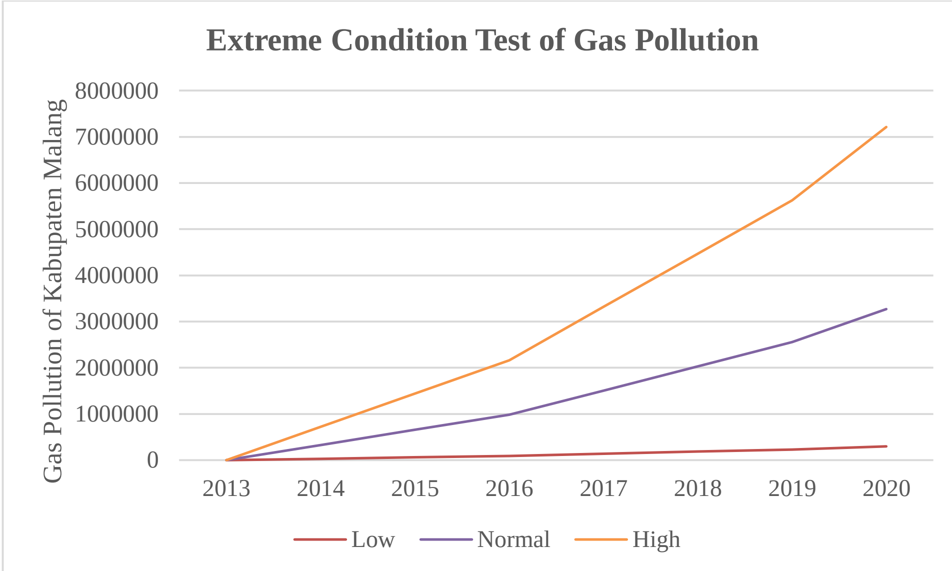
Boundary adequacy test is used to test the boundary adequacy of simulation model of the objective. Objective of this research is to generate scenario for livestock ecotourism development in Kabupaten Malang and see the impact on gas pollution, own source revenue, and gross regional domestic product of Kabupaten Malang. Boundary adequacy test depends on causal loop diagram which the system will have own limitation. This step is conducted on modeling the system by testing some variables and the result is not significantly influenced.

4. Extreme Condition Test

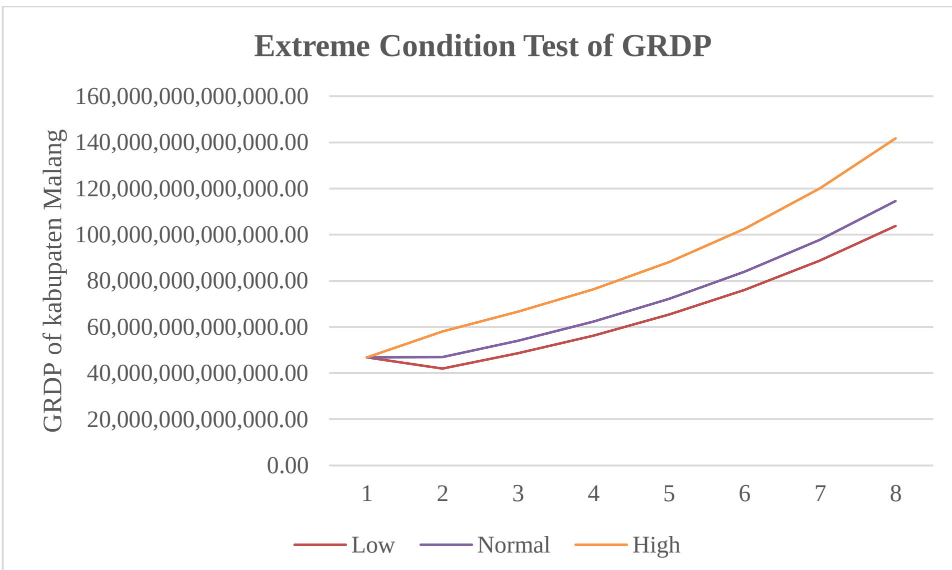
Extreme condition test is conducted to test model's ability on extreme condition. The extreme condition is change of variable value into high and low extreme. Controlled variable is system variable that can be controlled and measured. Model performance will be visible by inputting extreme values. If extreme condition model still gives appropriate and logical result, so model is valid. Conversely, if the result is not logic, so it can be concluded that there is error maybe in the structural or parameter value of model. Extreme condition test is conducted on Sub model OSR and GRDP and Sub model Gas Pollution. Variables that will be controlled to see the respond of OSR Kabupaten Malang are consisted of proportion of tourism retribution and tariff of tourism tax. Variables that will be controlled to see the respond of Gas Pollution Kabupaten Malang are consisted of number of livestock ecotourism object and number of tourism promotion. While, variables that will be controlled to see the respond of GRDP Kabupaten Malang are consisted of proportion budget allocation of agriculture, livestock, livestock's productivity, and livestock's promotion.



a. Own Source Revenue



b. Gas Pollution



c. Gross Regional Domestic Product

Figure 4.24 Extreme Condition Test

Extreme test is conducted by inputting normal value, low extreme, and high extreme. Performance of model can be seen by inputting extreme values. Figure 4.24 shows that each sub model still shows same pattern between input normal value and extreme value. So, it can be concluded that model has function based on goal logic of research and model is valid.

5. Model Behavior Test

Behavior Test is conducted to know how the behavior of model same with behavior of actual condition. This test is conducted a number of replication on the output and compared to actual data (Barlas, 1996). Table 4.19 until 4.26 are the output of simulation and actual of some variables.

Table 4.19 Comparison between Actual Data and Simulation Data on Number of Tourists Kabupaten Malang

Period	Number of Tourists Actual	Number of Tourists Simulation
2009	1,879,884	1,879,884
2010	1,942,253	1,954,643
2011	2,111,805	2,034,695
2012	2,177,560	2,157,407
2013	2,384,478	2,327,001

Table 4.20 Comparison between Actual Data and Simulation Data on Budget Allocation of Kabupaten Malang

Period	Budget Allocation Actual	Budget Allocation Simulation
2009	1,427,167,882,057.99	1,427,167,882,058.00
2010	1,665,125,923,961.92	1,661,895,809,862.00
2011	1,950,582,284,844.86	1,946,551,915,908.25
2012	2,218,403,705,873.55	2,216,419,862,578.01
2013	2,528,001,233,010.00	2,525,581,627,694.00

Table 4.21 Comparison between Actual Data and Simulation Data on GRDP of Agriculture Kabupaten Malang

Period	GRDP Agriculture Actual	GRDP Agriculture Simulation
2009	7,979,506,960,000	7,979,506,960,000.00
2010	8,621,802,450,000	8,658,706,522,010.63
2011	9,382,923,980,000	9,362,482,216,186.89
2012	10,331,892,170,000	10,235,031,758,173.70
2013	11,445,404,000,000	11,062,300,186,599.60

Table 4.22 Comparison between Actual Data and Simulation Data on GRDP of Livestock Kabupaten Malang

Period	GRDP Livestock Actual	GRDP Livestock Simulation
2009	1,130,770,320,000	1,130,770,320,000.00
2010	1,452,642,010,000	1,489,546,522,010.63
2011	1,616,645,290,000	1,596,202,216,186.89
2012	1,807,247,770,000	1,710,391,758,173.72
2013	2,173,008,000,000	1,832,760,186,599.66

Table 4.23 Comparison between Actual Data and Simulation Data of Retribution in Kabupaten Malang

Period	Retribution Actual	Retribution Simulation
2009	24,512,496,389.00	24,512,496,389.00
2010	29,861,750,121.01	29,762,790,537.00
2011	37,145,935,538.45	36,958,498,234.00
2012	42,775,834,434.95	42,159,941,291.00
2013	45,314,153,760.00	44,773,666,296.00

Table 4.24 Comparison between Actual Data and Simulation Data of Tax Revenue in Kabupaten Malang

Period	Tax Revenue Actual	Tax Revenue Simulation
2009	33,782,874,886	31,945,116,326.00
2010	39,362,653,309	36,823,591,497.00
2011	64,689,653,942	61,482,614,470.25
2012	71,301,888,447	70,903,939,255.01
2013	95,918,841,190	95,452,466,858.00

Table 4.25 Comparison between Actual Data and Simulation Data of GRDP in Kabupaten Malang

Period	GRDP of Kabupaten Malang Actual	GRDP of Kabupaten Malang Simulation
2009	27,754,389,820,000	27,754,389,820,000.00
2010	31,390,584,510,000	28,433,589,382,010.60
2011	35,674,997,970,000	32,499,095,162,386.80
2012	40,763,813,140,000	37,304,868,905,227.70
2013	46,830,737,760,000	42,734,009,648,652.80

Table 4.26 Comparison between Actual Data and Simulation Data of OSR in Kabupaten Malang

Period	OSR of Kabupaten Malang Actual	OSR of Kabupaten Malang Simulation
2009	153,526,441,537.99	153,526,441,538.00
2010	130,465,915,601.92	127,235,801,502.00
2011	172,333,335,999.86	168,302,967,063.25
2012	197,253,958,804.55	195,270,115,509.01
2013	260,582,631,310.00	258,163,025,994.00

Model behavior test is conducted by using statistic test on the output of simulation and actual. Statistic test uses hypothesis test with t-test expressed as follows:

H_0 = There is no difference between simulation and actual output

H_a = There is difference between simulation and actual output

Then, p-value that is generated by t-test is compared to significant level. The significant level used in this test is alpha (α) about 0.05. The calculation of p-value uses Minitab software and the result can be seen on Table 4.27.

Table 4.27 Recapitulation Result of p-value Each Variables

No.	Simulated Variable	p-value	Hypothesis Statement
1	Number of Tourists	0.817	Accept H_0
2	Budget Allocation of Kabupaten Malang	0.993	Accept H_0
3	GRDP of Agriculture Kabupaten Malang	0.913	Accept H_0
4	GRDP of Livestock Kabupaten Malang	0.701	Accept H_0
5	Regional Retribution	0.959	Accept H_0
6	Tax Revenue	0.919	Accept H_0
7	GRDP of Kabupaten Malang	0.551	Accept H_0
8	OSR of Kabupaten Malang	0.943	Accept H_0

Based on the calculation of p-value above, it can be known that p-value of each variables are greater than alpha value. So, the result of hypothesis test is accepted H_0. It can be concluded that there is no difference between simulation and actual output on livestock ecotourism development in Kabupaten Malang.

4.5 Model Simulation

Simulation on the valid model is conducted in this model to get behavior description or projection of variable outputs in the system. Simulation model is run in time period of 2013 to 2020. This timing is based on implementation of MP3EI (Masterplan Percepatan dan Perluasan Pembangunan Ekonomi Indonesia) which is implemented in 2011-2025. RPJPD (Rencana Pembangunan Jangka Panjang Daerah) Kabupaten Malang in 2005-2025 is also used to be one of consideration on the timing because 2010-2015 is the second part of development. Besides, the time period is adapted to work period of Bupati Malang as the leader in Kabupaten Malang, which is for five years. 2013 is selected as the initial period in this simulation because the limitation of data availability. Simulation is conducted in unit of year based on performance measurement or regional finance that is quantified every year.

4.5.1 Sub Model Labor

Sub model labor is measured by number of population that is belong to be absorbed work force after motion of tourism object and labor force of other sectors. Besides, number of unemployment in Kabupaten Malang is conducted in this sub model. Number of unemployment is expected to decrease as rising of labor. Thus, it can generate ratio of unemployment in Kabupaten Malang.

It can be seen that ratio of unemployment is still fluctuate decreased based on number of unemployment. From the graph in Figure 4.25 also shows that number of population is directly proportional with number of unemployment in Kabupaten Malang.

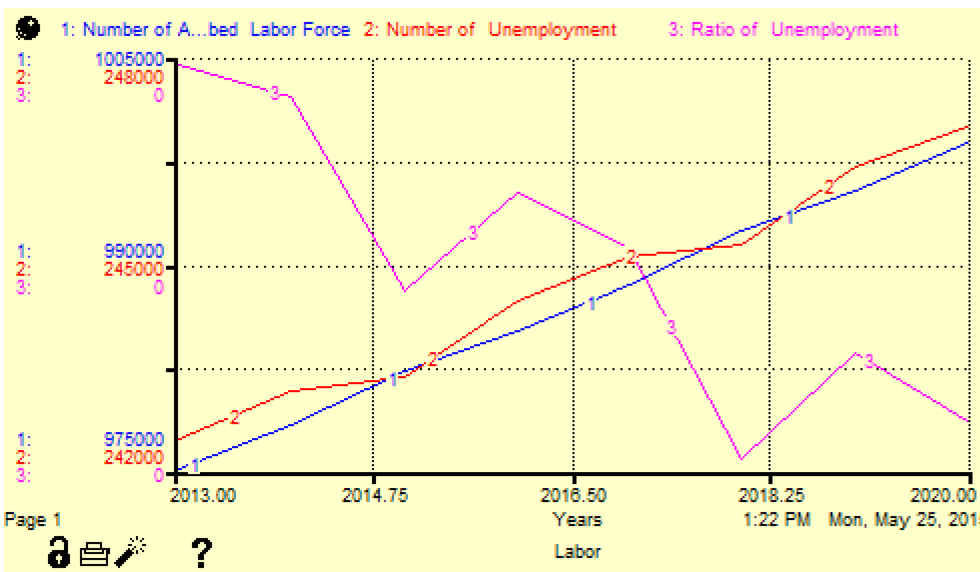


Figure 4.25 Simulation Graph of Labor

Notes:

1. Number of Absorbed Labor Force
2. Number of Unemployment
3. Ratio of Unemployment

4.5.2 Sub Model Land Usage and Tourism Object

Sub model division of land usage is used to know land area of livestock and also can be used for tourism. It directly correlates with number of ecotourism and non ecotourism object in the real system and also the increasing every year. The increasing of ecotourism object will increase also land usage of livestock for tourism. The real condition in Kabupaten Malang is zero livestock ecotourism object in 2013 and one livestock ecotourism object in 2014.

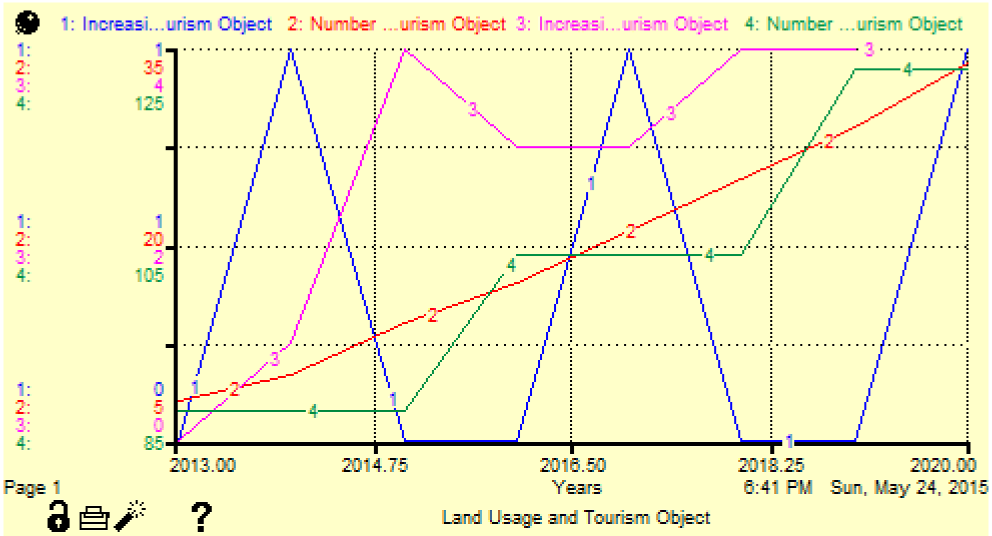


Figure 4.26 Simulation Graph of Land Usage and Tourism Object
Notes:
1. Increasing Number of Ecotourism Object
2. Number of Ecotourism Object
3. Increasing Number of Non Ecotourism Object
4. Number of Non Ecotourism Object

4.5.3 Sub Model Gas Pollution

This sub model is used to quantify gas pollution of Kabupaten Malang with the limitation of CO_2 emission from transportation and waste pollution from tourism object. Output of this sub model is number of CO_2 emission that is quantified as the total gas pollution caused by tourism activities. Figure 4.27 shows that total gas pollution in Kabupaten Malang is increasing steadily until 2020. It is caused by the limitation which is no reduction of pollution.

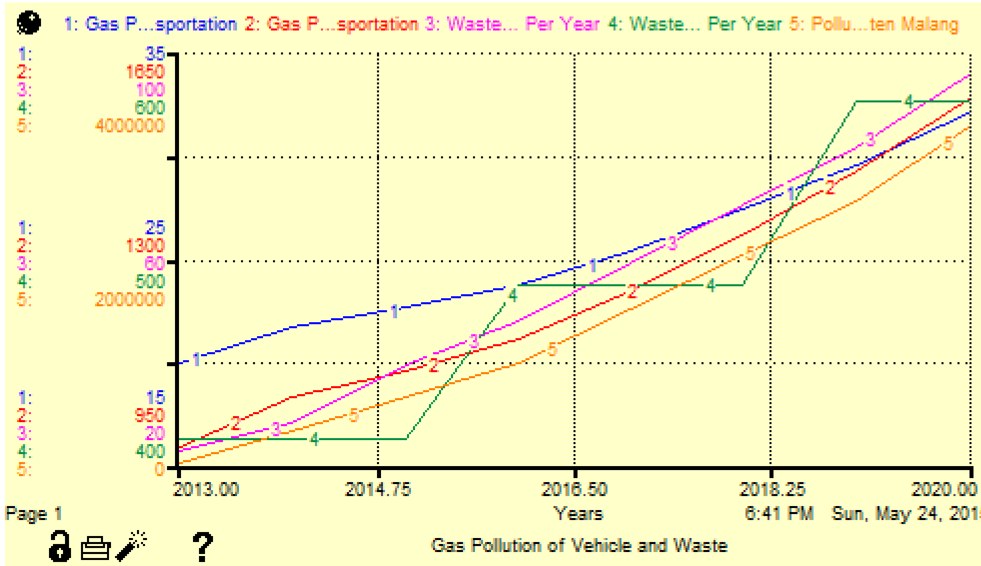


Figure 4.27 Simulation Graph of Gas Pollution from Vehicle and Waste

Note:

1. Gas Pollution of Transportation to Ecotourism Object
2. Gas Pollution of Transportation to Non Ecotourism Object
3. Gas Pollution of Waste in Ecotourism Object
4. Gas Pollution of Waste in Non Ecotourism Object
5. Gas Pollution of Kabupaten Malang

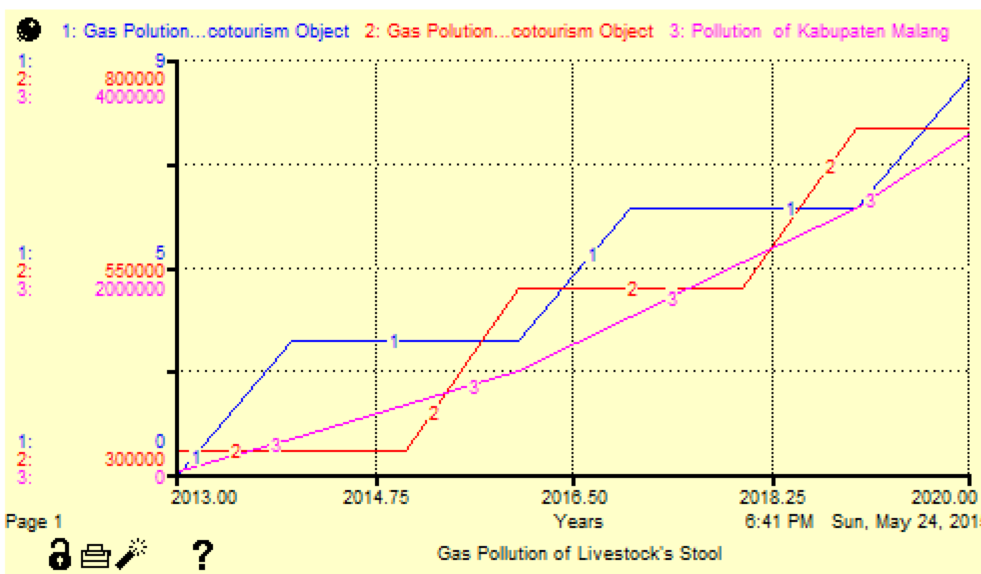


Figure 4. 28 Simulation Graph of Gas Pollution from Livestock's Stool

Notes:

1. Gas Pollution of Livestock’s Stool in Ecotourism Object
2. Gas Pollution of Livestock’s Stool in Non Ecotourism Object
3. Gas Pollution of Kabupaten Malang

4.5.4 Sub Model Tourists

This sub model is used to know number of tourists in Kabupaten Malang. Then, it will divided into tourists of non ecotourism and ecotourism. It directly relates to number of tourism object and ecotourism object that is influenced by promotion effort. Number of tourist ecotourism couldn't compete in existing number of ecotourism object. But, number of ecotourism and non ecotourism tourist continue to rise until 2020.

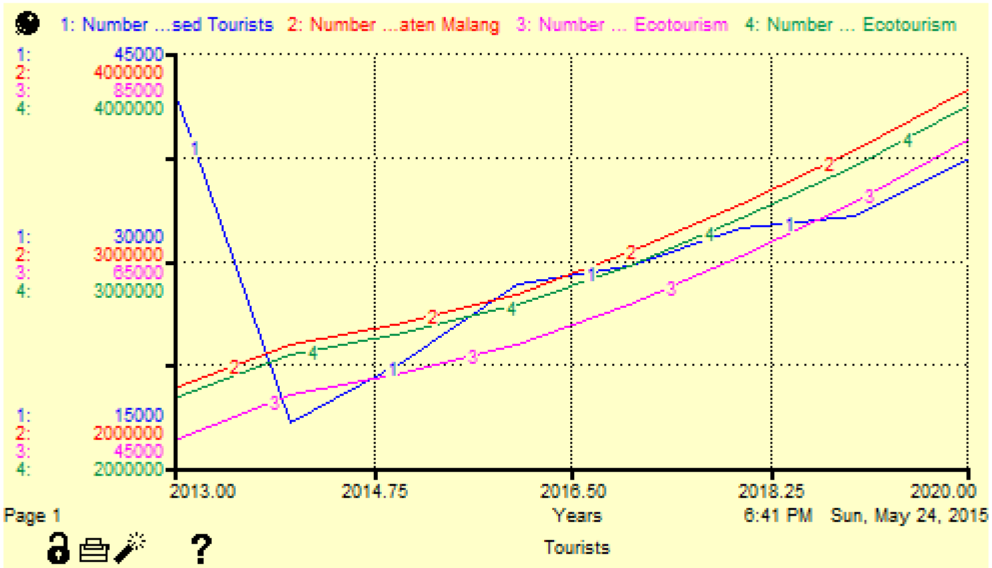


Figure 4.29 Simulation Graph of Tourists
Note:

1. Number of Increased Tourists
2. Number of Tourists in Kabupaten Malang
3. Number of Tourists Ecotourism
4. Number of Tourists Non Ecotourism

4.5.5 Sub Model Budget Allocation

This sub model is used to see budget allocation of Kabupaten Malang. It is limited by 2 sectors in this system, which are agriculture and tourism sectors. Then, there is specific sub sector in this system, which is livestock. There is increasing of budget allocation per year and increasing of own source revenue. Budget allocation for ecotourism development is used as ecotourism investment and promotion for existing tourism and ecotourism. Meanwhile, budget allocation for agriculture development is divided into subsectors and this system is only focused on livestock. Budget allocation for livestock development is used to increase productivity of livestock's land in Kabupaten Malang. The important outputs of this sub model are increasing land's productivity and increasing of purchase level from livestock's promotion. Figure 4.30 shows that proportion of budget allocation for tourism and agriculture especially livestock are increased per year. Likewise, Figure 4.31 shows that livestock's productivity in Ton/Ha increases until 2020.

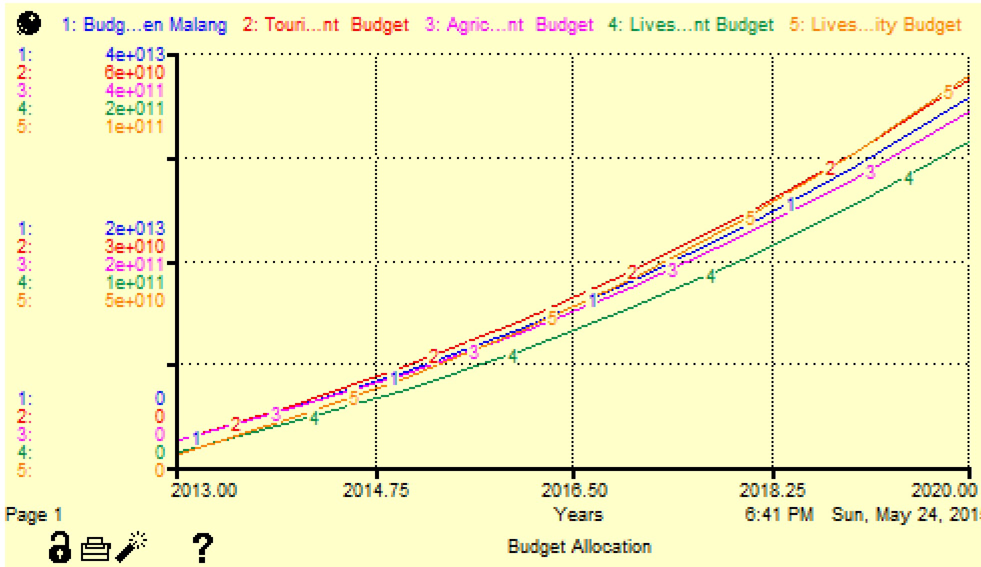


Figure 4.30 Simulation Graph of Budget Allocation

Notes:

1. Budget Allocation of Kabupaten Malang
2. Tourism Development Budget Per Year
3. Agriculture Development Budget Per Year
4. Livestock Development Budget Per Year
5. Livestock Productivity Budget Per Year

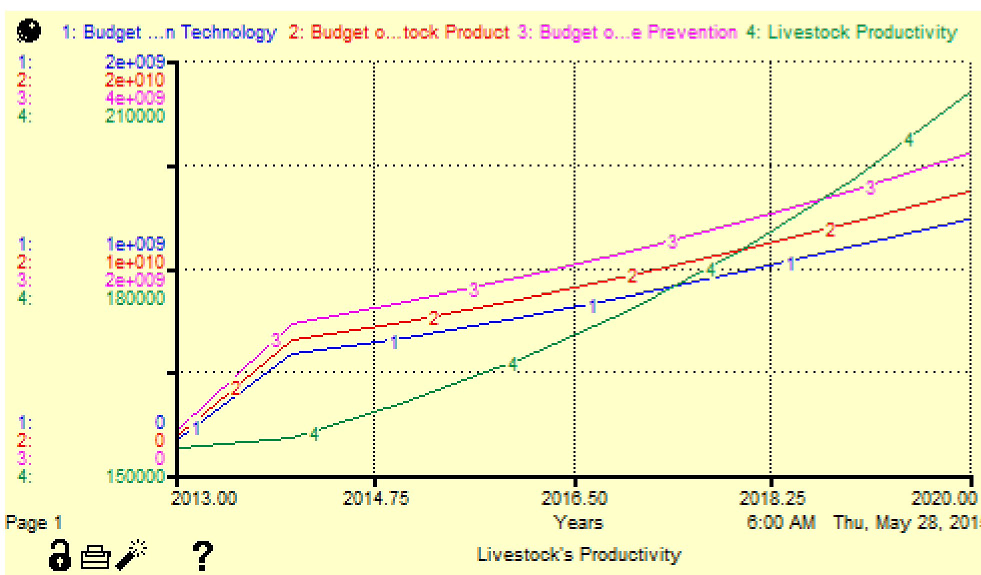


Figure 4.31 Simulation Graph of Livestock's Productivity

Notes:

1. Budget of Increasing Livestock Application Technology
2. Budget of Increasing Livestock Product
3. Budget of Livestock Disease Prevention
4. Livestock's Productivity

4.5.6 Sub Model GRDP of Livestock

This sub model is used to know revenue of Livestock's GRDP. The revenue of livestock relates to productivity, selling rate, selling price of livestock's products. Figure 4.32 shows that livestock's revenue will increase until 2020.

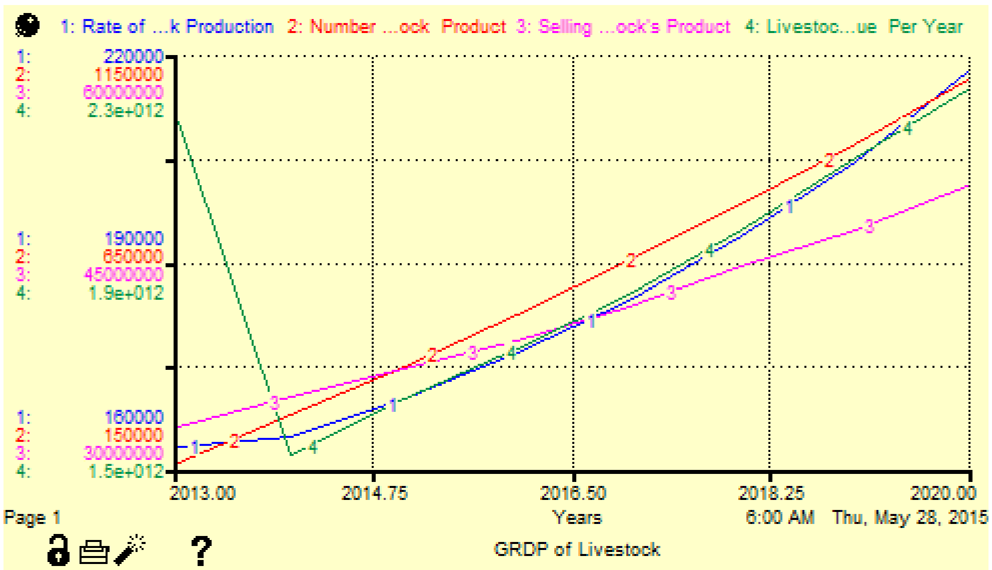


Figure 4.32 Simulation Graph of GDRP Livestock

Notes:

1. Rate of Livestock Production
2. Number of Livestock Product
3. Selling Price of Livestock's Product
4. Livestock Revenue Per Year

4.5.7 Sub Model Investment

Sub model investment is used to know total of government investment needed for tourism investment and other sector's investment. Figure 4.33 shows that government investment is total investment. It is generated by total investment of ecotourism object and other sectors. The number of existing livestock's ecotourism object is one in 2014 and it will increase an object per 3 years, so it will generate total investment.

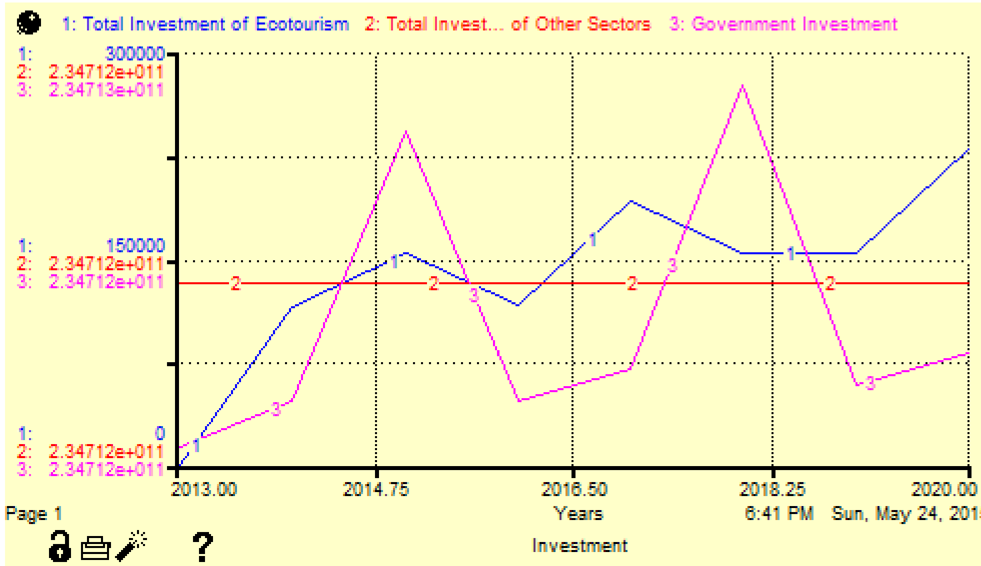


Figure 4.33 Simulation Graph of Investment

Notes:

1. Total Investment of Ecotourism
2. Total Investment of Other Sectors
3. Government Investment

4.5.8 Sub Model OSR and GRDP of Kabupaten Malang

This sub model is used to see economy of Kabupaten Malang from two sectors, which are tourism and agriculture especially in livestock. Figure 4.36 shows that revenue of tourism sector will increase until 2020 and it is quantified by using OSR. The increasing of OSR directly relates to tax and retribution. Figure 4.35 shows that revenue of tourism tax will increase until 2020. It is generated from number of existing and ecotourism object. Meanwhile, Figure 4.34 shows that revenue of tourism retribution will increase until 2020. It relates to number of ecotourism and non ecotourism tourist. Agriculture sector is quantified by revenue of livestock and other subsectors. Figure 4.37 shows that GRDP of agriculture and other sectors and it can be concluded that GRDP of Kabupaten Malang will increase until 2020 by developing livestock's ecotourism.

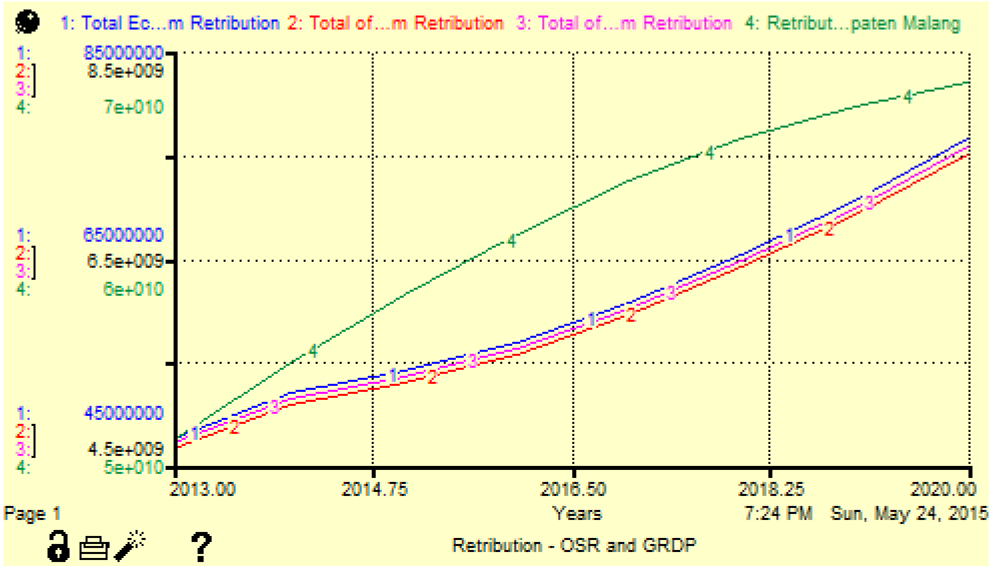


Figure 4.34 Simulation Graph of Retribution in Sub model OSR and GRDP

Notes:

1. Total of Ecotourism Object Retribution
2. Total of Non Ecotourism Object Retribution
3. Total of Tourism Retribution
4. Retribution Revenue of Kabupaten Malang

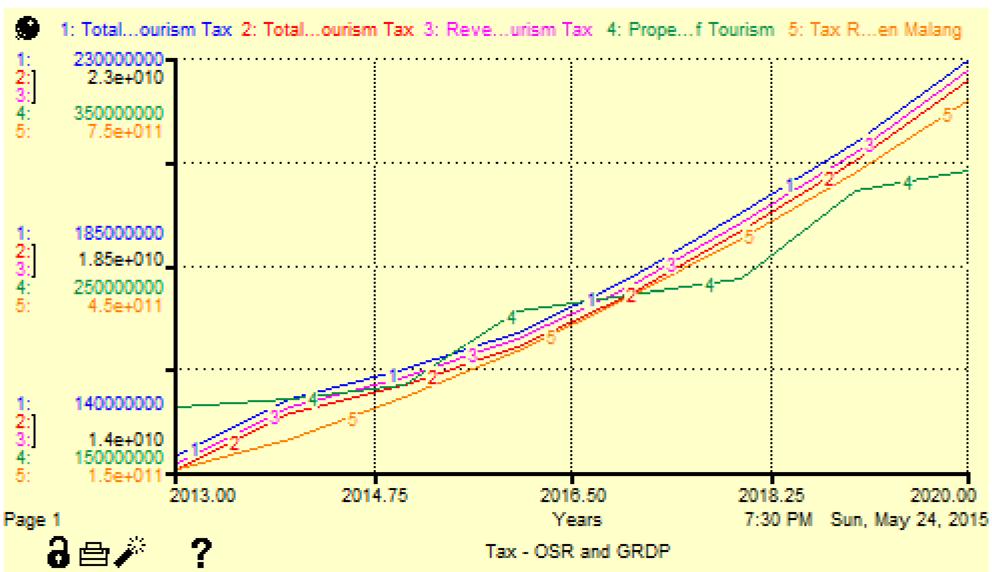


Figure 4.35 Simulation Graph of Tax in Sub model OSR and GRDP

Notes:

1. Total of Ecotourism Tax
2. Total of Non Ecotourism Tax
3. Revenue of Tourism Tax
4. Property Tax Revenue of Tourism
5. Tax Revenue of Kabupaten Malang

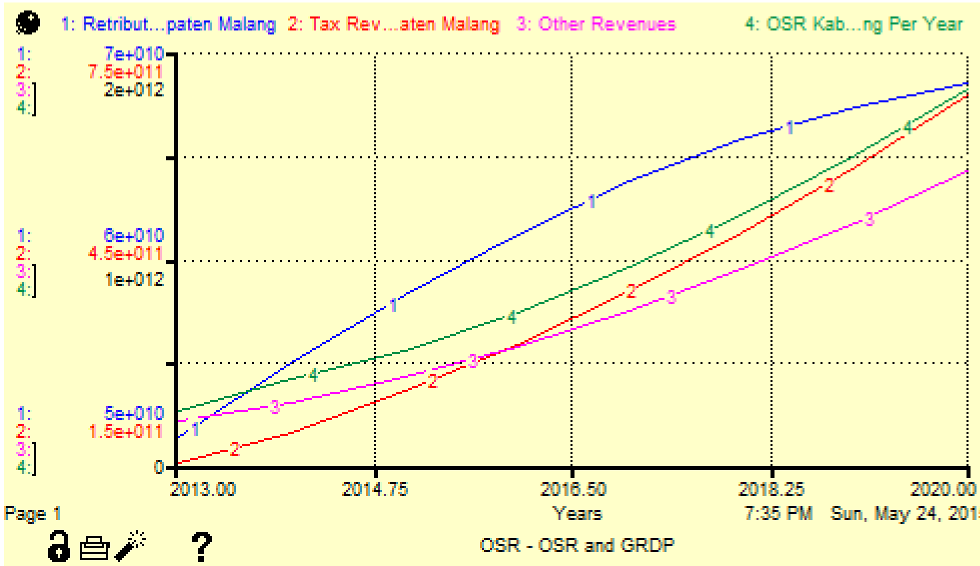


Figure 4.36 Simulation Graph of OSR in Sub model OSR and GRDP
Notes:
1. Retribution of Kabupaten Malang
2. Tax Revenue of Kabupaten Malang
3. Other Revenues
4. OSR Kabupaten Malang Per Year

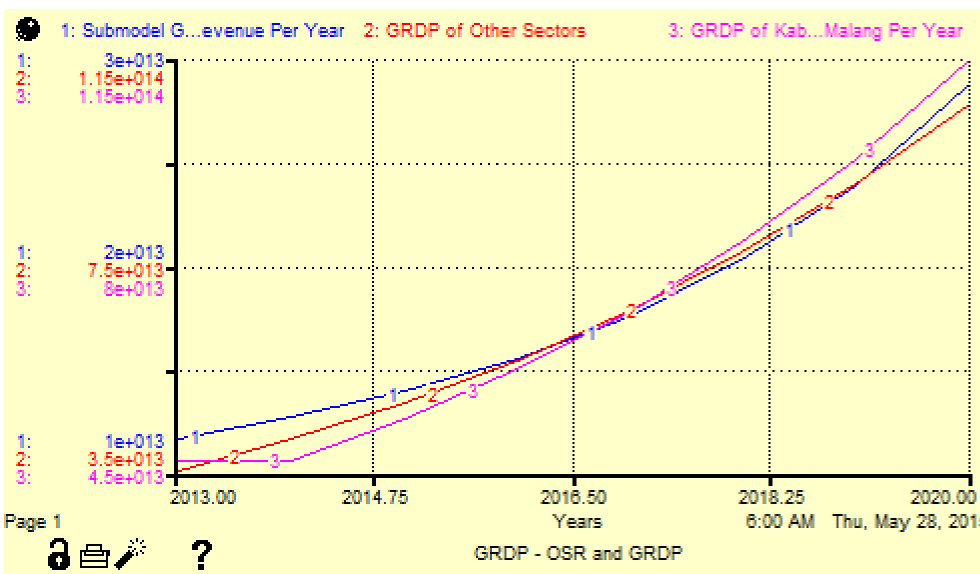


Figure 4.37 Simulation Graph of GRDP in Sub model OSR and GRDP
Notes:
1. GRDP of Agriculture Per Year
2. GRDP of Other Sectors Per Year
3. GRDP of Kabupaten Malang Per Year

CHAPTER 5
GENERATING SCENARIO MODEL

This chapter explains about how to generate policy scenario conducted on simulation model to develop livestock's ecotourism in Kabupaten Malang. Based on output from running and analysis of simulation model before, so the model is used as a reference in designing policy scenario. Alternative of policy scenario is made by changing the possible variable to be controlled by stakeholder in livestock's ecotourism development in Kabupaten Malang.

One of the objective of this research is generating scenarios for livestock's ecotourism development in Kabupaten Malang and see the impact on economy of Kabupaten Malang that is quantified by using OSR and GRDP. Besides, the impact on gas pollution that is generated by ecotourism object. By considering those objectives, scenario is designed by changing variables on livestock's ecotourism development. Variables of policy scenario that will be designed are:

1. Number of tourist promotion in Kabupaten Malang.
2. Proportion of livestock's promotion budget to increase the purchase level of livestock's products.
3. Number of livestock's ecotourism object in Kabupaten Malang.

Existing scheme of those variables can be seen in Table 5.1.

Table 5.1 Existing Condition of Each Variables of Scenario

No.	Controlled by	Variable	Existing
1	Dinas Pariwisata Kabupaten Malang	Number of Tourism Promotion	5 promotion activities in 2013
2	Dinas Peternakan Kabupaten Malang	Proportion of Livestock's Promotion Budget	Proportion of Livestock's Promotion = 0.2
3	Dinas Pariwisata & Dinas Peternakan Kabupaten Malang	Number of Livestock Ecotourism Object	Number of livestock ecotourism object is 1 in 2014 and increasing number of livestock ecotourism object is 1 object per 3 years

Each variables have a scheme, which is the value is high. From those controlled variables, so it will be combined with each variables. The schemes will be seen how impact on OSR Kabupaten Malang and GRDP Kabupaten Malang. Then, it will be conducted designing scenario for each schemes. The considered schemes are:

1. High scheme on proportion of livestock's promotion budget.
2. High scheme on number of tourism promotion Kabupaten Malang.
3. High scheme on number of livestock's ecotourism object in Kabupaten Malang.

Then, parameter of variables in high condition is constructed based on the schemes and it can be seen in Table 5.2.

Table 5.2 High Condition of Each Variables of Scenario

<table>
<tr><th>No.</th><th>Player</th><th>Variable</th><th>Existing</th></tr>
<tr><td>1</td><td>Dinas Pariwisata Kabupaten Malang</td><td>Number of Tourism Promotion</td><td>10 promotion activities in 2013 and increasing 50% of promotion activities existing</td></tr>
<tr><td>2</td><td>Dinas Peternakan Kabupaten Malang</td><td>Proportion of Livestock's Promotion</td><td>Proportion of Livestock's Promotion = 0.4</td></tr>
<tr><td rowspan="2">3</td><td>Dinas Peternakan Kabupaten Malang</td><td rowspan="2">Number of Livestock Ecotourism Object</td><td>Number of livestock ecotourism object is 3 in 2014 and increasing number of livestock ecotourism object is 2 objects per 3 years</td></tr>
<tr><td>Dinas Pariwisata Kabupaten Malang</td><td>Number of livestock ecotourism object is 5 in 2014 and increasing number of livestock ecotourism object is 2 objects per 2 years</td></tr>
</table>

Both schemes will be combined so that it will be an alternative scenario and analyzed based on the output. The optimal scenario for livestock's ecotourism development will be selected on assessment criteria scenario, which are:

1. OSR of Kabupaten Malang
2. GRDP of Kabupaten Malang
3. Gas Pollution of Kabupaten Malang

5.1 Scenario of Livestock Ecotourism Development in Kabupaten Malang

Based on the determination of schemes for variables, there are four strategies for each players. Strategies of Player 1 are generated from combination of variable schemes Player 1 and compromised variable. Strategies of Player 2 are generated from combination of variable schemes Player 2 and compromised variable.

Table 5.3 Combination of variable's scheme Player 1

Strategy of Dinas Pariwisata		**Number of Tourism Promotion**	**Number of Livestock Ecotourism Object**
Index	**Combination**	**X**	**Z**
S1.1	1 7	5	1 object in 2014 and increasing 1 object per 3 years
S1.2	1 8	5	5 objects in 2014 and increasing 2 objects per 2 years
S1.3	2 7	10	1 object in 2014 and increasing 1 object per 3 years
S1.4	2 8	10	5 objects in 2014 and increasing 2 objects per 2 years

Table 5.3 shows that the combination of tourist promotion variable and livestock's ecotourism object variable. Number 1 and 7 are existing scheme of tourist promotion variable and livestock's ecotourism object variable, while number 2 and 8 are high scheme of tourist promotion variable and livestock's ecotourism object variable. Index S1.1 shows that the existing condition scheme for both variables, while S1.4 shows that the high condition scheme for both variables. Meanwhile, S1.2 and S1.3 show that combination of existing and high scheme of both variables.

Table 5.4 Combination of variable's scheme Player 2

Strategy of Dinas Peternakan		**Proportion of Livestock's Promotion**	**Number of Livestock Ecotourism Object**
Index	**Combination**	**Y**	**Z**
S2.1	3 5	0.2	1 object in 2014 and increasing 1 object per 3 years
S2.2	3 6	0.2	3 objects in 2014 and increasing 2 objects per 3 years
S2.3	4 5	0.4	1 object in 2014 and increasing 1 object per 3 years
S2.4	4 6	0.4	3 objects in 2014 and increasing 2 objects per 3 years

Table 5.4 shows that the combination of livestock's promotion variable and livestock's ecotourism object variable. Number 3 and 5 are existing scheme of livestock's promotion variable and livestock's ecotourism object variable, while number 4 and 6 are high scheme of livestock's promotion variable and livestock's ecotourism object variable. Index S2.1 shows that the existing condition scheme for both variables, while S2.4 shows that the high condition scheme for both variables. Meanwhile, S2.2 and S2.3 show that combination of existing and high scheme of both variables.

Thus, scenarios can be designed based on the strategies of each players. There are four strategies of each players that will be designed as scenarios, so there will be designed 16 alternatives scenario to develop livestock's ecotourism in Kabupaten Malang. A scenario is designed from combination of each player's strategies. Table 5.5 shows that Scenario 1 is the existing scheme of each variables, scenario 16 is the high scheme of each variables, and others are the combination. The combination of compromised variable can be classified as four schemes, which are:

1. Existing scheme of number of livestock's ecotourism object. It is conducted on combination of existing scheme for Dinas Pariwisata (Player 1) and existing scheme for Dinas Peternakan (Player 2). This scheme is 1 object in 2014 and increasing 1 object per 3 years.
2. Low-high scheme of number of livestock's ecotourism object. It is conducted on combination of existing scheme for Dinas Pariwisata (Player 1) and high scheme for Dinas Peternakan (Player 2). This scheme is 2 object in 2014 and increasing 1 object per 3 years.
3. Medium-high scheme of number of livestock's ecotourism object. It is conducted on combination of high scheme for Dinas Pariwisata (Player 1) and existing scheme for Dinas Peternakan (Player 2). This scheme is 3 objects in 2014 and increasing 2 objects per 3 years
4. Absolute-high scheme of number of livestock's ecotourism object. It is conducted on combination of high scheme for Dinas Pariwisata (Player 1) and high scheme for Dinas Peternakan (Player 2). This scheme is 4 objects in 2014 and increasing 1 object per 2 years

The summary of each scenarios can be seen in Table 5.6.

Table 5.5 Design Alternatives Scenario of Livestock's Ecotourism Development

		Player 2			
		S2.1	S2.2	S2.3	S2.4
Player 1	S1.1	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	S1.2	Scenario 5	Scenario 6	Scenario 7	Scenario 8
	S1.3	Scenario 9	Scenario 10	Scenario 11	Scenario 12
	S1.4	Scenario 13	Scenario 14	Scenario 15	Scenario 16

Table 5.6 Summary of Each Scenarios

Alternative Scenario	**Player 1**	**Player 2**	**Compromised**
Scenario	**X**	**Y**	**Z**
1	5	0.2	1 object in 2014 and increasing 1 object per 3 years
2	5	0.2	2 object in 2014 and increasing 1 object per 3 years
3	5	0.4	1 object in 2014 and increasing 1 object per 3 years
4	5	0.4	2 object in 2014 and increasing 1 object per 3 years
5	5	0.2	3 objects in 2014 and increasing 2 objects per 3 years
6	5	0.2	4 objects in 2014 and increasing 1 objects per 2 years
7	5	0.4	3 objects in 2014 and increasing 2 objects per 3 years
8	5	0.4	4 objects in 2014 and increasing 1 objects per 2 years
9	10	0.2	1 object in 2014 and increasing 1 object per 3 years
10	10	0.2	2 object in 2014 and increasing 1 object per 3 years
11	10	0.4	1 object in 2014 and increasing 1 object per 3 years
12	10	0.4	2 object in 2014 and increasing 1 object per 3 years
13	10	0.2	3 objects in 2014 and increasing 2 objects per 3 years
14	10	0.2	4 objects in 2014 and increasing 1 objects per 2 years
15	10	0.4	3 objects in 2014 and increasing 2 objects per 3 years
16	10	0.4	4 objects in 2014 and increasing 1 objects per 2 years

5.1.1 Scenario 1: Existing Scheme of Number of Tourism Promotion, Proportion of Livestock's Promotion, and Number of Livestock Ecotourism Object

Scenario 1 is designed the existing scheme of each variables to develop livestock's ecotourism in Kabupaten Malang. Based on the scheme in Scenario 1, the output of each criteria in 2013-2020 are:

Table 5.7 Output Simulation of Scenario 1 on Each Assessment Criteria

Period	Scenario 1		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	550,312,973,416.00	54,069,048,754,529.50	463,209.31
2016	736,173,706,652.00	62,393,732,695,430.50	641,345.34
2017	956,254,947,008.00	72,219,101,456,713.20	935,023.57
2018	1,210,907,417,168.00	83,898,098,217,952.60	1,238,279.11
2019	1,500,003,919,116.00	97,853,350,169,206.00	1,551,139.09
2020	1,823,426,804,248.00	114,613,624,131,350.00	1,993,879.48

5.1.2 Scenario 2: Existing Scheme of Number of Tourism Promotion, Existing Proportion of Livestock's Promotion, and Low-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of existing scheme in number of tourist promotion and proportion of livestock's promotion with low-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 2 in 2014 and the increasing number of livestock's ecotourism object is 1 object per 3 years. Based on the scheme in Scenario 2, the output of each criteria in 2013-2020 are:

Table 5.8 Output Simulation of Scenario 2 on Each Assessment Criteria

Period	Scenario 2		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	550,314,853,416.00	54,069,048,754,529.50	463,215.00
2016	736,175,586,652.00	62,393,732,695,430.50	641,356.72
2017	956,256,827,008.00	72,219,101,456,713.20	935,040.63
2018	1,210,909,297,168.00	83,898,098,217,952.60	1,238,301.86
2019	1,500,005,799,116.00	97,853,350,169,206.00	1,551,167.53
2020	1,823,428,684,248.00	114,613,624,131,350.00	1,993,913.61

5.1.3 Scenario 3: Existing Scheme of Number of Tourism Promotion, Existing Scheme of Number of Livestock Ecotourism Object, and High Scheme of Proportion of Livestock's Promotion

This scenario uses combination of existing scheme in number of tourist promotion and high scheme of proportion of livestock's promotion with existing scheme in number of livestock's ecotourism object. Based on the scheme in Scenario 3, the output of each criteria in 2013-2020 are:

Table 5.9 Output Simulation of Scenario 3 on Each Assessment Criteria

Period	Scenario 3		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	550,312,973,416.00	54,069,326,634,916.60	463,209.31
2016	736,173,706,652.00	62,394,073,028,873.30	641,345.34
2017	956,254,947,008.00	72,219,541,828,385.60	935,023.57
2018	1,210,907,417,168.00	83,898,663,798,274.80	1,238,279.11
2019	1,500,003,919,116.00	97,854,083,616,992.00	1,551,139.09
2020	1,823,426,804,248.00	114,614,576,285,975.00	1,993,879.48

5.1.4 Scenario 4: Existing Scheme of Number of Tourism Promotion, High Scheme of Proportion of Livestock's Promotion, and Low-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of existing scheme in number of tourist promotion, high scheme of proportion of livestock's promotion, and low-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 2 in 2014 and the increasing number of livestock's ecotourism object is 1 object per 3 years. Based on the scheme in Scenario 4, the output of each criteria in 2013-2020 are:

Table 5.10 Output Simulation of Scenario 4 on Each Assessment Criteria

Period	Scenario 4		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	550,314,853,416.00	54,069,326,634,916.60	463,215.00
2016	736,175,586,652.00	62,394,073,028,873.30	641,356.72

Table 5.10 Output Simulation of Scenario 4 on Each Assessment Criteria (Con't)

Period	Scenario 4		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2017	956,256,827,008.00	72,219,541,828,385.60	935,040.63
2018	1,210,909,297,168.00	83,898,663,798,274.80	1,238,301.86
2019	1,500,005,799,116.00	97,854,083,616,992.00	1,551,167.53
2020	1,823,428,684,248.00	114,614,576,285,975.00	1,993,913.61

5.1.5 Scenario 5: Existing Scheme of Number of Tourism Promotion, Existing Scheme of Proportion of Livestock's Promotion, and Medium-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of existing scheme in number of tourist promotion, existing scheme of proportion of livestock's promotion, and medium-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 3 in 2014 and the increasing number of livestock's ecotourism object is 2 objects per 3 years. Based on the scheme in Scenario 5, the output of each criteria in 2013-2020 are:

Table 5.11 Output Simulation of Scenario 5 on Each Assessment Criteria

Period	Scenario 5		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	550,316,733,416.00	54,069,048,754,529.50	463,220.69
2016	736,177,466,652.00	62,393,732,695,430.50	641,368.09
2017	956,258,707,008.00	72,219,101,456,713.20	935,057.70
2018	1,210,913,057,168.00	83,898,098,217,952.60	1,238,330.30
2019	1,500,009,559,116.00	97,853,350,169,206.00	1,551,207.34
2020	1,823,432,444,248.00	114,613,624,131,350.00	1,993,964.80

5.1.6 Scenario 6: Existing Scheme of Number of Tourism Promotion, Existing Scheme of Proportion of Livestock's Promotion, and Absolute-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of existing scheme in number of tourist promotion, existing scheme of proportion of livestock's promotion, and medium-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 4 in 2014 and the increasing number of livestock's ecotourism object is 1 objects per 2 years. Based on the scheme in Scenario 6, the output of each criteria in 2013-2020 are:

Table 5.12 Output Simulation of Scenario 6 on Each Assessment Criteria

Period	Scenario 6		
	OSR (Rupiahs)	**GRDP (Rupiahs)**	**Pollution (Ton)**
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	550,318,613,416.00	54,069,048,754,529.50	463,226.37
2016	736,179,346,652.00	62,393,732,695,430.50	641,379.47
2017	956,262,467,008.00	72,219,101,456,713.20	935,080.45
2018	1,210,913,057,168.00	83,898,098,217,952.60	1,238,353.05
2019	1,500,011,439,116.00	97,853,350,169,206.00	1,551,235.78
2020	1,823,434,324,248.00	114,613,624,131,350.00	1,993,998.92

5.1.7 Scenario 7: Existing Scheme of Number of Tourism Promotion, High Scheme of Proportion of Livestock's Promotion, and Medium-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of existing scheme in number of tourist promotion, high scheme of proportion of livestock’s promotion, and medium-high scheme in number of livestock’s ecotourism object. In this scenario, number of livestock’s ecotourism object is 3 in 2014 and the increasing number of livestock’s ecotourism object is 2 objects per 3 years. Based on the scheme in Scenario 7, the output of each criteria in 2013-2020 are:

Table 5.13 Output Simulation of Scenario 7 on Each Assessment Criteria

Period	Scenario 7		
	OSR (Rupiahs)	**GRDP (Rupiahs)**	**Pollution (Ton)**
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	550,316,733,416.00	54,069,326,634,916.60	463,220.69
2016	736,177,466,652.00	62,394,073,028,873.30	641,368.09
2017	956,258,707,008.00	72,219,541,828,385.60	935,057.70
2018	1,210,913,057,168.00	83,898,663,798,274.80	1,238,330.30
2019	1,500,009,559,116.00	97,854,083,616,992.00	1,551,207.34
2020	1,823,432,444,248.00	114,614,576,285,975.00	1,993,964.80

5.1.8 Scenario 8: Existing Scheme of Number of Tourism Promotion, High Scheme of Proportion of Livestock's Promotion, and Absolute-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of existing scheme in number of tourist promotion, high scheme of proportion of livestock's promotion, and medium-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 4 in 2014 and the increasing number of livestock's ecotourism object is 1 objects per 2 years. Based on the scheme in Scenario 8, the output of each criteria in 2013-2020 are:

Table 5.14 Output Simulation of Scenario 8 on Each Assessment Criteria

Period	Scenario 8		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	550,318,613,416.00	54,069,326,634,916.60	463,226.37
2016	736,179,346,652.00	62,394,073,028,873.30	641,379.47
2017	956,262,467,008.00	72,219,541,828,385.60	935,080.45
2018	1,210,913,057,168.00	83,898,663,798,274.80	1,238,353.05
2019	1,500,011,439,116.00	97,854,083,616,992.00	1,551,235.78
2020	1,823,434,324,248.00	114,614,576,285,975.00	1,993,998.92

5.1.9 Scenario 9: High Scheme of Number of Tourism Promotion, Existing Scheme of Proportion of Livestock's Promotion, and Number of Livestock Ecotourism Object

This scenario uses combination of high scheme in number of tourist promotion, existing scheme of proportion of livestock's promotion, and existing scheme in number of livestock's ecotourism object. Based on the scheme in Scenario 9, the output of each criteria in 2013-2020 are:

Table 5.15 Output Simulation of Scenario 9 on Each Assessment Criteria

Period	Scenario 9		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	551,956,413,816.00	54,069,070,588,686.20	463,296.17
2016	738,676,184,204.00	62,393,773,180,278.70	641,564.47

Table 5.15 Output Simulation of Scenario 9 on Each Assessment Criteria (Con't)

Period	Scenario 9		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2017	959,832,734,288.00	72,219,170,595,248.00	935,431.80
2018	1,216,047,674,928.00	83,898,219,224,734.20	1,238,959.01
2019	1,507,013,498,924.00	97,853,550,941,412.10	1,552,189.48
2020	1,832,487,179,192.00	114,613,932,835,669.00	1,995,408.74

5.1.10 Scenario 10: High Scheme of Number of Tourism Promotion, Existing Proportion of Livestock's Promotion, and Low-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of high scheme in number of tourist promotion, existing scheme of proportion of livestock's promotion, and low-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 2 in 2014 and the increasing number of livestock's ecotourism object is 1 object per 3 years. Based on the scheme in Scenario 10, the output of each criteria in 2013-2020 are:

Table 5.16 Output Simulation of Scenario 10 on Each Assessment Criteria

Period	Scenario 10		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	551,958,293,816.00	54,069,070,588,686.20	463,301.86
2016	738,678,064,204.00	62,393,773,180,278.70	641,575.84
2017	959,834,614,288.00	72,219,170,595,248.00	935,448.86
2018	1,216,049,554,928.00	83,898,219,224,734.20	1,238,981.76
2019	1,507,015,378,924.00	97,853,550,941,412.10	1,552,217.92
2020	1,832,489,059,192.00	114,613,932,835,669.00	1,995,442.87

5.1.11 Scenario 11: High Scheme of Number of Tourism Promotion, Existing Scheme of Number of Livestock Ecotourism Object, and High Scheme of Proportion of Livestock's Promotion

This scenario uses combination of high scheme in number of tourist promotion, high scheme of proportion of livestock's promotion, and existing scheme in number of livestock's ecotourism object. Based on the scheme in Scenario 11, the output of each criteria in 2013-2020 are:

Table 5.17 Output Simulation of Scenario 11 on Each Assessment Criteria

Period	Scenario 11		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	551,956,413,816.00	54,069,370,715,195.20	463,296.17
2016	738,676,184,204.00	62,394,153,334,883.60	641,564.47
2017	959,832,734,288.00	72,219,681,107,463.00	935,431.80
2018	1,216,047,674,928.00	83,898,905,811,838.00	1,238,959.01
2019	1,507,013,498,924.00	97,854,482,930,602.00	1,552,189.48
2020	1,832,487,179,192.00	114,615,193,694,613.00	1,995,408.74

5.1.12 Scenario 12: High Scheme of Number of Tourism Promotion, High Scheme of Proportion of Livestock's Promotion, and Low-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of high scheme in number of tourist promotion, high scheme of proportion of livestock's promotion, and low-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 2 in 2014 and the increasing number of livestock's ecotourism object is 1 object per 3 years. Based on the scheme in Scenario 12, the output of each criteria in 2013-2020 are:

Table 5.18 Output Simulation of Scenario 12 on Each Assessment Criteria

Period	Scenario 12		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	551,958,293,816.00	54,069,370,715,195.20	463,301.86
2016	738,678,064,204.00	62,394,153,334,883.60	641,575.84
2017	959,834,614,288.00	72,219,681,107,463.00	935,448.86
2018	1,216,049,554,928.00	83,898,905,811,838.00	1,238,981.76
2019	1,507,015,378,924.00	97,854,482,930,602.00	1,552,217.92
2020	1,832,489,059,192.00	114,615,193,694,613.00	1,995,442.87

5.1.13 Scenario 13: High Scheme of Number of Tourism Promotion, Existing Scheme of Proportion of Livestock's Promotion, and Medium-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of high scheme in number of tourist promotion, existing scheme of proportion of livestock's promotion, and medium-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 3 in 2014 and the increasing number of livestock's ecotourism object is 2 objects per 3 years. Based on the scheme in Scenario 13, the output of each criteria in 2013-2020 are:

Table 5. 19 Output Simulation of Scenario 13 on Each Assessment Criteria

Period	Scenario 13		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	551,960,173,816.00	54,069,070,588,686.20	463,307.55
2016	738,679,944,204.00	62,393,773,180,278.70	641,587.22
2017	959,836,494,288.00	72,219,170,595,248.00	935,465.92
2018	1,216,053,314,928.00	83,898,219,224,734.20	1,239,010.20
2019	1,507,019,138,924.00	97,853,550,941,412.10	1,552,257.73
2020	1,832,492,819,192.00	114,613,932,835,669.00	1,995,494.06

5.1.14 Scenario 14: High Scheme of Number of Tourism Promotion, Existing Scheme of Proportion of Livestock's Promotion, and Absolute-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of high scheme in number of tourist promotion, existing scheme of proportion of livestock's promotion, and absolute-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 4 in 2014 and the increasing number of livestock's ecotourism object is 1 objects per 2 years. Based on the scheme in Scenario 14, the output of each criteria in 2013-2020 are:

Table 5.20 Output Simulation of Scenario 14 on Each Assessment Criteria

Period	Scenario 14		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18

Table 5.20 Output Simulation of Scenario 14 on Each Assessment Criteria (Con't)

Period	Scenario 14		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2015	551,962,053,816.00	54,069,070,588,686.20	463,313.24
2016	738,681,824,204.00	62,393,773,180,278.70	641,598.59
2017	959,840,254,288.00	72,219,170,595,248.00	935,488.67
2018	1,216,053,314,928.00	83,898,219,224,734.20	1,239,032.95
2019	1,507,021,018,924.00	97,853,550,941,412.10	1,552,286.17
2020	1,832,494,699,192.00	114,613,932,835,669.00	1,995,528.18

5.1.15 Scenario 15: High Scheme of Number of Tourism Promotion, High Scheme of Proportion of Livestock's Promotion, and Medium-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of high scheme in number of tourist promotion, high scheme of proportion of livestock's promotion, and medium-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 3 in 2014 and the increasing number of livestock's ecotourism object is 2 objects per 3 years. Based on the scheme in Scenario 15, the output of each criteria in 2013-2020 are:

Table 5. 21 Output Simulation of Scenario 15 on Each Assessment Criteria

Period	Scenario 15		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	551,960,173,816.00	54,069,370,715,195.20	463,307.55
2016	738,679,944,204.00	62,394,153,334,883.60	641,587.22
2017	959,836,494,288.00	72,219,681,107,463.00	935,465.92
2018	1,216,053,314,928.00	83,898,905,811,838.00	1,239,010.20
2019	1,507,019,138,924.00	97,854,482,930,602.00	1,552,257.73
2020	1,832,492,819,192.00	114,615,193,694,613.00	1,995,494.06

5.1.16 Scenario 16: High Scheme of Number of Tourism Promotion, High Scheme of Proportion of Livestock's Promotion, and Absolute-high Scheme of Number of Livestock Ecotourism Object

This scenario uses combination of high scheme in number of tourist promotion, high scheme of proportion of livestock's promotion, and absolute-high scheme in number of livestock's ecotourism object. In this scenario, number of livestock's ecotourism object is 4 in 2014 and the increasing number of livestock's ecotourism object is 1 objects per 2 years. Based on the scheme in Scenario 16, the output of each criteria in 2013-2020 are:

Table 5. 22 Output Simulation of Scenario 16 on Each Assessment Criteria

Period	Scenario 16		
	OSR (Rupiahs)	GRDP (Rupiahs)	Pollution (Ton)
2013	260,582,631,310.00	46,830,737,760,000.00	151,763.04
2014	409,042,784,583.00	46,971,162,488,681.70	303,478.18
2015	551,962,053,816.00	54,069,370,715,195.20	463,313.24
2016	738,681,824,204.00	62,394,153,334,883.60	641,598.59
2017	959,840,254,288.00	72,219,681,107,463.00	935,488.67
2018	1,216,053,314,928.00	83,898,905,811,838.00	1,239,032.95
2019	1,507,021,018,924.00	97,854,482,930,602.00	1,552,286.17
2020	1,832,494,699,192.00	114,615,193,694,613.00	1,995,528.18

CHAPTER 6
SELECTING SCENARIO USING GAME THEORY

This chapter explains about how to select the optimal scenario for each players by using game theory approach. The output simulation of each scenarios will be the input of game theory. The optimal solution for each players is generated by designing matrix payoff first. After matrix payoff is designed, then it is conducted solution of the game.

6.1 Designing Matrix Payoff

Matrix payoff is a table that is consisted of strategies of Dinas Pariwisata Kabupaten Malang as Player 1 and Dinas Peternakan Kabupaten Malang as Player 2. Each Players have four strategies and the payoff value of each strategies is the output simulation of each scenarios. The payoff value used in this game is the final output of simulation in 2020 from OSR and GRDP. The matrix payoff for the output OSR and GRDP of each scenarios can be seen in the Table 6.1.

Because there are two goals of scenario's scheme for each players, so both goals must be considered to select the optimal strategy for each players. However, OSR and GRDP have different input and objective. OSR is used to measure revenue that comes from retribution, tax and other revenues of ecotourism objects, while GRDP is used to measure revenue that comes from livestock's product sale. Therefore, OSR and GRDP can't be combined into one output to select the best strategy.

Based on the previous chapter, Dinas Pariwisata as Player 1 has controlled variables, which are number of tourism promotion and number of livestock's ecotourism object. By controlling those variables, the controlled variables of Dinas Pariwisata will give impact to OSR of Kabupaten Malang. It is because both variables can increase retribution and tax revenue, so it will also increase OSR of Kabupaten Malang. Thus, OSR is used to select the best strategy for Player 1 (Figure 6.2).

Table 6.1 Matrix Payoff of Livestock's Ecotourism Development in Kabupaten Malang

Player 1 (Dinas Pariwisata Kabupaten Malang)		Player 2 (Dinas Peternakan Kabupaten Malang)			
		S2.1 (Rp Million)	S2.2 (Rp Million)	S2.3 (Rp Million)	S2.4 (Rp Million)
	S1.1 (Rp Million)	114,613,624.13 1,823,426.80	114,613,624.13 1,823,428.68	114,614,576.29 1,823,426.80	114,614,576.29 1,823,428.68
	S1.2 (Rp Million)	114,613,624.13 1,823,432.44	114,613,624.13 1,823,434.32	114,614,576.29 1,823,432.44	114,614,576.29 1,823,434.32
	S1.3 (Rp Million)	114,613,932.84 1,832,487.18	114,613,932.84 1,832,489.06	114,615,193.69 1,832,487.18	114,615,193.69 1,832,489.06
	S1.4 (Rp Million)	114,613,932.84 1,832,492.82	114,613,932.84 1,832,494.70	114,615,193.69 1,832,492.82	114,615,193.69 1,832,494.70

Table 6.2 Matrix Payoff for OSR of Livestock's Ecotourism Development

		Player 2 (Dinas Peternakan)			
		S2.1 (Rp Million)	S2.2 (Rp Million)	S2.3 (Rp Million)	S2.4 (Rp Million)
Player 1 (Dinas Pariwisata)	S1.1 (Rp Million)	1,823,426.80	1,823,428.68	1,823,426.80	1,823,428.68
	S1.2 (Rp Million)	1,823,432.44	1,823,434.32	1,823,432.44	1,823,434.32
	S1.3 (Rp Million)	1,832,487.18	1,832,489.06	1,832,487.18	1,832,489.06
	S1.4 (Rp Million)	1,832,492.82	1,832,494.70	1,832,492.82	1,832,494.70

Table 6.3 Matrix Payoff for GRDP of Livestock's Ecotourism Development

		Player 2 (Dinas Peternakan)			
		S2.1 (Rp Million)	**S2.2 (Rp Million)**	**S2.3 (Rp Million)**	**S2.4 (Rp Million)**
Player 1 (Dinas Pariwisata)	**S1.1 (Rp Million)**	114,613,624	114,613,624	114,614,576	114,614,576
	S1.2 (Rp Million)	114,613,624	114,613,624	114,614,576	114,614,576
	S1.3 (Rp Million)	114,613,933	114,613,933	114,615,194	114,615,194
	S1.4 (Rp Million)	114,613,933	114,613,933	114,615,194	114,615,194

Based on the previous chapter, Dinas Peternakan as Player 2 has controlled variables, which are proportion of livestock's promotion and number of livestock's ecotourism object. By controlling those variable, the controlled variables of Dinas Pariwisata will give impact to GRDP of Kabupaten Malang. It is because both variables can increase revenue from product sales, so it will also increase OSRGRDP of Kabupaten Malang. Thus, GRDP is used to select the best strategy for Player 2 (Figure 6.3).

Table 6.1 shows the payoff value of each scenarios. It can be seen that there is increasing value on OSR in scenario 2. Scenario 2 is increasing on compromised variables, which is number of livestock ecotourism object. This compromised variable can't give impact to value of GRDP Kabupaten Malang. It can be seen also in the scenario 11 and 12. Scenario 11 shows that there changing on high scheme of variables owned by each players, but the compromised variable uses existing scheme. Otherwise, scenario 12 is closely same with scenario

scenario 11, but there is increasing in the compromised variable. The payoff value also gives impact only on OSR Kabupaten Malang compared to Scenario 1 and 2. This result applied on other scenarios that only change the scheme of compromised variable. From this result, it can be analyzed that number of livestock ecotourism object is a variable that can be controlled by Dinas Pariwisata and Dinas Peternakan, but this variable only give impact significantly to OSR Kabupaten Malang. It is because GRDP of Kabupaten Malang is generated from sales of products. Sales of products are influenced by consumption per kapita and also demand of the products. The consumption is influenced by number of products and it relates to productivity, which is influenced also by land area. While, the increasing of number of livestock ecotourism object will not increase land are of Kabupaten Malang. It only uses proportion of land area in Kabupaten Malang. Besides, GRDP of Kabupaten Malang is not only generated from GRDP of livestock, but also there are other sectors that gives impact to GRDP of Kabupaten Malang. Meanwhile, this research only concerns about livestock and don't consider about impact of other sectors. So, it is logic if the increasing of number of livestock ecotourism object doesn't give impact significantly to GRDP of Kabupaten Malang and otherwise to OSR of Kabupaten Malang.

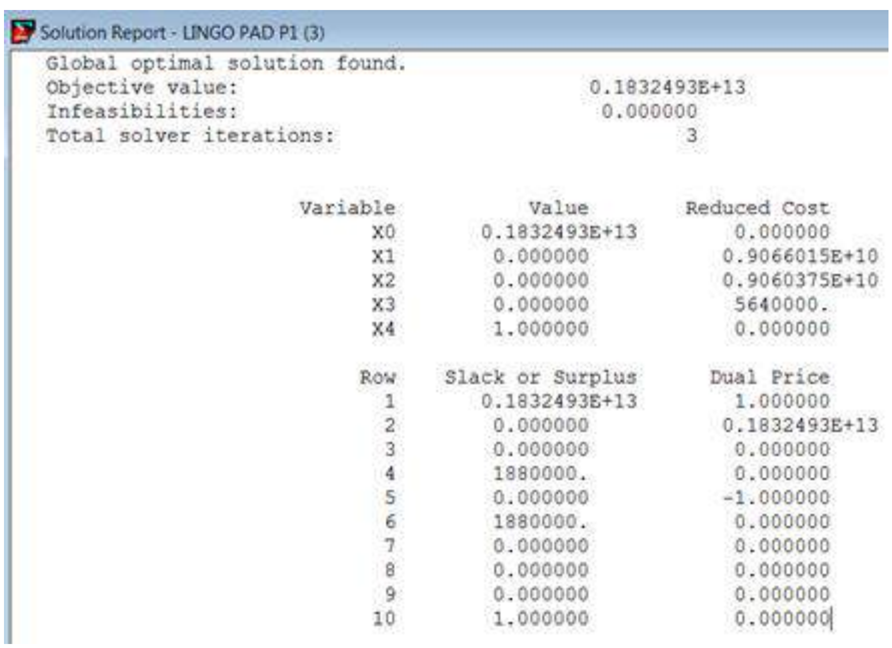
6.2 Solution of the Game

The first steps usually take when trying to find optimum strategies have to deal with dominated strategy. This is one of the early works that can be done on a matrix to work a solution. The reason, as the name implies, is that it eliminate strategies in the matrix by removing dominated strategies from a game. It can be argued that situations can be found where by only using this tool a solution can be found. By eliminating through duplication what we actually do is remove any strategies that are identical in our payoff matrix. Elimination by dominance is when the solution uses common sense to eliminate any strategies that provide lower, weaker payoff.

Based on the Table 6.2 which explains about matrix payoff of OSR, strategy 4 of Player 1 dominates other strategies. However, other solution can be conducted in this matrix payoff to make the reason stronger. One of the method to solve this game is by using complementary slackness. Complementary slackness is conducted by using linear programming on matrix payoff. The linear programming model of matrix payoff for OSR can be seen below.

Max = x0 + 0*x1 + 0*x2 + 0*x3 + 0*x4;
x1 + x2 + x3 + x4 = 1;
1823426804248*x1 + 1823432444248*x2 + 1832487179192*x3 +
1832492819192*x4 - x0 >=0;
1823428684248*x1 + 1823434324248*x2 + 1832489059192*x3 +
1832494699192*x4 - x0 >=0;
1823426804248*x1 + 1823432444248*x2 + 1832487179192*x3 +
1832492819192*x4 - x0 >=0;
1823428684248*x1 + 1823434324248*x2 + 1832489059192*x3 +
1832494699192*x4 - x0 >=0;
x1 >= 0;
x2 >= 0;
x3 >= 0;
x4 >= 0;

Then, it is solved by using Lingo 11 to get the solution (Figure 6.1). The result is same with dominance method, which are strategy 4 of Player 1 dominates other strategies.


Solution Report - LINGO PAD P1 (3)

Global optimal solution found.
Objective value: 0.1832493E+13
Infeasibilities: 0.000000
Total solver iterations: 3

Variable	Value	Reduced Cost
X0	0.1832493E+13	0.000000
X1	0.000000	0.9066015E+10
X2	0.000000	0.9060375E+10
X3	0.000000	5640000.
X4	1.000000	0.000000

Row	Slack or Surplus	Dual Price
1	0.1832493E+13	1.000000
2	0.000000	0.1832493E+13
3	0.000000	0.000000
4	1880000.	0.000000
5	0.000000	-1.000000
6	1880000.	0.000000
7	0.000000	0.000000
8	0.000000	0.000000
9	0.000000	0.000000
10	1.000000	0.000000

Figure 6.1 Solution Report of Matrix Payoff OSR by using Linear Programming

Based on the Table 6.3 which explains about matrix payoff of GRDP, strategy 4 of Player 2 dominates other strategies. However, other solution can be conducted in this matrix payoff to make the reason stronger. One of the methods to solve this game is by using complementary slackness. Complementary slackness is conducted by using linear programming on matrix payoff. The linear programming model of matrix payoff for OSR can be seen below.

```
Max = y0 + 0*y1 + 0*y2 + 0*y3 + 0*y4;
y1 + y2 + y3 + y4 = 1;
114613624131350*y1 + 114613624131350*y2 + 114614576285975*y3 +
114614576285975*y4 - y0 >=0;
114613624131350*y1 + 114613624131350*y2 + 114614576285975*y3 +
114614576285975*y4 - y0 >=0;
114613932835669*y1 + 114613932835669*y2 + 114615193694613*y3 +
114615193694613*y4 - y0 >=0;
114613932835669*y1 + 114613932835669*y2 + 114615193694613*y3 +
114615193694613*y4 - y0 >=0;
y1 >= 0;
y2 >= 0;
y3 >= 0;
y4 >= 0;
```

Then, it is solved by using Lingo 11 to get the solution (Figure 6.5). The result is same with previous tool, which are strategy 4 of Player 2 dominates other strategies.

```
Solution Report - LINGO PDRB P2 (3)
Global optimal solution found.
Objective value:                              0.1146146E+15
Infeasibilities:                               0.000000
Total solver iterations:                              3

                     Variable           Value        Reduced Cost
                           Y0    0.1146146E+15           0.000000
                           Y1         0.000000      0.9521546E+09
                           Y2         0.000000      0.9521546E+09
                           Y3         0.000000           0.000000
                           Y4         1.000000           0.000000

                          Row   Slack or Surplus      Dual Price
                            1    0.1146146E+15           1.000000
                            2         0.000000      0.1146146E+15
                            3         0.000000           0.000000
                            4         0.000000          -1.000000
                            5    0.6174086E+09           0.000000
                            6    0.6174086E+09           0.000000
                            7         0.000000           0.000000
                            8         0.000000           0.000000
                            9         0.000000           0.000000
                           10         1.000000           0.000000
```

Figure 6.2 Solution Report of Matrix Payoff GRDP by using Linear Programming

Based on the calculation of dominance and complementary slackness above, it can be concluded that the optimum solution is in scenario 16. Scenario 16 is generated from strategy 4 of Player 1 and strategy 4 of Player 2, which use high scheme for each variables.

In other hand, gas pollution also gives impact along the increasing of promotion, livestock's promotion and livestock's ecotourism object. Then, cost parameter is conducted on gas pollution. Cost, caused by gas contamination, uses the planting cost of industrial forests, which is about Rp 16,662,034/Ha (Kementrian Kehutanan RI, 2009) with absorption level of CO_2 in forests is 51.65 ton.CO_2/Ha (Rahmat, 2010). Thus, cost of CO_2 impacts is Rp 322,600.27/ton.CO_2. Cost caused by pollution based on the output simulation can be seen in Table 6.4. Then, the cost will reduce OSR of Kabupaten Malang. Matrix Payoff of Livestock's Ecotourism Development in Kabupaten Malang by considering impact of gas contamination can be seen in Table 6.5.

Table 6.4 Cost Caused by Gas Contamination of Livestock's Ecotourism Development in Kabupaten Malang

Scenario	Pollution in 2020 (Ton)	Cost Caused by Pollution in 2020 (Rp)
Scenario 1	1,993,879.48	643,215,637,708.85
Scenario 2	1,993,913.61	643,226,647,877.69
Scenario 3	1,993,879.48	643,215,637,708.85
Scenario 4	1,993,913.61	643,226,647,877.69
Scenario 5	1,993,947.73	643,237,654,820.58
Scenario 6	1,993,981.86	643,248,664,989.41
Scenario 7	1,993,964.80	643,243,161,517.97
Scenario 8	1,993,998.92	643,254,168,460.86
Scenario 9	1,995,408.74	643,708,969,405.17
Scenario 10	1,995,442.87	643,719,979,574.01
Scenario 11	1,995,408.74	643,708,969,405.17
Scenario 12	1,995,442.87	643,719,979,574.01
Scenario 13	1,995,494.06	643,736,493,214.29
Scenario 14	1,995,528.18	643,747,500,157.18
Scenario 15	1,995,494.06	643,736,493,214.29
Scenario 16	1,995,528.18	643,747,500,157.18

Table 6.5 Matrix Payoff of Livestock's Ecotourism Development in Kabupaten Malang by Considering Gas Contamination

Player 1 (Dinas Pariwisata Kabupaten Malang)		Player 2 (Dinas Peternakan Kabupaten Malang)			
		S2.1 (Rp Million)	S2.2 (Rp Million)	S2.3 (Rp Million)	S2.4 (Rp Million)
	S1.1 (Rp Million)	114,613,624.13 1,180,211.17	114,613,624.13 1,180,202.04	114,614,576.29 1,180,211.17	114,614,576.29 1,180,202.04
	S1.2 (Rp Million)	114,613,624.13 1,180,194.79	114,613,624.13 1,180,185.66	114,614,576.29 1,180,189.28	114,614,576.29 1,180,180.16
	S1.3 (Rp Million)	114,613,932.84 1,188,778.21	114,613,932.84 1,188,769.08	114,615,193.69 1,188,778.21	114,615,193.69 1,188,769.08
	S1.4 (Rp Million)	114,613,932.84 1,188,756.33	114,613,932.84 1,188,747.20	114,615,193.69 1,188,756.33	114,615,193.69 1,188,747.20

Table 6.6 Matrix Payoff for OSR of Livestock's Ecotourism Development by Considering Gas Contamination

		Player 2 (Dinas Peternakan)			
		S2.1 (Rp Million)	S2.2 (Rp Million)	S2.3 (Rp Million)	S2.4 (Rp Million)
Player 1 (Dinas Pariwisata)	S1.1 (Rp Million)	1,180,211.17	1,180,202.04	1,180,211.17	1,180,202.04
	S1.2 (Rp Million)	1,180,194.79	1,180,185.66	1,180,189.28	1,180,180.16
	S1.3 (Rp Million)	1,188,778.21	1,188,769.08	1,188,778.21	1,188,769.08
	S1.4 (Rp Million)	1,188,756.33	1,188,747.20	1,188,756.33	1,188,747.20

Table 6.7 Matrix Payoff for GRDP of Livestock's Ecotourism Development by Considering Gas Contamination

		Player 2 (Dinas Peternakan)			
		S2.1 (Rp Million)	**S2.2 (Rp Million)**	**S2.3 (Rp Million)**	**S2.4 (Rp Million)**
Player 1 (Dinas Pariwisata)	**S1.1 (Rp Million)**	114,613,624	114,613,624	114,614,576	114,614,576
	S1.2 (Rp Million)	114,613,624	114,613,624	114,614,576	114,614,576
	S1.3 (Rp Million)	114,613,933	114,613,933	114,615,194	114,615,194
	S1.4 (Rp Million)	114,613,933	114,613,933	114,615,194	114,615,194

Based on Table 6.6, the linear programming model of matrix payoff for OSR can be seen below.

Max = x0 + 0*x1 + 0*x2 + 0*x3 + 0*x4;
x1 + x2 + x3 + x4 = 1;
1180211166539.15*x1 + 1180194789427.42*x2 + 1188778209786.83*x3 + 1188756325977.71*x4 - x0 >=0;
1180202036370.31*x1 + 1180185659258.59*x2 + 1188769079617.99*x3 + 1188747199034.82*x4 - x0 >=0;
1180211166539.15*x1 + 1180189282730.03*x2 + 1188778209786.83*x3 + 1188756325977.71*x4 - x0 >=0;
1180202036370.31*x1 + 1180180155787.14*x2 + 1188769079617.99*x3 + 1188747199034.82*x4 - x0 >=0;
x1 >= 0;
x2 >= 0;
x3 >= 0;
x4 >= 0;

Then, it is solved by using Lingo 11 to get the solution (Figure 6.3). The result is same with previous tool, which are strategy 3 of Player 1 dominates other strategies.

```
Solution Report - LINGO PAD P1 (3) (2)
  Global optimal solution found.
  Objective value:                              0.1188769E+13
  Infeasibilities:                               0.000000
  Total solver iterations:                              2


                     Variable           Value        Reduced Cost
                           X0     0.1188769E+13        0.000000
                           X1        0.000000        0.8567043E+10
                           X2        0.000000        0.8583420E+10
                           X3        1.000000         0.000000
                           X4        0.000000        0.2188058E+08

                          Row    Slack or Surplus      Dual Price
                            1     0.1188769E+13        1.000000
                            2        0.000000       0.1188769E+13
                            3        9130169.          0.000000
                            4        0.000000         -1.000000
                            5        9130169.          0.000000
                            6        0.000000          0.000000
                            7        0.000000          0.000000
                            8        0.000000          0.000000
                            9        1.000000          0.000000
                           10        0.000000          0.000000
```

Figure 6.3 Solution Report of Matrix Payoff OSR by using Linear Programming and considering gas contamination

Based on the Table 6.7 which explains about matrix payoff of GRDP, strategy 4 of Player 2 dominates other strategies. However, other solution can be conducted in this matrix payoff to make the reason stronger. One of the tools to solve this game is by using complementary slackness. Complementary slackness is conducted by using linear programming on matrix payoff. The linear programming model of matrix payoff for OSR can be seen below.

```
Max = y0 + 0*y1 + 0*y2 + 0*y3 + 0*y4;
y1 + y2 + y3 + y4 = 1;
114613624131350*y1 + 114613624131350*y2 + 114614576285975*y3 +
114614576285975*y4 - y0 >=0;
114613624131350*y1 + 114613624131350*y2 + 114614576285975*y3 +
114614576285975*y4 - y0 >=0;
114613932835669*y1 + 114613932835669*y2 + 114615193694613*y3 +
114615193694613*y4 - y0 >=0;
114613932835669*y1 + 114613932835669*y2 + 114615193694613*y3 +
114615193694613*y4 - y0 >=0;
```

y1 >= 0;
y2 >= 0;
y3 >= 0;
y4 >= 0;

Then, it is solved by using Lingo 11 to get the solution (Figure 6.5). The result is same with previous tool, which are strategy 4 of Player 2 dominates other strategies.

```
Solution Report - LINGO PDRB P2 (3)
  Global optimal solution found.
  Objective value:                              0.1146146E+15
  Infeasibilities:                               0.000000
  Total solver iterations:                              3


                     Variable           Value        Reduced Cost
                           Y0    0.1146146E+15          0.000000
                           Y1         0.000000     0.9521546E+09
                           Y2         0.000000     0.9521546E+09
                           Y3         0.000000          0.000000
                           Y4         1.000000          0.000000

                          Row    Slack or Surplus      Dual Price
                            1    0.1146146E+15          1.000000
                            2         0.000000     0.1146146E+15
                            3         0.000000          0.000000
                            4         0.000000         -1.000000
                            5    0.6174086E+09          0.000000
                            6    0.6174086E+09          0.000000
                            7         0.000000          0.000000
                            8         0.000000          0.000000
                            9         0.000000          0.000000
                           10         1.000000          0.000000
```

Figure 6.4 Solution Report of Matrix Payoff GRDP by using Linear Programming

Based on the search solutions above, it can be concluded that the optimum solution is in scenario 12. Scenario 12 is generated from strategy 3 of Player 1 and strategy 4 of Player 2, which use high scheme for each variables.

CHAPTER 7
CONCLUSSION AND RECOMMENDATION

This chapter includes the conclusion obtained from analysis and interpretation. It also provides recommendations for further researches.

7.1 Conclusion

After conducting this research, several conclusions to present are:

1. There are two models representing this research, which are conceptual and simulation model. Conceptual model is described by using input-output and causal loop diagram, while simulation model is described by using stock flow diagram which is run using STELLA software. Identified variables becomes input for input-output diagram and it is classified into controlled and uncontrolled input. Then, the reciprocity of variables is identified through causal loop diagram. Based on the identification and reciprocity of variables, stock flow diagram is constructed by using STELLA software and it will generate output for livestock ecotourism development in Kabupaten Malang. Eight Sub models is constructed in the stock flow diagram and it represents the conceptual model, The eight sub models are consisted of labor, land usage and tourism object, gas pollution, tourists, budget allocation, GRDP of livestock, investment, OSR and GRDP.
2. Policy Scenarios on livestock ecotourism development in Kabupaten Malang is generated by combining schemes of controlled variables. In this research, the controlled variables is taken from each players. The controlled variable of Dinas Pariwisata is number of tourism promotion, while the controlled variable of Dinas Peternakan is proportion of livestock's promotion. Because variable of Dinas Pariwisata only effects OSR and variable of Dinas Peternakan only effects GRDP of Kabupaten Malang, so compromised variable is needed to give impact on OSR and GRDP of Kabupaten Malang. Compromised variable is

taken from variable owned by two players, which is number of livestock's ecotourism object. A treatment of scheme is conducted on each variables. High scheme of existing condition is constructed because this research discussed about development. Based on two schemes (high and existing scheme) and thee controlled variables (number of tourism promotion, proportion of livestock's promotion, and number of livestock's ecotourism object), so 16 policy scenarios is generated to develop livestock's ecotourism in Kabupaten Malang.

- Scenario 1: Existing scheme of number of tourism promotion, proportion of livestock's promotion, and number of livestock ecotourism object
- Scenario 2: Existing scheme of number of tourism promotion, existing proportion of livestock's promotion, and low-high number of livestock ecotourism object
- Scenario 3: Existing scheme of number of tourism promotion, existing scheme of number of livestock ecotourism object, and high scheme of proportion of livestock's promotion
- Scenario 4: Existing scheme of number of tourism promotion, high scheme of proportion of livestock's promotion, and low-high number of livestock ecotourism object
- Scenario 5: Existing scheme of number of tourism promotion, existing scheme of proportion of livestock's promotion, and medium-high number of livestock ecotourism object
- Scenario 6: Existing scheme of number of tourism promotion, existing scheme of proportion of livestock's promotion, and absolute-high number of livestock ecotourism object
- Scenario 7: Existing scheme of number of tourism promotion, high scheme of proportion of livestock's promotion, and medium-high number of livestock ecotourism object

- Scenario 8: Existing scheme of number of tourism promotion, high scheme of proportion of livestock's promotion, and absolute-high number of livestock ecotourism object
- Scenario 9: High scheme of number of tourism promotion, existing scheme of proportion of livestock's promotion, and number of livestock ecotourism object
- Scenario 10: High scheme of number of tourism promotion, existing proportion of livestock's promotion, and low-high number of livestock ecotourism object
- Scenario 11: High scheme of number of tourism promotion, existing scheme of number of livestock ecotourism object, and high scheme of proportion of livestock's promotion
- Scenario 12: High scheme of number of tourism promotion, high scheme of proportion of livestock's promotion, and low-high number of livestock ecotourism object
- Scenario 13: High scheme of number of tourism promotion, existing scheme of proportion of livestock's promotion, and medium-high number of livestock ecotourism object
- Scenario 14: High scheme of number of tourism promotion, existing scheme of proportion of livestock's promotion, and absolute-high number of livestock ecotourism object
- Scenario 15: High scheme of number of tourism promotion, high scheme of proportion of livestock's promotion, and medium-high number of livestock ecotourism object
- Scenario 16: High scheme of number of tourism promotion, high scheme of proportion of livestock's promotion, and absolute-high number of livestock ecotourism object

3. The combination of two schemes and two variables of each players can generate the strategies of each players. There are four strategies for Player 1 (Dinas Pariwisata Kabupaten Malang), which are:
   - Allocate 5 promotions in a year and build 1 object in 2014 with the increasing 1 object per 3 years.
   - Allocate 5 promotions in a year and build 5 objects in 2014 with the increasing 2 objects per 2 years.
   - Allocate 10 promotions in a year and build 1 object in 2014 with the increasing 1 object per 3 years.
   - Allocate 10 promotions in a year and build 5 objects in 2014 with the increasing 2 objects per 2 years.

   On the other hand, Player 2 (Dinas Peternakan Kabupaten Malang) also has four strategies to develop livestock's ecotourism in Kabupaten Malang, which are:

   - Allocate 5 promotions in a year and build 1 object in 2014 with the increasing 1 object per 3 years.
   - Allocate 5 promotions in a year and build 3 objects in 2014 with the increasing 2 objects per 3 years.
   - Allocate 10 promotions in a year and build 1 object in 2014 with the increasing 1 object per 3 years.
   - Allocate 10 promotions in a year and build 3 objects in 2014 with the increasing 2 objects per 3 years.

   Selection of best policy scenario for two players is conducted by using game theory. It is identified through assessment criteria of scenario simulation. The assessment criteria of scenario are OSR, GRDP, and gas pollution of Kabupaten Malang. Solution of the game is solved by using complementary slackness on matrix payoff. It is identified by considering the cost impact of gas pollution or not. The solution if the players don't consider cost impact of gas pollution is dominant strategy 4 for Player 1 and strategy 4 for Player 2.

However, the best policy is considering cost impact of gas pollution for strategies of each players. The best policy scenario is expected to give win-win solution for both players. Based on the solution of the game, scenario 12 is selected to be the best policy scenario for Dinas Pariwisata and Dinas Peternakan. Scenario 12 is the combination of strategy 3 of Player 1 and strategy 4 of Player 2. Those strategies are expected to increase Own Source Revenue and Gross Regional Domestic Product of Kabupaten Malang. So, the best strategy for each players to develop livestock's ecotourism in Kabupaten Malang is:

1. Dinas Pariwisata Kabupaten Malang should increase promotion of livestock's ecotourism object until 10 promotions in a year.
2. Dinas Peternakan Kabupaten Malang should increase proportion of livestock's promotion budget in a year.
3. Both Players should cooperate to build 2 livestock's ecotourism objects in 2014 and then increase to build 1 object per 3 years.

7.2 Recommendation

For future researches, it is advisable from this research to:

1. Consider the best potential location to build livestock's ecotourism object so that Dinas Peternakan and Dinas Pariwisata can build in the strategic location.
2. Play more than 2 players that relates to livestock's ecotourism object.
3. Get the data more representative and represent the real system.

APPENDIX

Equation of Model Livestock's Ecotourism Development in Kabupaten Malang

Submodel Budget Allocation:

Agriculture_Development__Budget(t) = Agriculture_Development__Budget(t - dt) + (Rate_of_Agriculture_Budget) * dt
INIT Agriculture_Development__Budget = 24674986609
INFLOWS:
Rate_of_Agriculture_Budget = Budget_Allocation_Plus__Investment_Per_Year*Proportion_of_Agriculture_Budget

Budget_Allocation_of_Kabupaten_Malang(t) = Budget_Allocation_of_Kabupaten_Malang(t - dt) + (Rate_of_Budget_Allocation_Kabupaten_Malang) * dt
INIT Budget_Allocation_of_Kabupaten_Malang = 2528001233010
INFLOWS:
Rate_of_Budget_Allocation_Kabupaten_Malang = Balance_Funds_of_Kabupaten_Malang+Other_Revenues_of_Kabupaten_Malang+Submodel_OSR_&_GRDP_of_Kabupaten_Malang.OSR_Per_Year

Livestock's_Promotion_Budget(t) = Livestock's_Promotion_Budget(t - dt) + (Rate_of_Increasing_Livestock's_Promotion_Budget) * dt
INIT Livestock's_Promotion_Budget = 196916000
INFLOWS:
Rate_of_Increasing_Livestock's_Promotion_Budget = Livestock_Budget_Per_Year*Proportion_of_Livestock's_Promotion

Livestock_Development_Budget(t) = Livestock_Development_Budget(t - dt) + (Rate_of_Livestock_Budget) * dt
INIT Livestock_Development_Budget = 6480363250
INFLOWS:
Rate_of_Livestock_Budget = Agriculture_Budget_Per_Year*Proportion_of_Livestock_Budget

Livestock_Productivity(t) = Livestock_Productivity(t - dt) + (Rate_of_Increasing_Livestock_Productivity) * dt
INIT Livestock_Productivity = 153688.6232
INFLOWS:
Rate_of_Increasing_Livestock_Productivity = (Activity_Number_of_Livestock_Disease_Prevention+Activity_Number_of_Increasing_Livestock_Apllication_technology+Activity_Number_of_Increasing_Livestock_Product)*Fraction_of_Increasing_Livestock_Productivity*Livestock_Productivity

Livestock_Productivity_Budget(t) = Livestock_Productivity_Budget(t - dt) + (Rate_of_Increasing_Livestock_Productivity_Budget) * dt
INIT Livestock_Productivity_Budget = 2570216750
INFLOWS:
Rate_of_Increasing_Livestock_Productivity_Budget = Livestock_Budget_Per_Year*Proportion_of_Livestock_Productivity

Tourism_Development__Budget(t) = Tourism_Development__Budget(t - dt) + (Rate_of__Increasing_Tourism_Budget) * dt
INIT Tourism_Development__Budget = 3774151470
INFLOWS:
Rate_of__Increasing_Tourism_Budget = Budget_Allocation_Plus__Investment_Per_Year*Proportion_of_Tourism_Budget_Allocation

Activity_Cost_of_Increasing_Livestock_Apllication_technology = 710950000
Activity_Cost_of_Increasing_Livestock_Product = 1002430362
Activity_Cost_of_Livestock_Disease_Prevention = 695508422
Activity_Number_of_Increasing_Livestock_Apllication_technology = Budget_of_Increasing_Livestock_Application_Technology/Activity_Cost_of_Increasing_Livestock_Apllication_technology
Activity_Number_of_Increasing_Livestock_Product = Budget_of_Increasing_Livestock_Product/Activity_Cost_of_Increasing_Livestock_Product
Activity_Number_of_Livestock_Disease_Prevention = Budget_of_Livestock_Disease_Prevention/Activity_Cost_of_Livestock_Disease_Prevention
Agriculture_Budget_Per_Year = Rate_of_Agriculture_Budget
Agriculture_Development_Budget_Delay = DELAY(Agriculture_Development__Budget,1)
Agriculture_Development_Budget_Per_Year = IF TIME=2013 THEN Agriculture_Development__Budget ELSE Agriculture_Development__Budget-Agriculture_Development_Budget_Delay
Average_Cost_of_Livestock_Promotion = 53252500
Budget_Allocation_of_Kabupaten_Malang_Delay = DELAY(Budget_Allocation_of_Kabupaten_Malang,1)
Budget_Allocation_of_Kabupaten__Malang_Per_Year = IF TIME=2013 THEN Budget_Allocation_of_Kabupaten_Malang ELSE Budget_Allocation_of_Kabupaten_Malang-Budget_Allocation_of_Kabupaten_Malang_Delay
Budget_Allocation_Per_Year = Rate_of_Budget_Allocation_Kabupaten_Malang
Budget_Allocation_Plus__Investment_Per_Year = Budget_Allocation_Per_Year+Submodel_Investment.Government_Investment
Budget_of_Increasing_Livestock_Application_Technology = Livestock_Productivity_Budget_Per_Year*Ratio_of_Increasing_Livestock_Application_Technology
Budget_of_Increasing_Livestock_Product = Livestock_Productivity_Budget_Per_Year*Ratio_of_Increasing_Livestock_Product
Budget_of_Livestock_Disease_Prevention = Livestock_Productivity_Budget_Per_Year*Ratio_of_Livestock_Disease_Prevention
Cost_Average_of_Tourism_Promotion = 383948000
Ecotourism__Object_Surplus = Tourism_Promotion_Budget-Total_Cost_Tousim__Promotion
Fraction_of_Increasing_Livestock_Productivity = 0.003607348
Livestock's_Promotion_Budget_Delay = DELAY(Livestock's_Promotion_Budget,1)
Livestock's_Promotion_Budget_Per_Year = IF TIME=2013 THEN Livestock's_Promotion_Budget ELSE Livestock's_Promotion_Budget-Livestock's_Promotion_Budget_Delay
Livestock_Budget_Per_Year = Rate_of_Livestock_Budget

Livestock_Development_Budget_Delay = DELAY(Livestock_Development_Budget,1)
Livestock_Development_Budget_Per_Year = IF TIME=2013 THEN Livestock_Development_Budget ELSE Livestock_Development_Budget-Livestock_Development_Budget_Delay
Livestock_Productivity_Budget_Delay = DELAY(Livestock_Productivity_Budget,1)
Livestock_Productivity_Budget_Per_Year = IF TIME=2013 THEN Livestock_Productivity_Budget ELSE Livestock_Productivity_Budget-Livestock_Productivity_Budget_Delay
Number_of_Livestok's_Promotion_Based_on_Budget = ROUND(Livestock's_Promotion_Budget_Per_Year/Average_Cost_of_Livestock_Promotion)
Proportion_of_Agriculture_Budget = 0.00913
Proportion_of_Livestock's_Promotion = 0.2
Proportion_of_Livestock_Budget = 0.473
Proportion_of_Livestock_Productivity = 0.611
Proportion_of_Tourism_Budget_Allocation = 0.0015
Proportion_of_Tourism_Promotion_Budget = 0.314
Ratio_of_Increasing_Livestock_Application_Technology = 0.067
Ratio_of_Increasing_Livestock_Product = 0.743
Ratio_of_Livestock_Disease_Prevention = 0.168
Total_Cost_Tousim__Promotion = Cost_Average_of_Tourism_Promotion*Submodel_Tourist.Number_of_Tourism_Promotion_Per_Year
Tourism_Development_Budget_Delay = DELAY(Tourism_Development__Budget,1)
Tourism_Development_Budget_Per_Year = IF TIME=2013 THEN Tourism_Development__Budget ELSE Tourism_Development__Budget-Tourism_Development_Budget_Delay
Tourism_Promotion_Budget = Proportion_of_Tourism_Promotion_Budget*Tourism_Development_Budget_Per_Year
Balance_Funds_of_Kabupaten_Malang = GRAPH(TIME)
(2013, 1.8e+012), (2014, 2.1e+012), (2015, 2.3e+012), (2016, 2.6e+012), (2017, 2.9e+012), (2018, 3.2e+012), (2019, 3.6e+012), (2020, 4e+012), (2021, 4.4e+012), (2022, 4.8e+012), (2023, 5.3e+012), (2024, 5.8e+012), (2025, 6.3e+012)
Other_Revenues_of_Kabupaten_Malang = GRAPH(TIME)
(2013, 8.2e+011), (2014, 8.6e+011), (2015, 9.7e+011), (2016, 1.1e+012), (2017, 1.2e+012), (2018, 1.2e+012), (2019, 1.3e+012), (2020, 1.4e+012), (2021, 1.5e+012), (2022, 1.6e+012), (2023, 1.6e+012), (2024, 1.7e+012), (2025, 1.7e+012)

Submodel GRDP of Livestock:
GRDP_of_Agriculture(t) = GRDP_of_Agriculture(t - dt) + (GRDP_Revenue_Per_Year) * dt
INIT GRDP_of_Agriculture = 11445404000000
INFLOWS:
GRDP_Revenue_Per_Year = Increasing_Rate_of_Livestock_Revenue+Increasing_Rate_of_Non_Livestock_Revenue
Livestock_Revenue(t) = Livestock_Revenue(t - dt) + (Increasing_Rate_of_Livestock_Revenue) * dt
INIT Livestock_Revenue = 2173008000000
INFLOWS:
Increasing_Rate_of_Livestock_Revenue = Selling_Price_of_Livestock's_Product*Rate_of_Livestock's_Product_Sold
Number_of_Livestock's__Product_Sold(t) = Number_of_Livestock's__Product_Sold(t - dt) + (Rate_of_Sale_for_Livestock_Product) * dt
INIT Number_of_Livestock's__Product_Sold = 0
INFLOWS:
Rate_of_Sale_for_Livestock_Product = Demand_of_Livestock's_Product_Per_Year+Demand_of_Livestock's_Product_from_Tourists
Number_of_Livestock__Product(t) = Number_of_Livestock__Product(t - dt) + (Rate_of__Livestock_Production - Rate_of_Livestock's_Product_Sold) * dt
INIT Number_of_Livestock__Product = 162980.33
INFLOWS:
Rate_of__Livestock_Production = Submodel_Budget_Allocation.Livestock_Productivity*Submodel_Land_Usage_&_Tourism_Object.Livestock_Land_Area
OUTFLOWS:
Rate_of_Livestock's_Product_Sold = Rate_of_Sale_for_Livestock_Product
Selling_Price_of_Livestock's_Product(t) = Selling_Price_of_Livestock's_Product(t - dt) + (Rate_Changes_Price_of_Livestock's_Product) * dt
INIT Selling_Price_of_Livestock's_Product = 33000000
INFLOWS:
Rate_Changes_Price_of_Livestock's_Product = Selling_Price_of_Livestock's_Product*Rate_of_Price_Changes
Consumption_of_Livestock's_Product_Per_Capita_Per_Year = 0.0187
Demand_of_Livestock's_Product_from_Tourists = Consumption_of_Livestock's_Product_Per_Capita_Per_Year*Ratio_of_Increasing_Demand_per_Livestock's_Promotion*Submodel_Budget_Allocation.Number_of_Livestok's_Promotion_Based_on_Budget*Submodel_Tourist.Number_of_Livestock's_Customer_from_Tourists
Demand_of_Livestock's_Product_Per_Year = Submodel_Labor.Population_of__Kabupaten_Malang*Consumption_of_Livestock's_Product_Per_Capita_Per_Year
GRDP_of_Agriculture_Delay = DELAY(GRDP_of_Agriculture,1)
GRDP_of_Agriculture_Per_Year = IF TIME=2013 THEN GRDP_of_Agriculture ELSE GRDP_of_Agriculture-GRDP_of_Agriculture_Delay
Livestock_Revenue_Delay = DELAY(Livestock_Revenue,1)
Livestock_Revenue__Per_Year = IF TIME=2013 THEN Livestock_Revenue ELSE Livestock_Revenue-Livestock_Revenue_Delay
Rate_of_GRDP_Revenue_Per_Year = GRDP_Revenue_Per_Year
Ratio_of_Increasing_Demand_per_Livestock's_Promotion = 0.02515
Increasing_Rate_of_Non_Livestock_Revenue = GRAPH(TIME)
(2013, 1e+013), (2014, 1.1e+013), (2015, 1.2e+013), (2016, 1.4e+013), (2017, 1.6e+013), (2018, 1.8e+013), (2019, 2.2e+013), (2020, 2.6e+013), (2021, 3.3e+013), (2022, 4.2e+013), (2023, 5.5e+013), (2024, 7.4e+013), (2025, 1e+014)
Rate_of_Price_Changes = GRAPH(TIME)
(2013, 0.066), (2014, 0.058), (2015, 0.056), (2016, 0.064), (2017, 0.068), (2018, 0.06), (2019, 0.068), (2020, 0.068), (2021, 0.064), (2022, 0.062), (2023, 0.064), (2024, 0.062), (2025, 0.066)

Submodel Investment:

- Average_Cost_Investment_for_Non_Livestock_Ecotourism = 38446888889
- Cost_Investment_for_Livestock_Ecotourism = 76350000000
- Cost_Investment_of_Non_Ecotourism_Object = 38446888889
- Government_Investment = Total_Investment
- Total_Investment = Total_Investment_of_Ecotourism+Total_Investment_of_Non_Ecotourism+Total_Investment_of_Other_Sectors
- Total_Investment_of_Ecotourism = (Total_Investment_of_Livestock_Ecotourism+Total_Investment_of_Non_Livestock_Ecotourism)/1000000
- Total_Investment_of_Livestock_Ecotourism = Cost_Investment_for_Livestock_Ecotourism*Submodel_Land_Usage_&_Tourism_Object.Increasing_Number_od_Livestock_Ecotourism_Object
- Total_Investment_of_Non_Ecotourism = (Cost_Investment_of_Non_Ecotourism_Object*Submodel_Land_Usage_&_Tourism_Object.Increasing_Number_of__Non_Ecotourism_Object)/1000000
- Total_Investment_of_Non_Livestock_Ecotourism = Average_Cost_Investment_for_Non_Livestock_Ecotourism*Submodel_Land_Usage_&_Tourism_Object.Increasing_Number_of_Non_Livestock_Ecotourism_Object
- Total_Investment_of_Other_Sectors = 234711739130.44

Submodel Labor:

Population_of__Kabupaten_Malang(t) = Population_of__Kabupaten_Malang(t - dt) + (Rate_of__Natality + Rate_of__Migration_Came - Rate_of__Mortality - Rate_of__Out_Migration) * dt
INIT Population_of__Kabupaten_Malang = 2473612
INFLOWS:
- Rate_of__Natality = Population_of__Kabupaten_Malang*Natality_Level_of_Kabupaten_Malang
- Rate_of__Migration_Came = Population_of__Kabupaten_Malang*Migration_Came_Level

OUTFLOWS:
- Rate_of__Mortality = Population_of__Kabupaten_Malang*Mortality_Level_of_Kabupaten_Malang
- Rate_of__Out_Migration = Population_of__Kabupaten_Malang*Out_Migration_Level

- Average_Number_of_Absorbed_Non_Ecotourism_Labor_Force = 25
- Fraction_of_Workforce = 0.4921883
- Migration_Came_Level = 0.011
- Mortality_Level_of_Kabupaten_Malang = 0.0065
- Natality_Level_of_Kabupaten_Malang = 0.0085
- Number_of_Absorbed_Ecotourism_Labor_Force_Per_Increasing = 40*Submodel_Land_Usage_&_Tourism_Object.Number_of_Ecotourism_Object
- Number_of_Absorbed_Ecotourism_Labor_Force_Per_Year = 10*Submodel_Land_Usage_&_Tourism_Object.Increasing_Number_of__Ecotourism_Object
- Number_of_Absorbed__Labor_Force = Number_of_Labor_Force_Other_Sectors+Number_of_Agriculture__Labor_Force+Number_of_Tourism__Labor_Force
- Number_of_Agriculture__Labor_Force = Number_of_Workforce*Ratio_of_Agriculture_Labor_Force
- Number_of_Ecotourism__Labor_Force = Number_of_Absorbed_Ecotourism_Labor_Force_Per_Increasing+Number_of_Absorbed_Ecotourism_Labor_Force_Per_Year
- Number_of_Labor_Force_Other_Sectors = Number_of_Workforce*Ratio_of_Labor_Force_Other_Sectors
- Number_of_Livestock_Labor_Force = Number_of_Agriculture__Labor_Force*Ratio_of_Livestock_Labor_Force
- Number_of_Non_Ecotourism_Labor_Force = Average_Number_of_Absorbed_Non_Ecotourism_Labor_Force*Submodel_Land_Usage_&_Tourism_Object.Increasing_Number_of__Non_Ecotourism_Object
- Number_of_Tourism__Labor_Force = Number_of_Ecotourism__Labor_Force+Number_of_Non_Ecotourism_Labor_Force
- Number_of_Workforce = ROUND(Population_of__Kabupaten_Malang*Fraction_of_Workforce)
- Number_of__Unemployment = Number_of_Workforce-Number_of_Absorbed__Labor_Force
- Out_Migration_Level = 0.0097
- Ratio_of_Agriculture_Labor_Force = 0.2975
- Ratio_of_Labor_Force_Other_Sectors = 0.5031
- Ratio_of_Livestock_Labor_Force = 0.203
- Ratio_of__Unemployment = Number_of__Unemployment/Number_of_Workforce

Submodel Land Usage & Tourism Object:

Number_of_Non_Ecotourism_Object(t) = Number_of_Non_Ecotourism_Object(t - dt) + (Increasing_Rate_of_Non_Ecotourism_Object) * dt
INIT Number_of_Non_Ecotourism_Object = 88
INFLOWS:
- Increasing_Rate_of_Non_Ecotourism_Object = Increasing_Number_of__Non_Ecotourism_Object

- Amount_of_Average_Non_Livestock_Land_Area = 0.4465
- Amount_of__Average_Livestock_Land = 0.4465
- Fraction_of_Non_Livestock_Land_Area = 0.7179
- Fraction_of__Livestock_Land = 0.003
- Increasing_Number_od_Livestock_Ecotourism_Object = Number_of__Livestock_Ecotourism_Object-Number_of__Livestock_Ecotourism_Object_Delay
- Increasing_Number_of_Non_Livestock_Ecotourism_Object = Number_of_Non_Livestock_Ecotourism_Object-Number_of_Non_Livestock_Ecotourism_Object_Delay
- Increasing_Number_of__Ecotourism_Object = Increasing_Number_od_Livestock_Ecotourism_Object+Increasing_Number_of_Non_Livestock_Ecotourism_Object

○ Land_Area_of_Kabupaten_Malang = 353.486
○ Livestock_Land_Area = Fraction_of__Livestock_Land*Land_Area_of_Kabupaten_Malang
○ Livestock_Land_Not_for_Ecotourism = Livestock_Land_Area-Livestock_Land__for_Ecotourism
○ Livestock_Land__for_Ecotourism = Amount_of__Average_Livestock_Land*Number_of__Livestock_Ecotourism_Object
○ Non_Livestock_Land_Area = Fraction_of_Non_Livestock_Land_Area*Land_Area_of_Kabupaten_Malang
○ Non_Livestock_Land_for_Ecotourism = Amount_of_Average_Non_Livestock_Land_Area*Number_of_Non_Livestock_Ecotourism_Object
○ Non_Livestock_Land_Not_for_Ecotourism = Non_Livestock_Land_Area-Non_Livestock_Land_for_Ecotourism
○ Number_of_Ecotourism_Object = Number_of_Non_Livestock_Ecotourism_Object+Number_of__Livestock_Ecotourism_Object
○ Number_of_Non_Livestock_Ecotourism_Object_Delay = DELAY(Number_of_Non_Livestock_Ecotourism_Object,1)
○ Number_of__Livestock_Ecotourism_Object_Delay = DELAY(Number_of__Livestock_Ecotourism_Object,1)
○ Increasing_Number_of__Non_Ecotourism_Object = GRAPH(TIME)
(2013, 0.00), (2014, 0.00), (2015, 16.0), (2016, 0.00), (2017, 0.00), (2018, 19.0), (2019, 0.00), (2020, 0.00), (2021, 21.0), (2022, 0.00), (2023, 0.00), (2024, 26.0), (2025, 0.00)
○ Number_of_Non_Livestock_Ecotourism_Object = GRAPH(TIME)
(2013, 8.00), (2014, 9.00), (2015, 13.0), (2016, 16.0), (2017, 19.0), (2018, 23.0), (2019, 27.0), (2020, 31.0), (2021, 36.0), (2022, 41.0), (2023, 46.0), (2024, 52.0), (2025, 59.0)
○ Number_of__Livestock_Ecotourism_Object = GRAPH(TIME)
(2013, 0.00), (2014, 1.00), (2015, 1.00), (2016, 1.00), (2017, 2.00), (2018, 2.00), (2019, 2.00), (2020, 3.00), (2021, 3.00), (2022, 3.00), (2023, 4.00), (2024, 4.00), (2025, 4.00)

Submodel OSR & GRDP of Kabupaten Malang:

□ GRDP_of_Kabupaten_Malang(t) = GRDP_of_Kabupaten_Malang(t - dt) + (GRDP_Revenue) * dt
INIT GRDP_of_Kabupaten_Malang = 46830737760000
INFLOWS:
GRDP_Revenue = GRDP_of_Other_Sectors+Submodel_GRDP_of_Livestock.Rate_of_GRDP_Revenue_Per_Year
□ GRDP_of_Other_Sectors(t) = GRDP_of_Other_Sectors(t - dt) + (Increasing_GRDP_of_Other_Sectors) * dt
INIT GRDP_of_Other_Sectors = 35385333760000
INFLOWS:
Increasing_GRDP_of_Other_Sectors = GRDP_of_Other_Sectors*Increasing_Rate_of_GRDP_Other_Sectors
□ OSR_Kabupaten_Malang(t) = OSR_Kabupaten_Malang(t - dt) + (Other_Revenues + Retribution_of__Kabupaten_Malang + Tax_Revenue_of__Kabupaten_Malang) * dt
INIT OSR_Kabupaten_Malang = 260582631310
INFLOWS:
Other_Revenues = Natural_Resources_Product+Other_Formal_Revenues
Retribution_of__Kabupaten_Malang = Total_of_Other_Sector_Retribution+Total_of__Tourism_Retribution
Tax_Revenue_of__Kabupaten_Malang = Property_Revenue+Revenue_of_Tourism_Tax+Revenue_of__Other_Taxes
○ GRDP_of_Kabupaten_Malang_Delay = DELAY(GRDP_of_Kabupaten_Malang,1)
○ GRDP_of_Kabupaten_Malang_Per_Year = IF TIME=2013 THEN GRDP_of_Kabupaten_Malang ELSE GRDP_of_Kabupaten_Malang-GRDP_of_Kabupaten_Malang_Delay
○ Increasing_Rate_of_GRDP_Other_Sectors = 0.17
○ OSR_Kabupaten__Malang_Delay = DELAY(OSR_Kabupaten_Malang,1)
○ OSR_Kabupaten__Malang_Per_Year = IF TIME=2013 THEN OSR_Kabupaten_Malang ELSE OSR_Kabupaten_Malang-OSR_Kabupaten__Malang_Delay
○ OSR_Per_Year = Other_Revenues+Retribution_of__Kabupaten_Malang+Tax_Revenue_of__Kabupaten_Malang
○ Property_Revenue = Property_Revenue_of_Other_Sectors+Property_Revenue__of_Tourism
○ Property_Revenue__of_Tourism = (Tarrif_of_Property_Tax*(Submodel_Land_Usage_&_Tourism_Object.Number_of_Non_Ecotourism_Object+Submodel_Land_Usage_&_Tourism_Object.Number_of_Ecotourism_Object))
○ Proportion_of_Tourism_Retribution = 0.1
○ Retribution_Cost_of_Non_Ecotourism = Proportion_of_Tourism_Retribution*Ticket_Price_of_Non_Ecotourism_Object
○ Retribution_Cost__of_Ecotourism = Proportion_of_Tourism_Retribution*Ticket_Price_of_Ecotourism_Object
○ Revenue_of_Ecotourism_Object = Ticket_Price_of_Ecotourism_Object*Submodel_Tourist.Number_of_Tourists_Ecotourism
○ Revenue_of_Non_Ecotourism_Object = Ticket_Price_of_Non_Ecotourism_Object*Submodel_Tourist.Number_of_Tourist_Non_Ecotourism
○ Revenue_of_Tourism_Tax = Total_of_Ecotourism_Tax+Total_of_Non_Ecotourism_Tax
○ Tarrif_of_Property_Tax = 1880000
○ Tarrif_of_Tourism_Tax = 0.3
○ Ticket_Price_of_Ecotourism_Object = 10000
○ Ticket_Price_of_Non_Ecotourism_Object = 20000
○ Total_Ecotourism_Retribution = Retribution_Cost__of_Ecotourism*Submodel_Tourist.Number_of_Tourists_Ecotourism
○ Total_of_Ecotourism_Tax = (Revenue_of_Ecotourism_Object*Tarrif_of_Tourism_Tax)
○ Total_of_Non_Ecotourism_Retribution = Retribution_Cost_of_Non_Ecotourism*Submodel_Tourist.Number_of_Tourist_Non_Ecotourism
○ Total_of_Non_Ecotourism_Tax = (Revenue_of_Non_Ecotourism_Object*Tarrif_of_Tourism_Tax)
○ Total_of__Tourism_Retribution = Total_Ecotourism_Retribution+Total_of_Non_Ecotourism_Retribution
○ Natural_Resources_Product = GRAPH(TIME)
(2013, 1.3e+010), (2014, 1.5e+010), (2015, 1.7e+010), (2016, 1.8e+010), (2017, 2e+010), (2018, 2.2e+010), (2019, 2.3e+010), (2020, 2.5e+010), (2021, 2.6e+010), (2022, 2.8e+010), (2023, 3e+010), (2024, 3.1e+010), (2025, 3.3e+010)
○ Other_Formal_Revenues = GRAPH(TIME)
(2013, 1.9e+011), (2014, 2.8e+011), (2015, 4.1e+011), (2016, 5.5e+011), (2017, 7.3e+011), (2018, 9.2e+011), (2019, 1.1e+012), (2020, 1.4e+012), (2021, 1.7e+012), (2022, 2e+012), (2023, 2.3e+012), (2024, 2.7e+012), (2025, 3e+012)

Property_Revenue_of_Other_Sectors = GRAPH(TIME)
(2013, 9.6e+010), (2014, 8.6e+010), (2015, 1e+011), (2016, 1.2e+011), (2017, 1.4e+011), (2018, 1.6e+011), (2019, 1.7e+011), (2020, 1.9e+011), (2021, 2.1e+011), (2022, 2.3e+011), (2023, 2.4e+011), (2024, 2.6e+011), (2025, 2.8e+011)
Revenue_of__Other_Taxes = GRAPH(TIME)
(2013, 4.2e+010), (2014, 9.5e+010), (2015, 1.4e+011), (2016, 1.9e+011), (2017, 2.4e+011), (2018, 3.1e+011), (2019, 3.9e+011), (2020, 4.8e+011), (2021, 5.7e+011), (2022, 6.7e+011), (2023, 7.9e+011), (2024, 9.1e+011), (2025, 1e+012)
Total_of_Other_Sector_Retribution = GRAPH(TIME)
(2013, 4.7e+010), (2014, 5e+010), (2015, 5.3e+010), (2016, 5.6e+010), (2017, 5.8e+010), (2018, 5.9e+010), (2019, 6e+010), (2020, 6.1e+010), (2021, 6.1e+010), (2022, 6e+010), (2023, 5.9e+010), (2024, 5.7e+010), (2025, 5.5e+010)

Submodel Pollution:

Pollution__of_Kabupaten_Malang(t) = Pollution__of_Kabupaten_Malang(t - dt) + (Increasing_Pollution_of_Kabupaten_Malang) * dt
INIT Pollution__of_Kabupaten_Malang = 151763.04
INFLOWS:
Increasing_Pollution_of_Kabupaten_Malang =
Gas_Pollution_from_Livestock_Stool+Gas_Pollution_from_Vehicle+Gas_Pollution_from_Waste_Per_Year
Average_Number_of_Livestock_Animals_in_Ecotourism_Object = 5
Average_Number_of_Passangers_Per_Vehicle = 50
CO2_Emission_of_Waste_Pollution_Per_Litre = 0.075
CO2_Emission__Factor_Per_Vehicle = 20.93
Gas_Pollution_from_Livestock_Stool =
Gas_Polution_of_Livestock's_Stool_Ecotourism_Object+Gas_Polution_of_Livestock's_Stool_Non_Ecotourism_Object
Gas_Pollution_from_Vehicle = Gas_Pollution_of_Ecotourism_Transportation+Gas_Pollution_of_Non_Ecotourism_Transportation
Gas_Pollution_from_Waste_Per_Year = { Place right hand side of equation here...
}Waste_Pollution_of_Ecotourism_Object_Per_Year+Waste_Pollution_of_Non_Ecotourism_Object_Per_Year
Gas_Pollution_of_Ecotourism_Transportation = (CO2_Emission__Factor_Per_Vehicle*Number_of_Ecotourism_Transportation)/1000
Gas_Pollution_of_Non_Ecotourism_Transportation =
(CO2_Emission__Factor_Per_Vehicle*Number_of_Non_Ecotourism_Transportation)/1000
Gas_Pollution_Rate_of_Livestock's_Stool = 23
Gas_Polution_of_Livestock's_Stool_Ecotourism_Object =
(Gas_Pollution_Rate_of_Livestock's_Stool*Stool_Pollution_of_Ecotourism_Object)/1000
Gas_Polution_of_Livestock's_Stool_Non_Ecotourism_Object =
(Gas_Pollution_Rate_of_Livestock's_Stool*Stool_Pollution_of_Non_Ecotourism_Object)/1000
Number_of_Ecotourism_Transportation =
Submodel_Tourist.Number_of_Tourists_Ecotourism/Average_Number_of_Passangers_Per_Vehicle
Number_of_Litre_Waste_Per_Ecotourism_Object_Per_Day = 150
Number_of_Litre_Waste_Per_Non_Ecotourism_Object_Per_Day = 250
Number_of_Non_Ecotourism_Transportation =
Submodel_Tourist.Number_of_Tourist_Non_Ecotourism/Average_Number_of_Passangers_Per_Vehicle
Stool_Pollution_of_Ecotourism_Object =
Average_Number_of_Livestock_Animals_in_Ecotourism_Object*Stool_Production_Per_Animal_Per_Day*Submodel_Land_Usage_&_Tourism_Object.Number_of__Livestock_Ecotourism_Object
Stool_Pollution_of_Non_Ecotourism_Object =
Average_Number_of_Livestock_Animals_in_Non_Ecotourism_Object*Number_of__Livestock_Non_Ecotourism_Object*Stool_Production_Per_Animal_Per_Day
Stool_Production_Per_Animal_Per_Day = 25
Waste_Pollution_of_Ecotourism_Object_Per_Year =
(Submodel_Land_Usage_&_Tourism_Object.Number_of_Ecotourism_Object*CO2_Emission_of_Waste_Pollution_Per_Litre*(Number_of_Litre_Waste_Per_Ecotourism_Object_Per_Day*250))/1000
Waste_Pollution_of_Non_Ecotourism_Object_Per_Year =
(Submodel_Land_Usage_&_Tourism_Object.Number_of_Non_Ecotourism_Object*CO2_Emission_of_Waste_Pollution_Per_Litre*(Number_of_Litre_Waste_Per_Non_Ecotourism_Object_Per_Day*250))/1000
Average_Number_of_Livestock_Animals_in_Non_Ecotourism_Object = GRAPH(TIME)
(2013, 5.00), (2014, 5.00), (2015, 5.00), (2016, 8.00), (2017, 8.00), (2018, 8.00), (2019, 11.0), (2020, 11.0), (2021, 11.0), (2022, 14.0), (2023, 14.0), (2024, 14.0), (2025, 17.0)
Number_of__Livestock_Non_Ecotourism_Object = GRAPH(TIME)
(2013, 52272), (2014, 55027), (2015, 61409), (2016, 63468), (2017, 65529), (2018, 67593), (2019, 69660), (2020, 71729)

Submodel Tourist:

Number_of_Tourists_Kabupaten_Malang(t) = Number_of_Tourists_Kabupaten_Malang(t - dt) + (Increasing_Number_of_Tourists) * dt
INIT Number_of_Tourists_Kabupaten_Malang = 2384478
INFLOWS:
Increasing_Number_of_Tourists = Number_of_Increased_Tourists*Number_of_Tourism_Promotion_Per_Year
Fraction_of__Livestock's_Customer = 0.03
Number_of_Livestock's_Customer_from_Tourists = Fraction_of__Livestock's_Customer*Number_of_Livestock_Tourists
Number_of_Livestock_Tourists = Number_of_Tourists_Ecotourism*Proportion_of_Livestock_Tourists
Number_of_Tourists_Ecotourism = Number_of_Tourists_Kabupaten_Malang*Proportion_of_Tourists_Ecotourism
Number_of_Tourist_Non_Ecotourism = ROUND(Number_of_Tourists_Kabupaten_Malang*(1-Proportion_of_Tourists_Ecotourism))
Proportion_of_Livestock_Tourists = 0.2
Proportion_of_Tourists_Ecotourism = 0.02
Number_of_Increased_Tourists = GRAPH(TIME)
(2013, 41501), (2014, 18077), (2015, 22629), (2016, 28183), (2017, 29503), (2018, 32367), (2019, 33199), (2020, 37282), (2021, 38799), (2022, 41234), (2023, 41966), (2024, 44895), (2025, 53318)
Number_of_Tourism_Promotion_Per_Year = GRAPH(TIME)
(2013, 5.00), (2014, 6.00), (2015, 6.00), (2016, 7.00), (2017, 8.00), (2018, 8.00), (2019, 9.00), (2020, 9.00), (2021, 10.0), (2022, 11.0), (2023, 11.0), (2024, 12.0), (2025, 12.0)

Data Input on Simulation Model

Period	Number of Tourism Promotion Per Year
2009	3
2010	3
2011	4
2012	5
2013	5

Source: (Tarida, 2015)

Period	Balance Funds	Other Revenues of Kabupaten Malang	Budget Allocation
2009	1,161,789,799,272.00	111,851,641,248.00	1,427,167,882,057.99
2010	1,204,222,084,704.00	330,437,923,656.00	1,665,125,923,961.92
2011	1,285,310,285,256.00	492,938,663,589.00	1,950,582,284,844.86
2012	1,547,448,684,110.00	473,701,062,959.00	2,218,403,705,873.55
2013	1,700,485,365,220.00	566,933,236,480.00	2,528,001,233,010.00
2014	1,831,998,927,025.00	815,487,243,701.00	3,058,669,154,996.78

Source: (Pemerintah Kabupaten Malang, 2010-2015)

Budget of Increasing Livestock Productivity (Rp)	2011		2012		2013		2014	
	Budget	Realization	Budget	Realization	Budget	Realization	Budget	Realization
Livestock's Budget	4,138,940,100	4,095,697,000	10,631,995,700	10,590,837,500	10,631,995,700	10,590,837,500	10,631,995,700	10,590,837,500
Livestock Disease Prevention	-	-	-	1,689,140,800	-	1,828,174,000	-	1,828,174,000
Increasing Livestock Apllication technology	-	-	730,000,000	723,650,000	717,300,000	710,950,000	704,600,000	698,250,000
Increasing Livestock Product	2,920,141,000	2,892,242,000	7,940,417,700	7,917,584,700	7,894,751,700	7,871,918,700	7,849,085,700	7,826,252,700

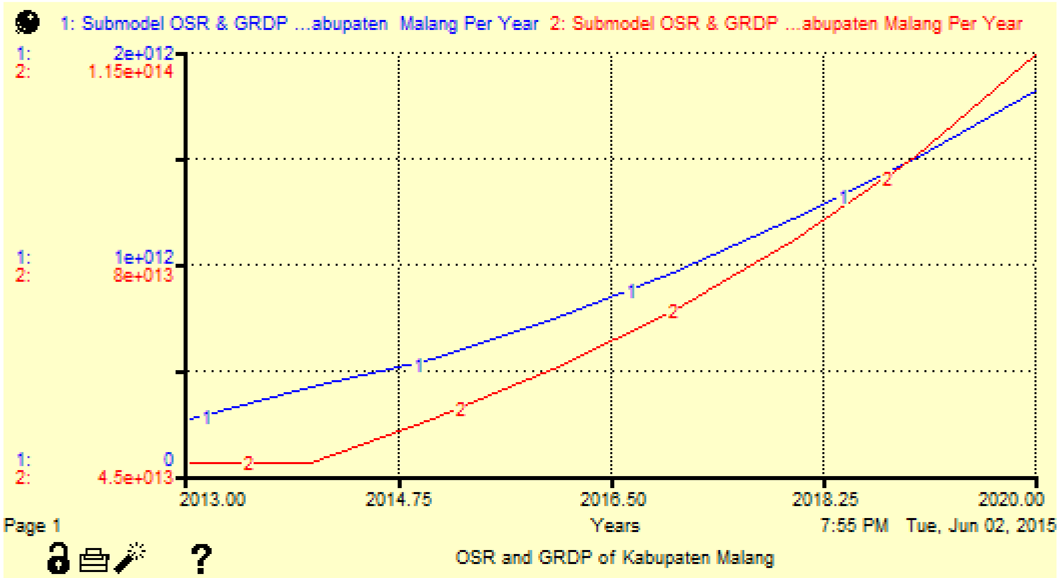
Source: (Pemerintah Kabupaten Malang, 2010-2015)

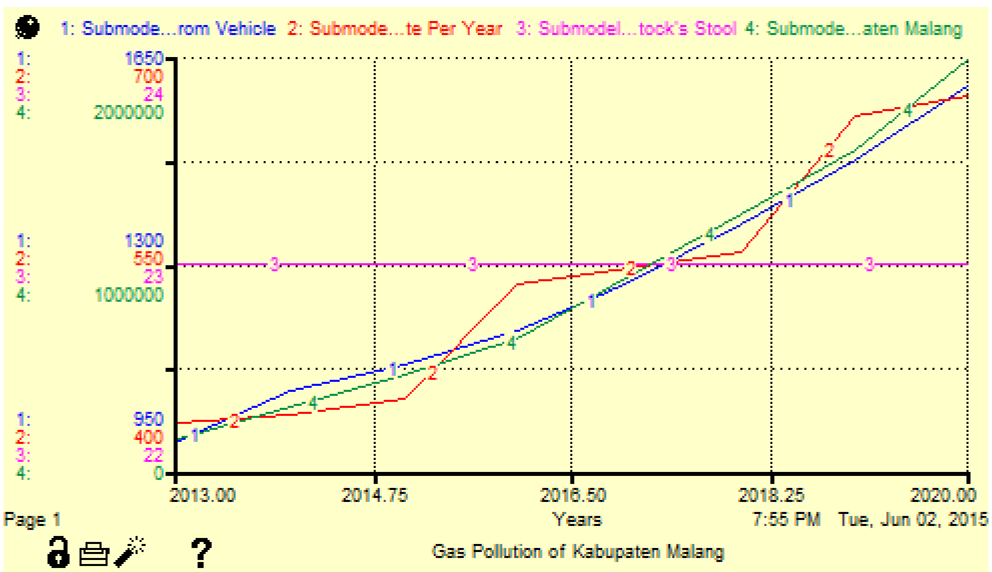
Period	GRDP of Agriculture	GRDP of Other Sectors
2007	6,352,330.72	15,350,151.33
2008	7,066,445.50	17,960,417.65
2009	7,979,506.96	19,774,882.86
2010	8,621,802.45	22,768,782.06
2011	9,382,923.98	26,292,073.99
2012	10,331,892.17	30,431,920.97

Source: (Badan Perencanaan Pembangunan Daerah Kabupaten Malang, 2013)

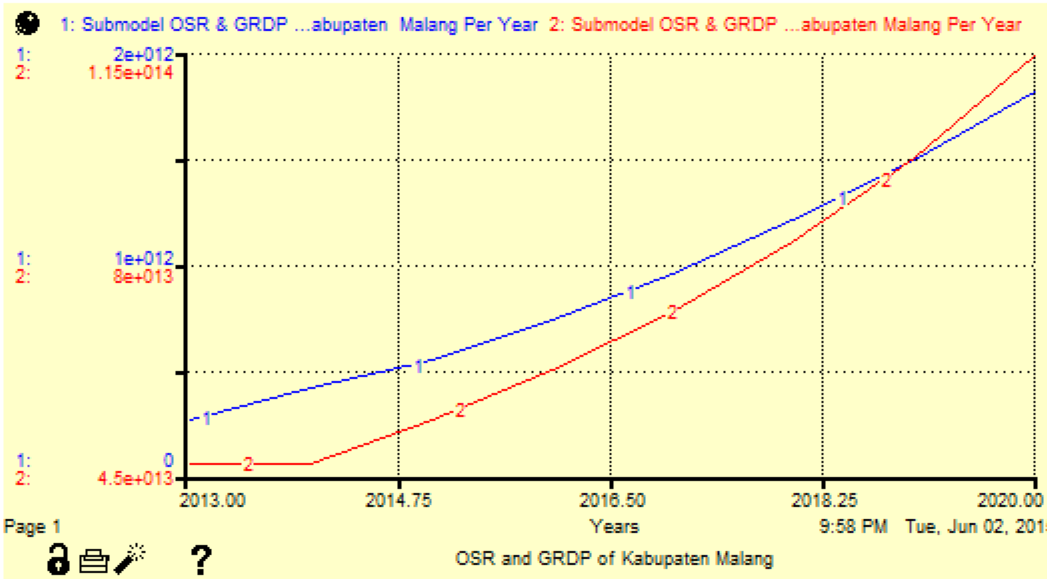
Output Simulation Graph of Each Scenario

Scenario 1





Scenario 2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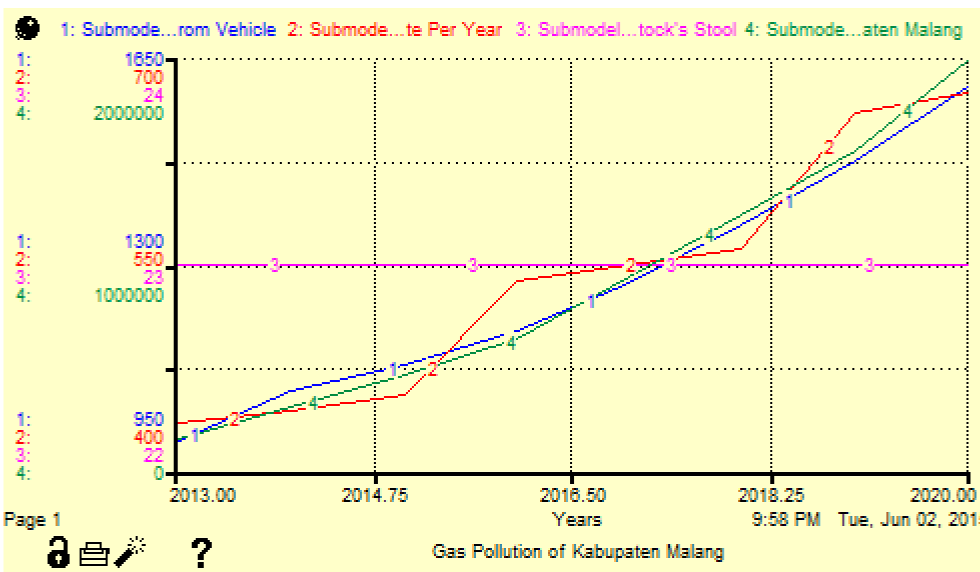
2: 1.15e+014
1: 1e+012
2: 8e+013
1: 0
2: 4.5e+013
2013.00
2014.75
2016.50
2018.25
2020.00
Page 1
Years
9:58 PM Tue, Jun 02, 2015
OSR and GRDP of Kabupaten Malang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1: 1650
2: 700
3: 24
4: 2000000
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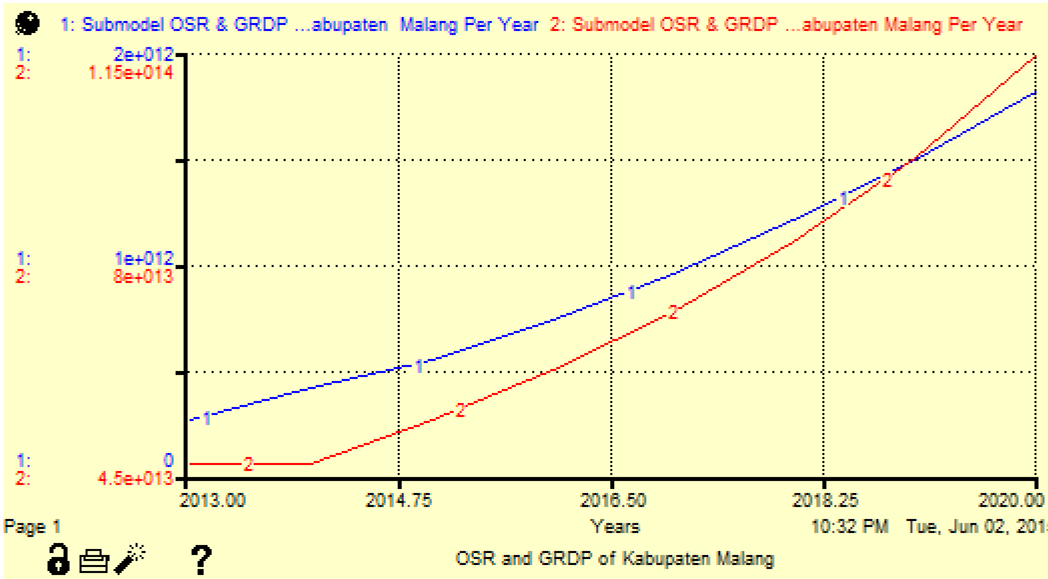
3: 23
4: 1000000
1: 950
2: 400
3: 22
4: 0
2013.00
2014.75
2016.50
2018.25
2020.00
Page 1
Years
9:58 PM Tue, Jun 02, 2015
Gas Pollution of Kabupaten Malang

Scenario 3



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1: 1e+012
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2018.25
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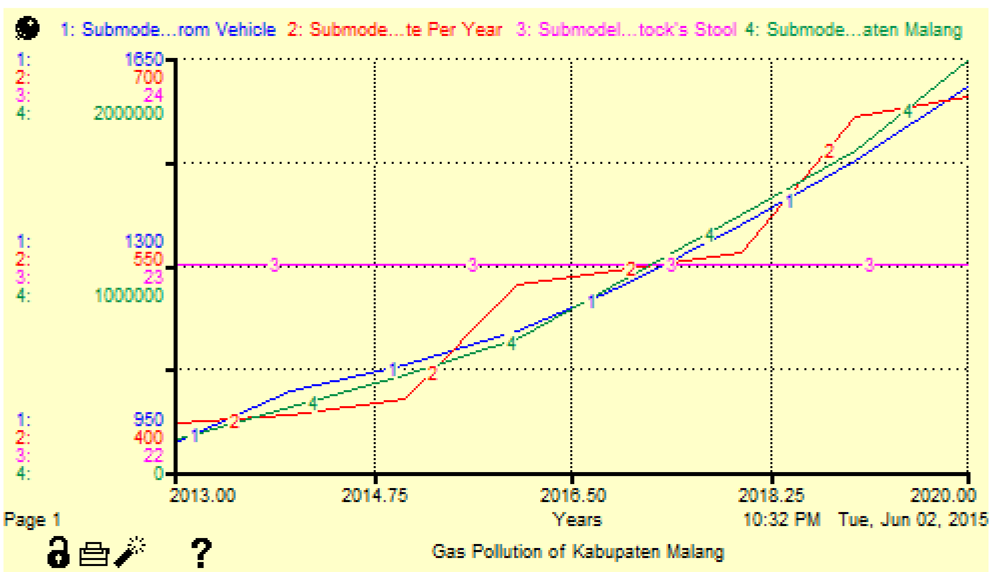
OSR and GRDP of Kabupaten Malang



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3: 24
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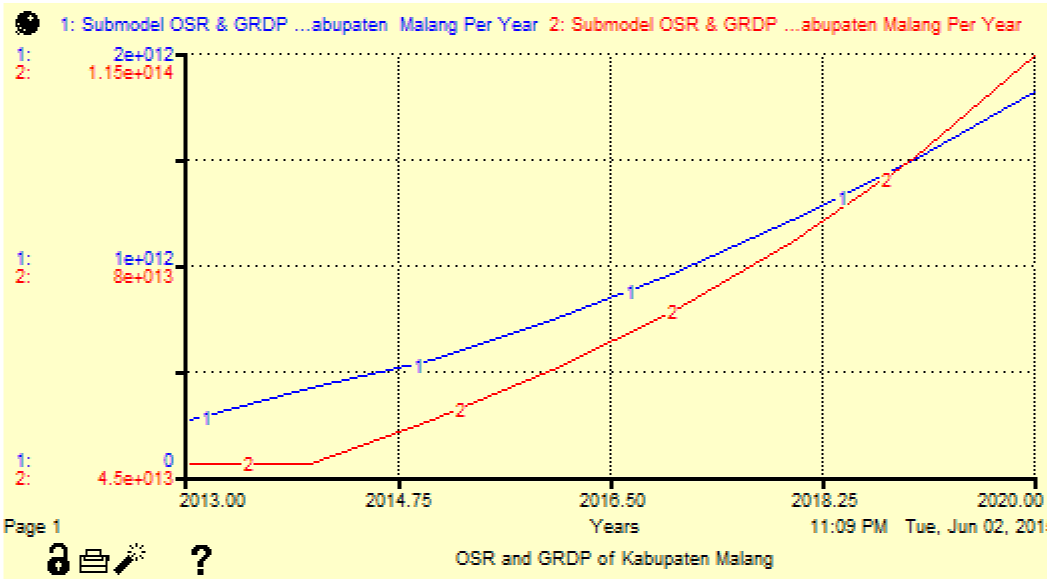
3: 23
4: 1000000
1: 950
2: 400
3: 22
4: 0
2013.00
2014.75
2016.50
2018.25
2020.00
Page 1
Years
10:32 PM Tue, Jun 02, 2015
Gas Pollution of Kabupaten Malang

Scenario 4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1: 1e+012
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1: 0
2: 4.5e+013
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2020.00
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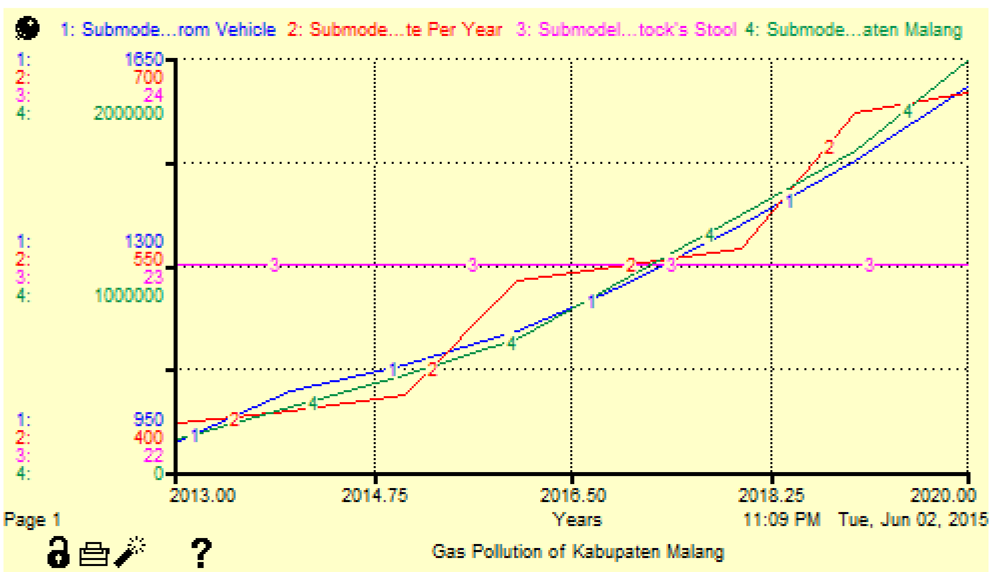
11:09 PM Tue, Jun 02, 2015
OSR and GRDP of Kabupaten Malang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2: 550
3: 23
4: 1000000
1: 950
2: 400
3: 22
4: 0
2013.00
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2020.00
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Years
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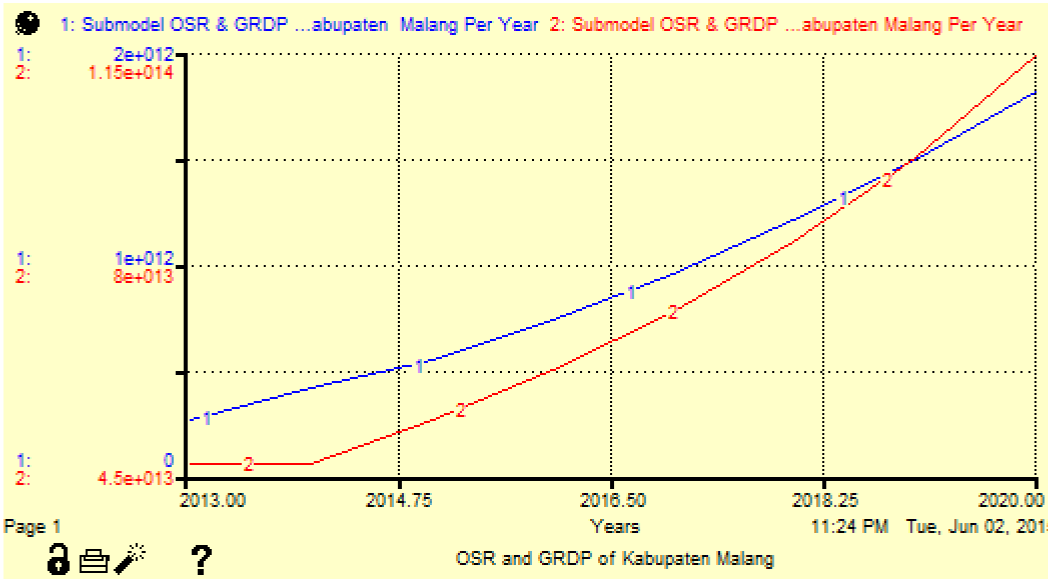
Gas Pollution of Kabupaten Malang

Scenario 5



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1: 1e+012
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1: 0
2: 4.5e+013
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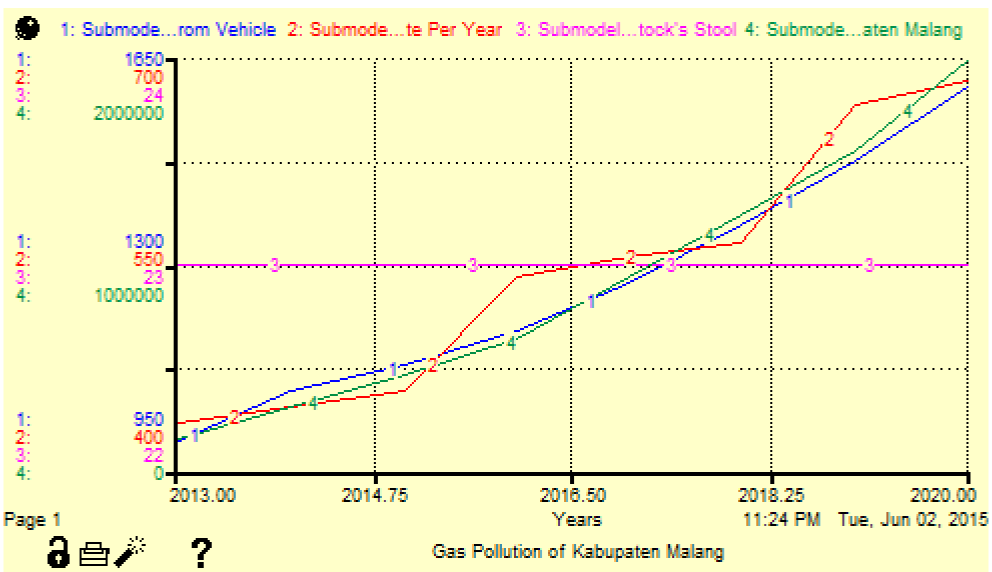
OSR and GRDP of Kabupaten Malang



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2: 700
3: 24
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3: 23
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1: 950
2: 400
3: 22
4: 0
2013.00
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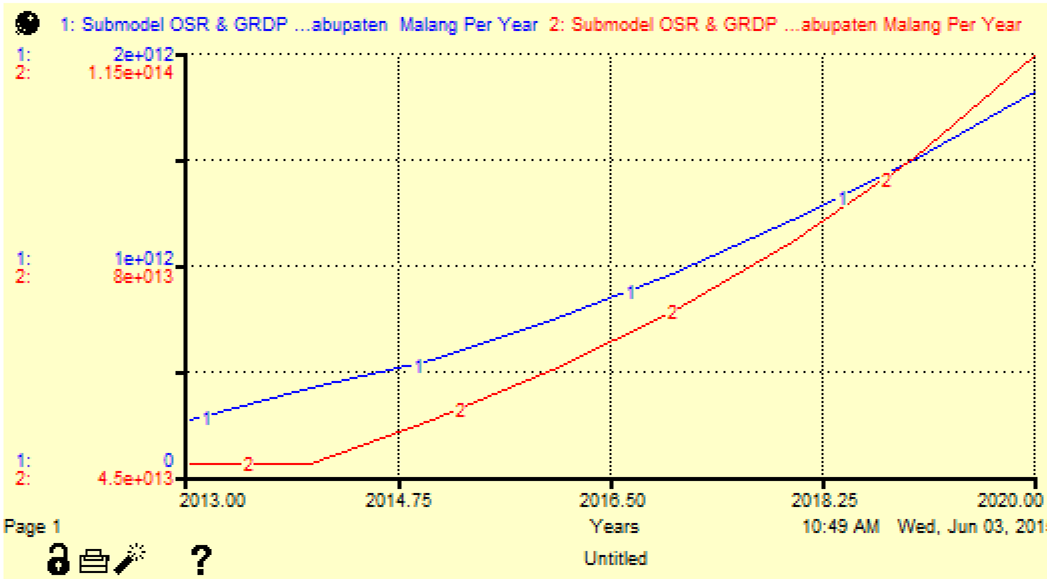
Gas Pollution of Kabupaten Malang

Scenario 6



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1: 1e+012
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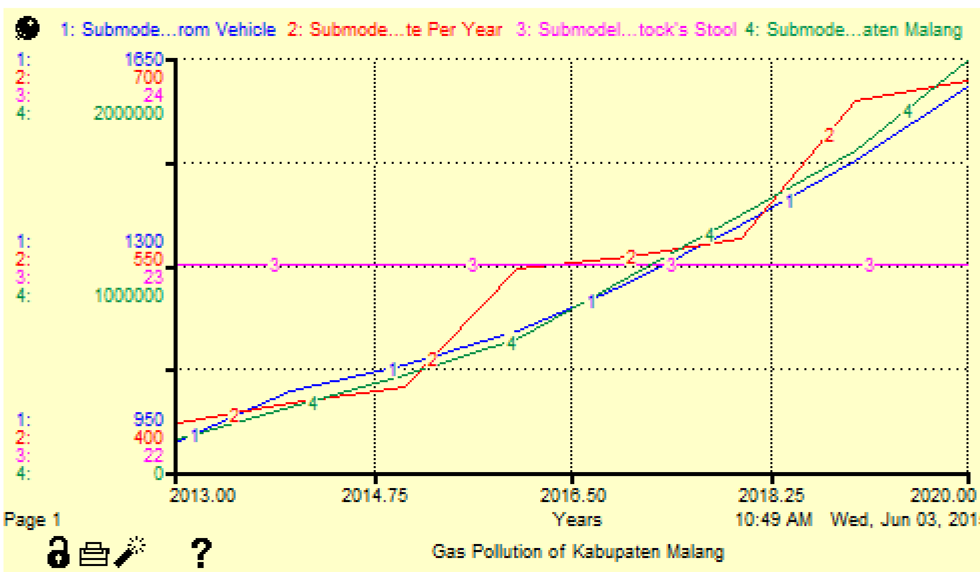

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3: 24
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3: 23
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1: 950
2: 400
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4: 0
2013.00
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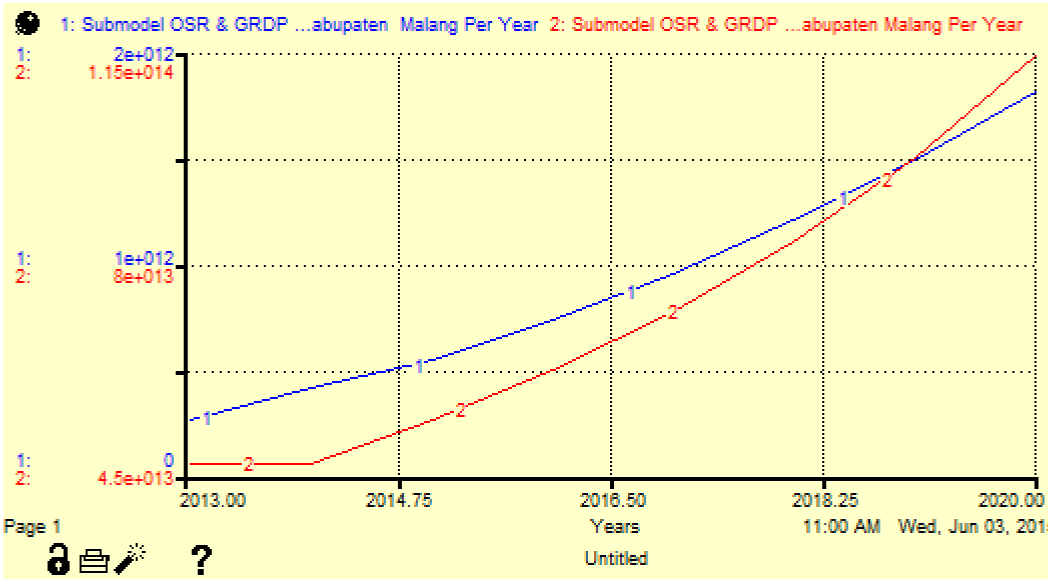
Gas Pollution of Kabupaten Malang

Scenario 7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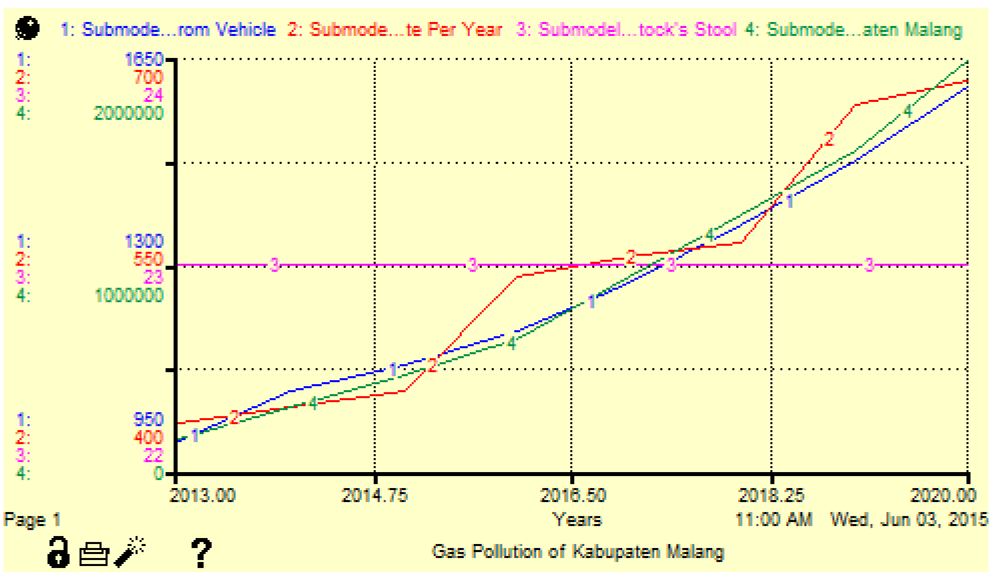
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3: 24
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2: 550
3: 23
4: 1000000
1: 950
2: 400
3: 22
4: 0
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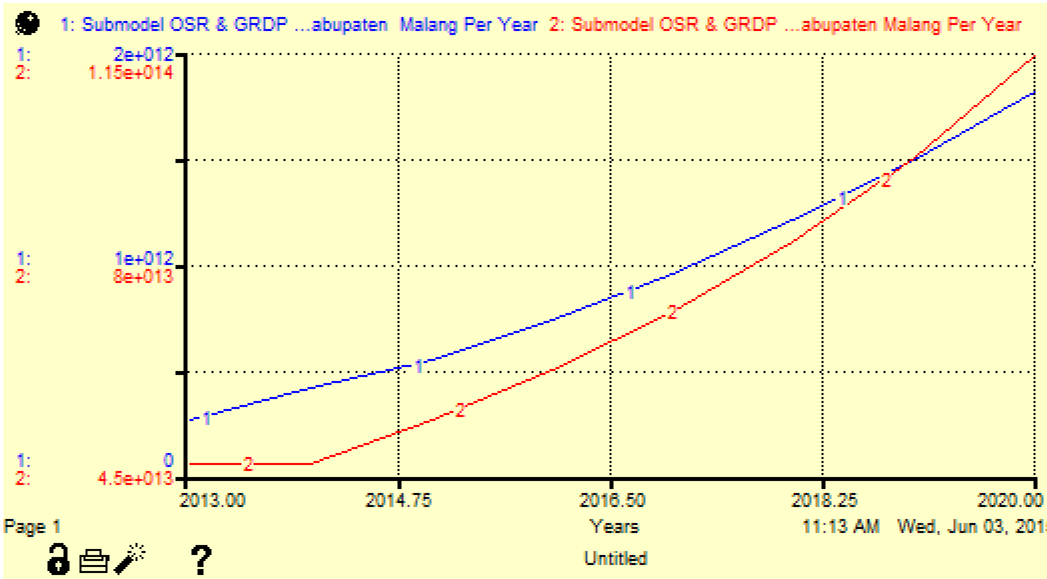
Gas Pollution of Kabupaten Malang

Scenario 8



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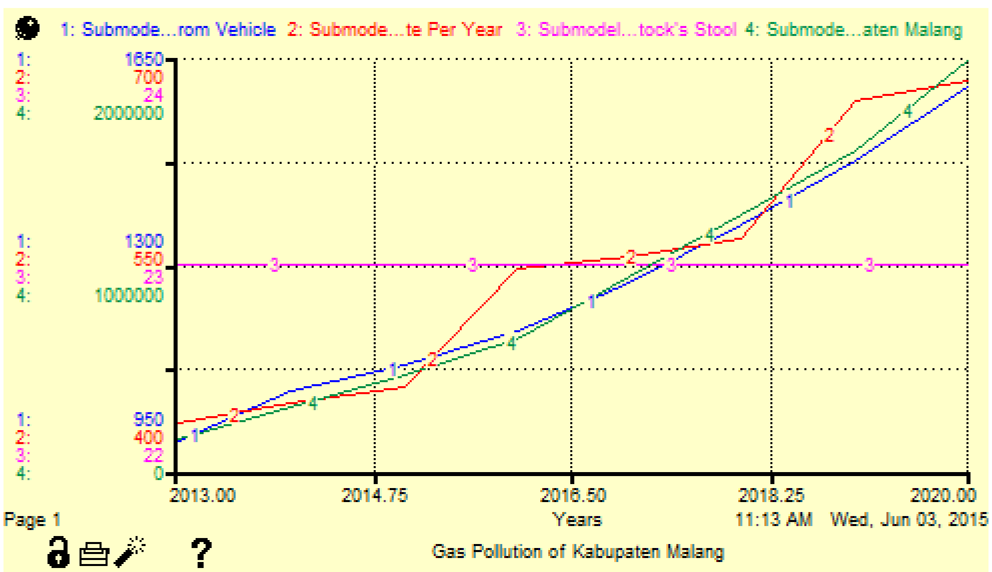

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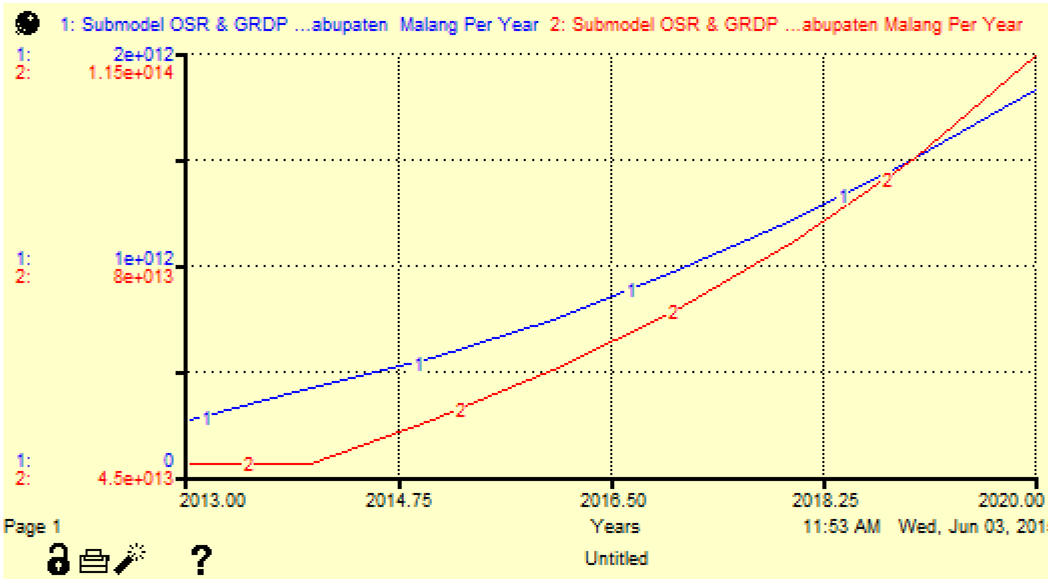
Gas Pollution of Kabupaten Malang

Scenario 9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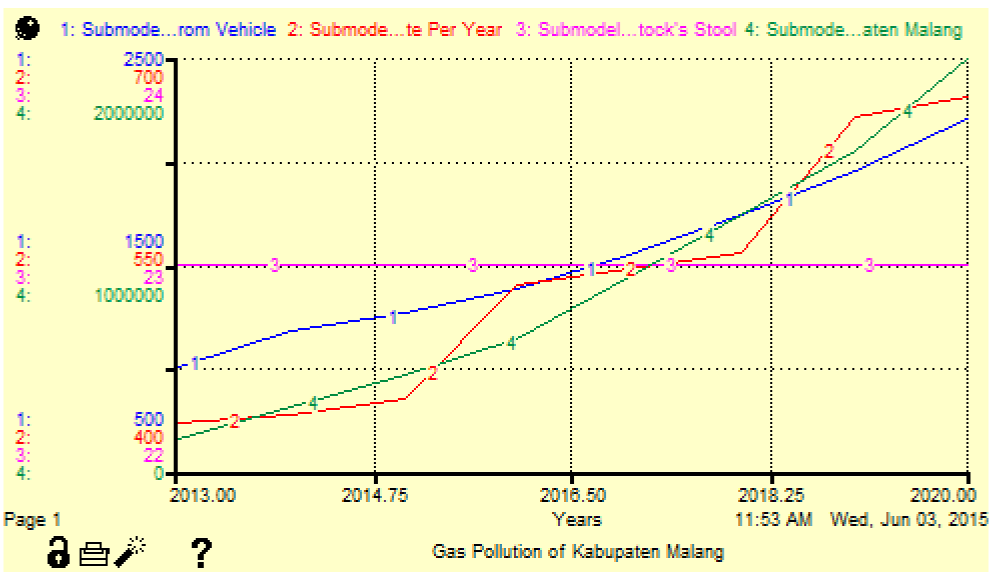
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4: 0
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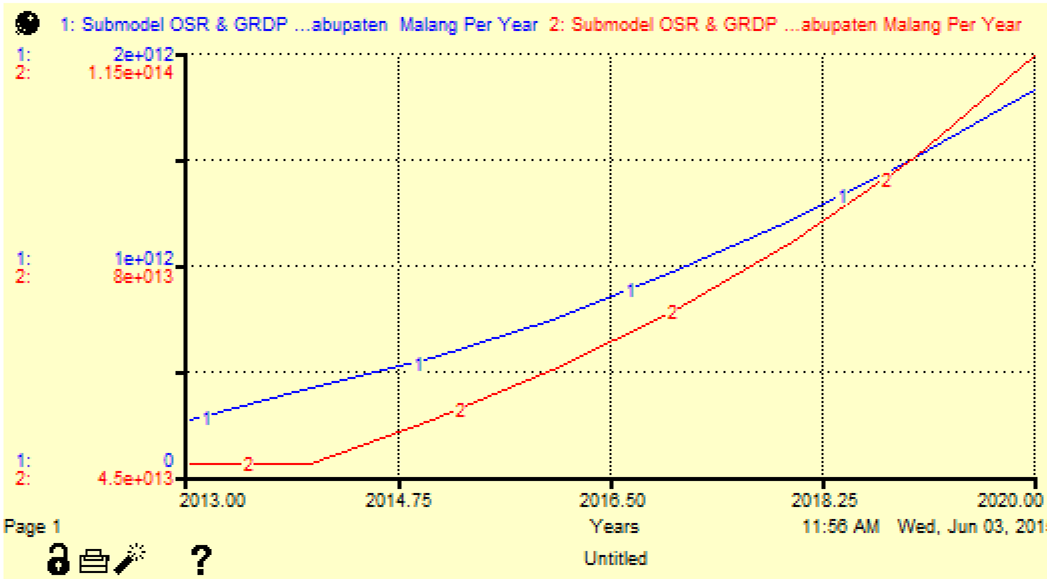
Gas Pollution of Kabupaten Malang

Scenario 10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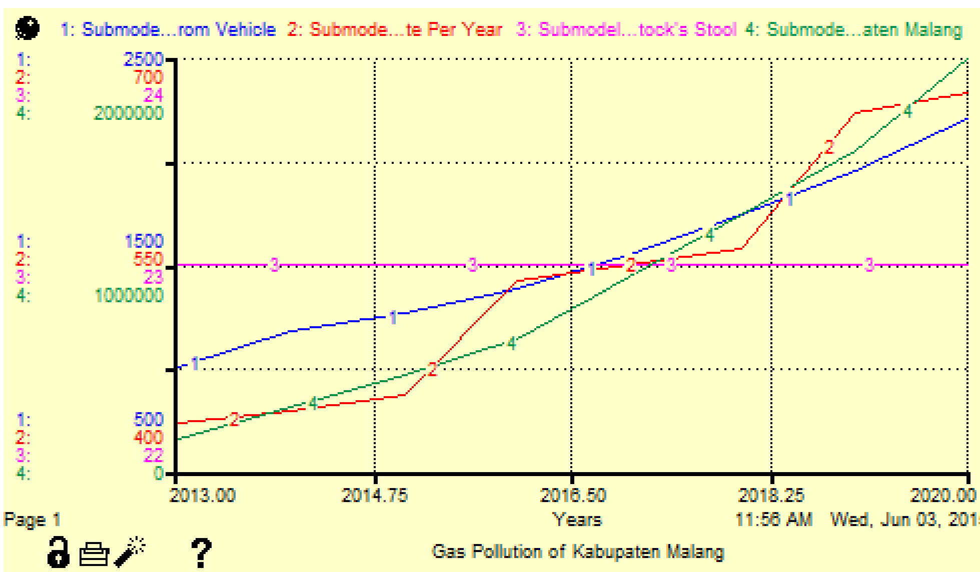
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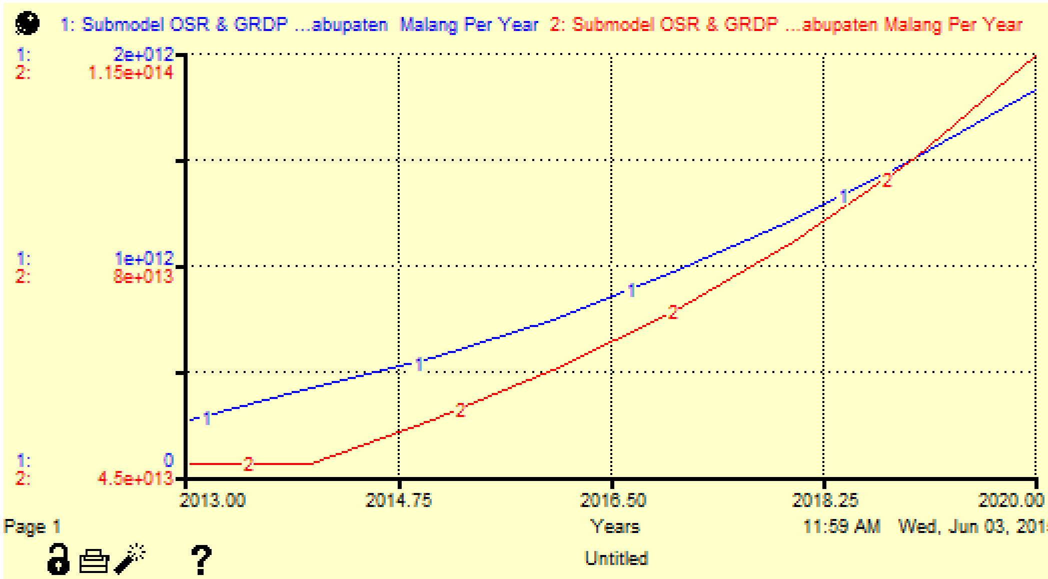
Years
11:56 AM Wed, Jun 03, 2015
Gas Pollution of Kabupaten Malang

Scenario 11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1: 1e+012
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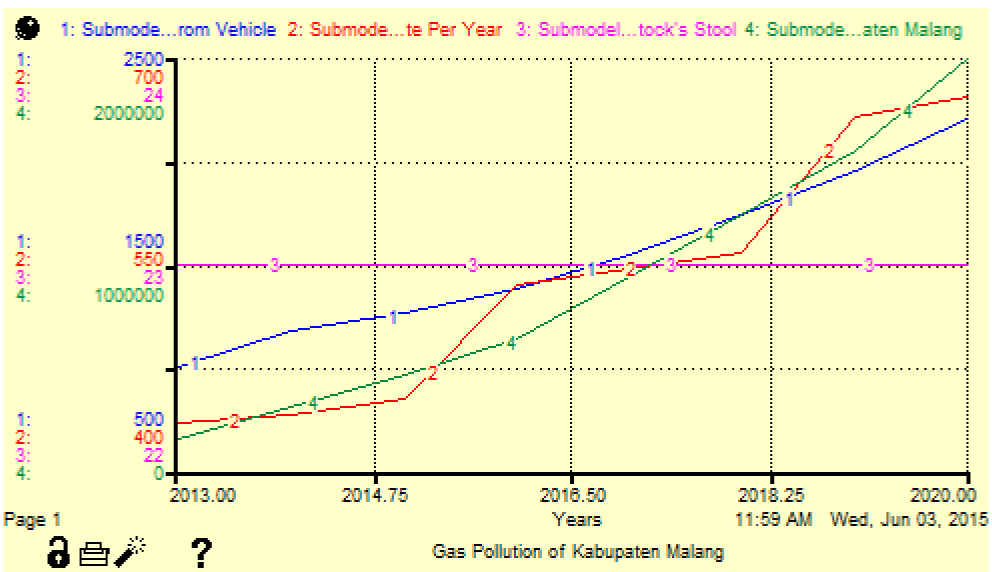
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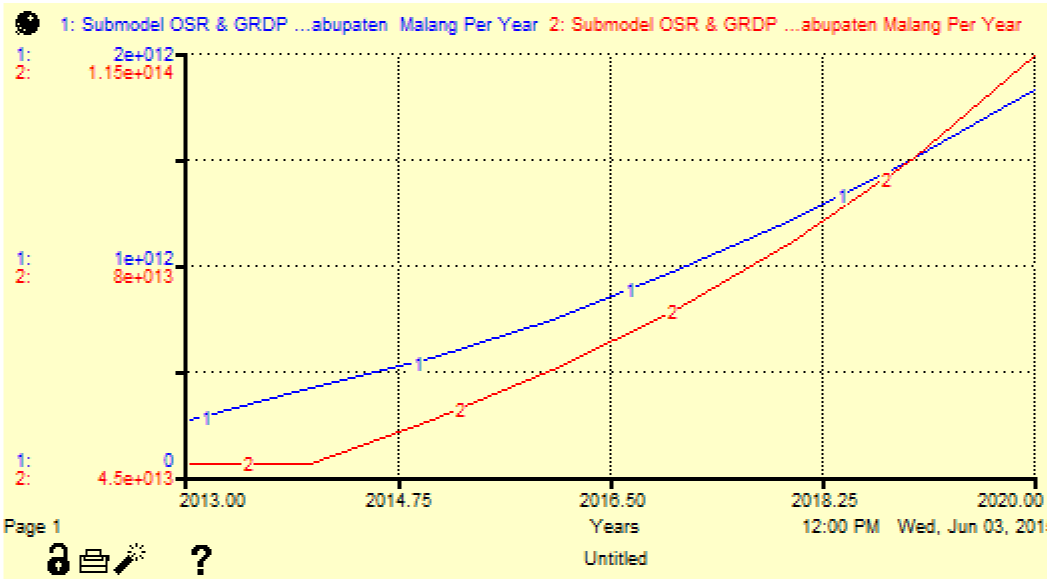
Gas Pollution of Kabupaten Malang

Scenario 12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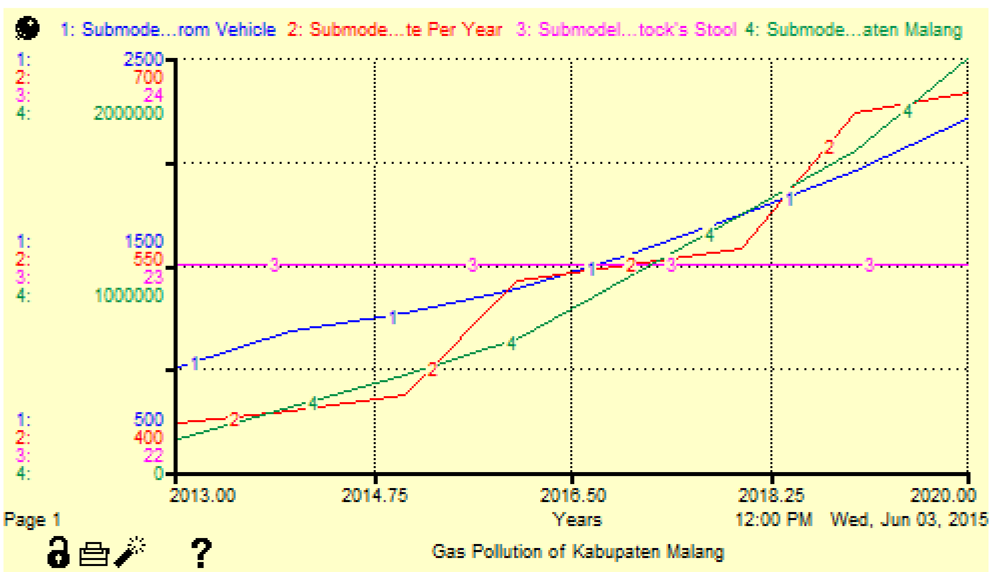
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1: 500
2: 400
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4: 0
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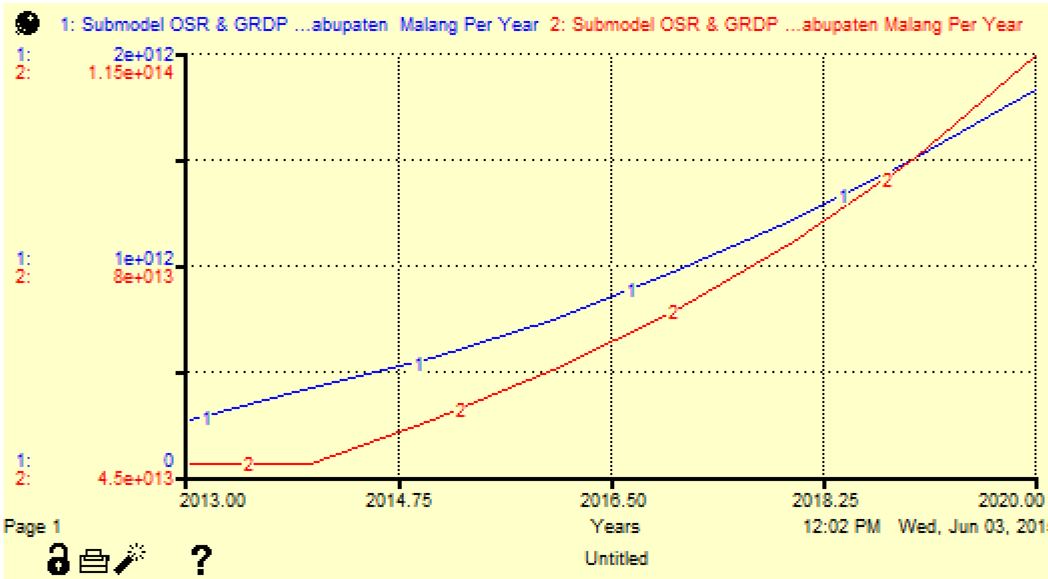
Page 1
Years
12:00 PM Wed, Jun 03, 2015
Gas Pollution of Kabupaten Malang

Scenario 13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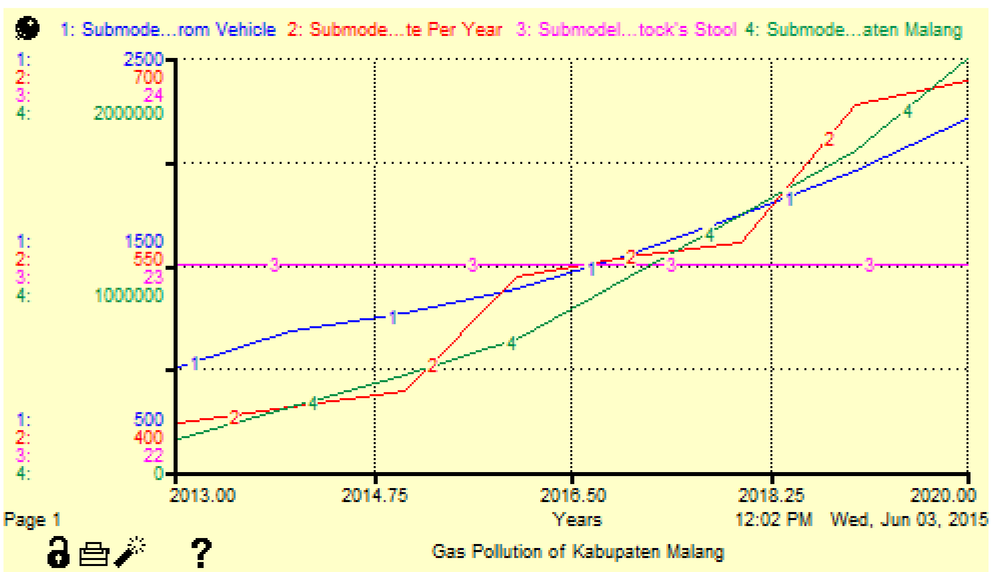
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1: 500
2: 400
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4: 0
2013.00
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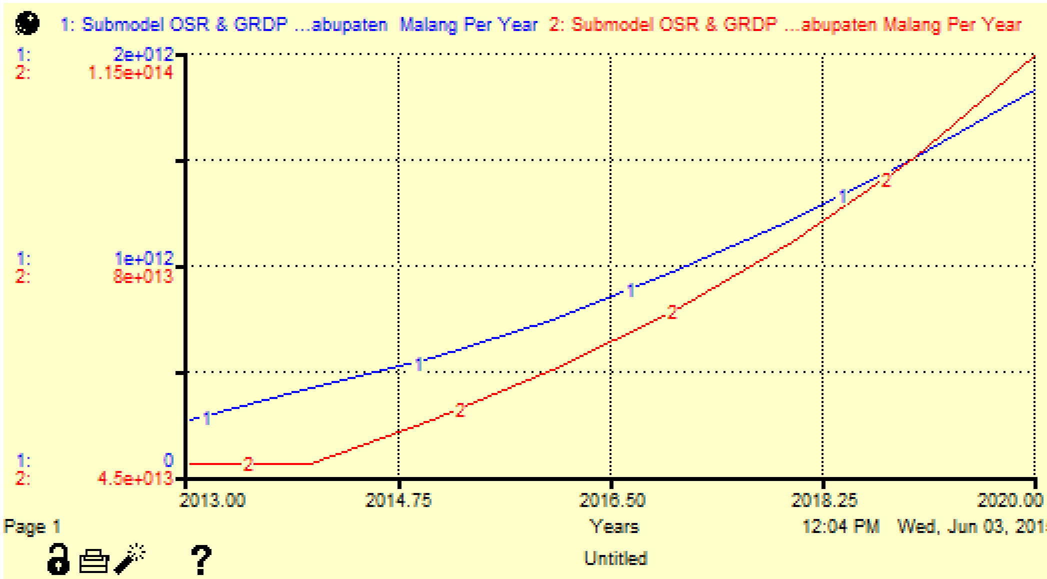
Years
12:02 PM Wed, Jun 03, 2015
Gas Pollution of Kabupaten Malang

Scenario 14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1: 1e+012
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2020.00
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Years
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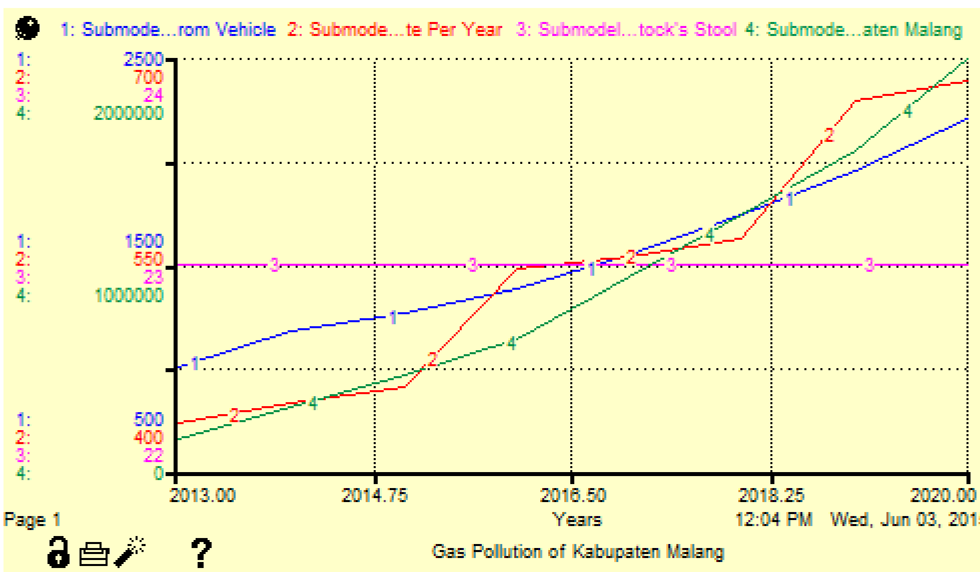
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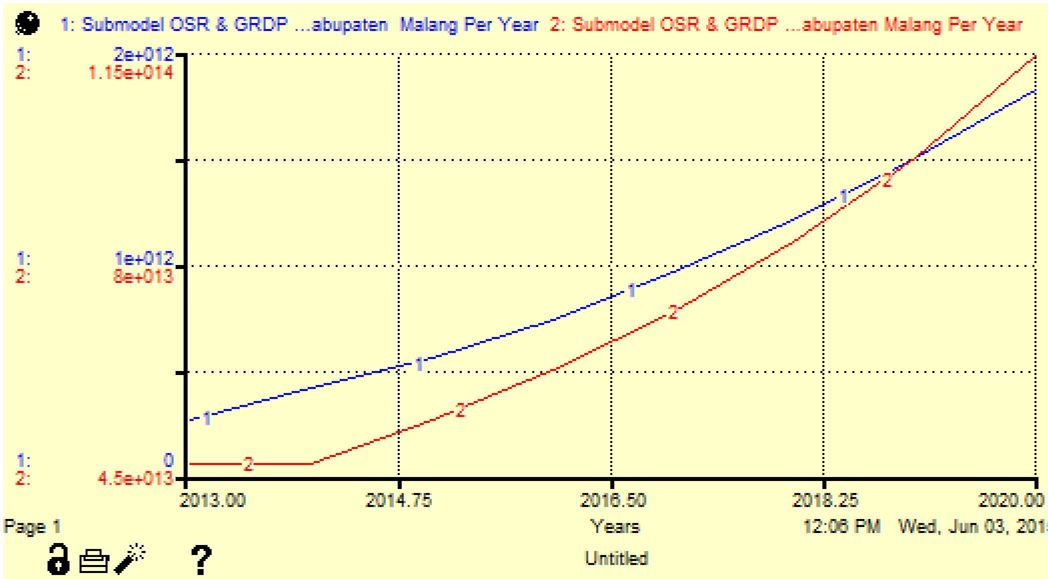
2: 550
3: 23
4: 1000000
1: 500
2: 400
3: 22
4: 0
2013.00
2014.75
2016.50
2018.25
2020.00
Page 1
Years
12:04 PM Wed, Jun 03, 2015
Gas Pollution of Kabupaten Malang

Scenario 15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2: 1.15e+014
1: 1e+012
2: 8e+013
1: 0
2: 4.5e+013
2013.00
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2018.25
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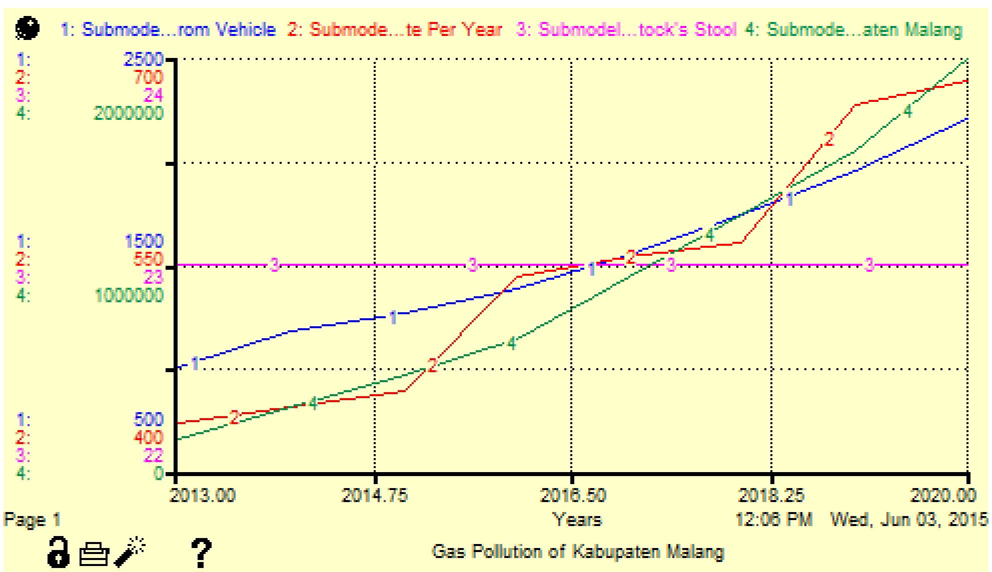
1: Submode...rom Vehicle 2: Submode...te Per Year 3: Submodel...tock's Stool 4: Submode...aten Malang
1: 2500
2: 700
3: 24
4: 2000000
1: 1500
2: 550
3: 23
4: 1000000
1: 500
2: 400
3: 22
4: 0
2013.00
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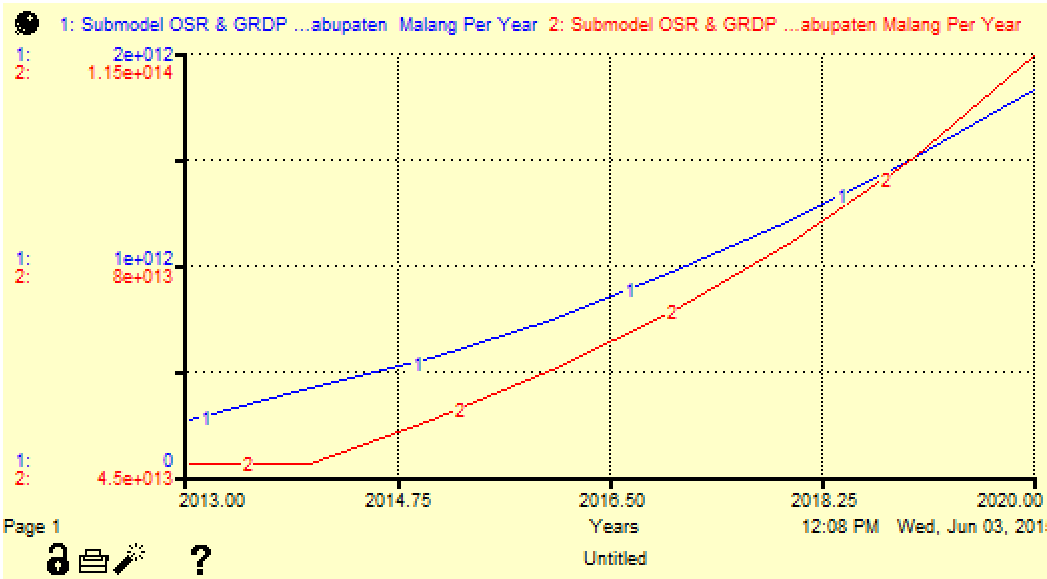
Scenario 16


1: Submodel OSR & GRDP ...abupaten Malang Per Year 2: Submodel OSR & GRDP ...abupaten Malang Per Year
1: 2e+012
2: 1.15e+014
1: 1e+012
2: 8e+013
1: 0
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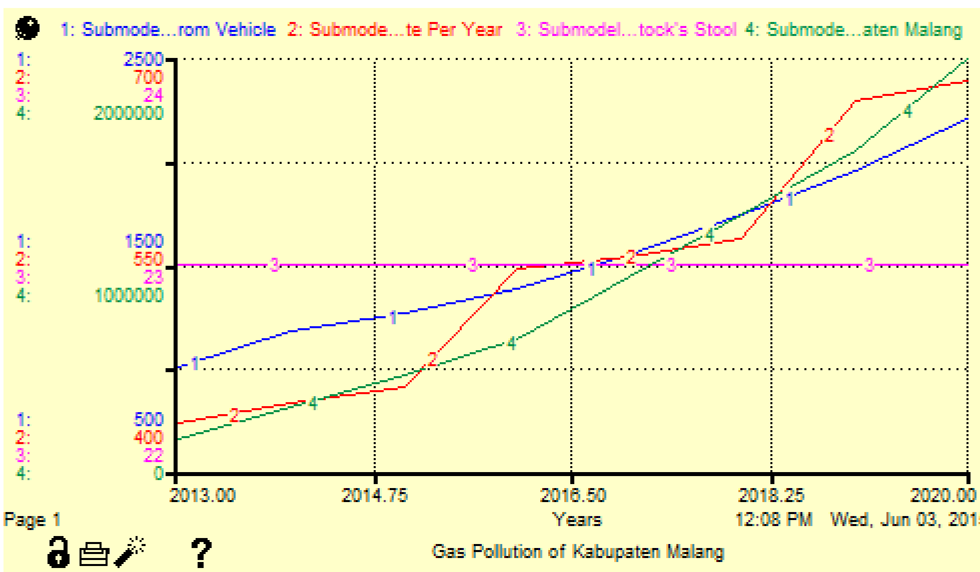
1: Submode...rom Vehicle 2: Submode...te Per Year 3: Submodel...tock's Stool 4: Submode...aten Malang
1: 2500
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3: 23
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