TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 6925 - 6939

Economics Sustainability of Soybean Supply Chain:Empirical Evidence of System Dynamics Malang Regency

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Article Info
Volume 82
Page Number: 6925 - 6939
Publication Issue:
January-February 2020

Article History
Article Received*: 18 May 2019*
Revised*: 14 July 2019*
Accepted*: 22 December 2019*
Publication*: 03February 2020*

Abstract:
The purpose of this study is to simulate soybean supply chain for the next 10 years and make improvement scenario to provide the best policy recommendations in economic sustainability aspect.This study uses a system dynamics approach with a sample of 32 farmers, 1 distributor and 9 soybean processing industries.The results showed the best alternative policy was to apply extensification by 2%, increase in productivity by 3.95%, controlling imported prices of soybeans by enactment of import tariff policies by 10%, distribution of seed and fertilizer assistance and changes in soybean distribution flow. This policy resulted in an upward trend in local soybean production of 79.6% and overall farmer profits of 111.8% in 2018 to 2028. This research can be a solution to support the stakeholders in the development of strategies for soybean supply chain in terms of economic sustainability.

Keywords: *Economics, sustainability, supply chain.*

I INTRODUCTION

Soybean is one of the strategic food commodities that is rich in protein sources and plays an important role in increasing national food security. This is because the use of soybeans in Indonesia is mostly to meet food needs in the form of processed products such as tofu, tempeh, soy sauce and soy milk, then the rest is for non-food ingredients such as animal feed and seed industries (Zakaria, 2010). Increased public awareness of the fulfillment of protein sources and increasing population annually has resulted in a large demand for processed soybean products (Hasan et al. 2016 and Aldillah, 2015). According to the Ministry of Agriculture's projected data (2016), the demand for Indonesian soybeans in 2018 will be around 2,770,496.45 tons, but the production of local farmers can only meet 935,191.57 tons or equivalent to 34% of total demand. The gap differences between soybean production and demand has been triggered import of soybean (Hasan et al. 2018). The difficulty of industry players in obtaining local soybeans resulted in almost all raw materials for the processed soybean industry being imported from America. This is also supported by the price of imported soybeans which are relatively cheaper than local soybeans (Hasan et al. 2016). Lack of interest in local soybeans caused by uneffective supply chain system and will cause soybean farmers losses. One effort to find solutions to these problems is by analyzing the soybean supply chain in terms of sustainability. Supply chain sustainability play an important role to improve performance by looking at the balance between economic, environmental and social (Mustafid, 2015). Social sustainability has a positive impact on local employment, environmental sustainability can reduce the negative impact of the environment and, economic sustainability aspect being able to

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see supply and demand, facilitating efforts to increase industrial income, increasing markets and improving product quality, and can predict increased farmer incomes (Widodo et al, 2010 and Jaya et al, 2014 ; Muzayanah et al, 2018).These components are dynamically connected and have complexity in achieving sustainable supply chain goals.

Previous research related to supply chain sustainability in Indonesia had been done by Mahbubi (2013), Aminudin (2014), Muzayanah et al (2017) and Jaya et al (2015). All of them researched about agricultural commodities, but there is still no similar research about soybeans. Previous research related to soybeanin Indonesia had been done by Hasan et al (2018),Oktyajati et al (2018) and Krisdayanti et al (2017) that researched about soybean production and demand to support food self sufficiency. However, these studies still have weakness that not discussing the sustainability of the soybean supply chain. Therefore, an analysis of the sustainability of the soybean supply chain is carried out in this study by reviewing the dynamic nature of the components of sustainability and the supply chain.

The modeling method using the system dynamics approach can be used to study complex supply chain problems. System dynamics is a methodology for facilitate analyzing dynamic problems in complex feedback systems. System dynamics aims to help understanding the construction of models that describe their characteristic (Daneshzand et al, 2019; Honti et al, 2019; Cao et al, 2019). System dynamics interpret real-life systems into simulation models in the form of Stock, flow and information networks (Jaramillo et al, 2019).

The main purpose of this research is to simulated soybean supply chainand make improvement scenario to provide the best policy recommendations in economic sustainability aspect for the next 10 years.This research also tried to develop previous research by adding some additional condition. The result from scenario can be used as support the stakeholders in the development of strategies for soybean supply chain.

II Research Methodology

This research is a quantitative descriptive research. The approach used in this study is a system dynamics approach to analyze soybean supply chains in Malang Regency. The variables in this study are local demand, soybean production, farmer profits, import purchase prices, farmer import prices, import demand, distributor selling prices, purchase costs, fertilizer costs, pesticide costs, seed costs, land costs, industrial consumption, planting area, land extensification, land conversion, harvested area, productivity, total local soybean sales.This causes these variables to influence the entire supply chain in the economic sustainability sub-system. The population studied in this study were all soybean supply chain actors in Malang Regency. Sampling is based on the purpose of sampling method, namely the way the sample is taken by selecting a subject based on specific criteria set by the researcher (Ferdinan et al, 2017). The sample of this study were respondents selected from supply chain subject and experts in accordance with the field of research studies. Supply chain subject consist of soybean farmers, distributors and soybean processing industries.The researcher will also involve several expert respondents consisting of representatives from Department of Agriculture and Horticulture Malang Regency. The study population can be known from the results of the preliminary survey, the District that produces the most soybeans in Malang Regency is the Kromengan District with a total sample of 32 farmers. The distributor who is most focused on the distribution of soybeans, especially imported soybeans, is KOPPTI (Cooperative producer of tofu and tempeh Indonesia) Malang Regency. The most soybean processing industry in this Regency is tofu and tempeh with a sample of 15 business units that take soybeans directly from KOPPTI or

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farmers. Research data processing was carried out at the Computational and Systems Analysis Laboratory, Department of Agricultural Industry Technology, Faculty of Agricultural Technology, Brawijaya University, Malang. The stages of this data analysis can be seen in Figure 1.

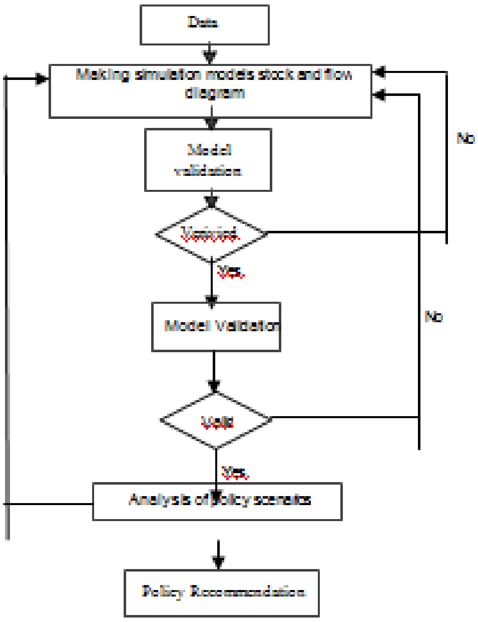

Fig. 1.Stages of data analysisThe results analysis stage starts from creating a stock model and flow diagram (SFD) to illustrate the soybean supply chain model using Powersim version 10. The next step is to verify the model by running a model check on the software to make sure the model is functioning properly and there are no errors. Then the validation is done in 2 stages, that is testing the structure of the model by analyzing the suitability of the model with conditions in the field using expert opinion and testing the parameters of the model by comparing two interrelated variables(Cao et al, 2019). The validated model is then processed in the form of tables and graphs to facilitate analysis. If the current policy is less than optimal, the addition of several policy alternatives will be added so that it will facilitate the determination of strategic decisions.

III RESULT AND DISCUSSION

Soybean plants grow and develop in several districts in Malang Regency with a total area of 12149 Ha (Department of Agriculture and Horticulture Malang Regency, 2018). Malang Regency geographically has alluvial, regosol, andosol and latosol soil types with tropical climate, so it can be used as a soybean cultivation location. Some Districts in Malang Regency have geographical location that supports the growth of soybeans, so farmers in these districts are directed by the government to cultivate soybeans that is Donomulyo, Kalipare and Kromengan Districts. The type of soybean planted is Anjasmoro which has an average productivity of 14.49 Kw / Ha with a harvest age of 3-4 months (Department of Agriculture and Horticulture, Malang Regency, 2018). The majority of soybean farmers in Malang regency planted soybean intercropping systems with cassava or corn to increase farmers' incomes. Soybean yields in Malang Regency are distributed to soybean processing industries in Malang Regency, but it is still not enough to meet the needs of processed soybean raw materials throughout Malang Regency.

The soybean supply chain system in Malang Regency consists of several members of the supply chain, that is farmers, Farmers Association, industry, and distributors of imported soybeans. The soybean supply chain in Malang Regency as a whole is supported and overseen by the government which has its own role. Soybean supply chain flow map can be seen in Figure 2

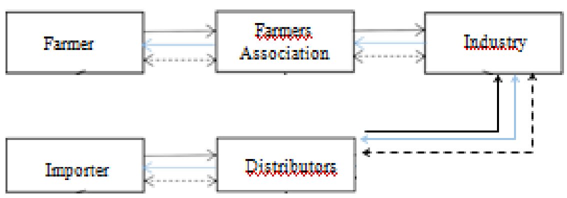

Fig. 2.Soybean Supply chainin Malang

RegencyKeterangan:

→ :Product Flow

→ :Financial Flow

---> :Information Flow

Model dynamics of soybean supply chain systems in Malang Regency

The sub-model studied is the economic aspect that explains the production and profits of each actor involved in the model. SFD description of soybean supply chain in Malang Regency can be seen in Figure 3.

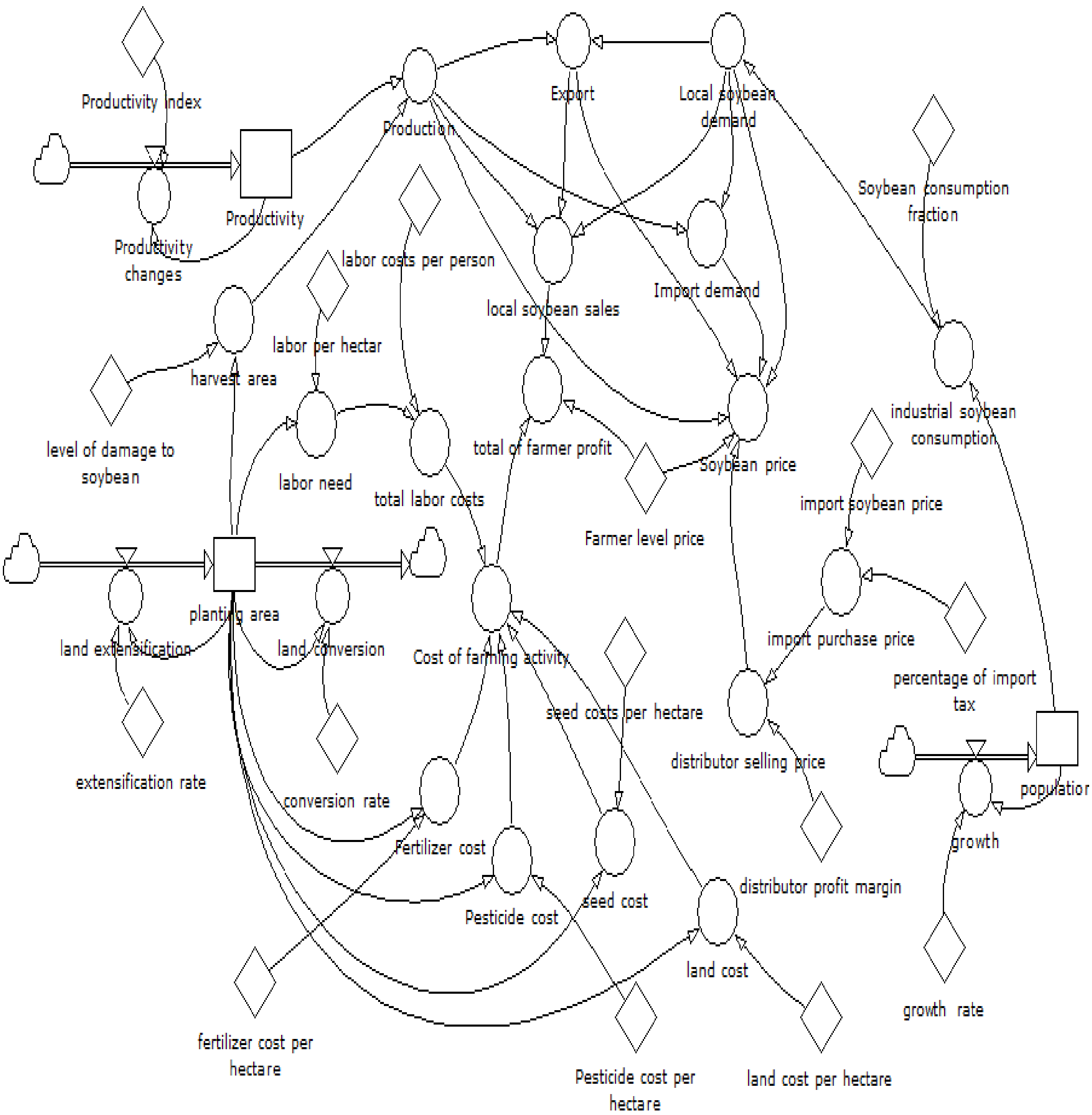

Fig. 3.SFD of soybean supply chain in Malang Regency

The supply chain model is described by looking at several variables, each variable has its own formulation so that the model can run well. The economic aspects of soybean supply chain sub model formulation can be seen in Table 1

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Table 1
Formulation of soybean supply chain variable economic aspects

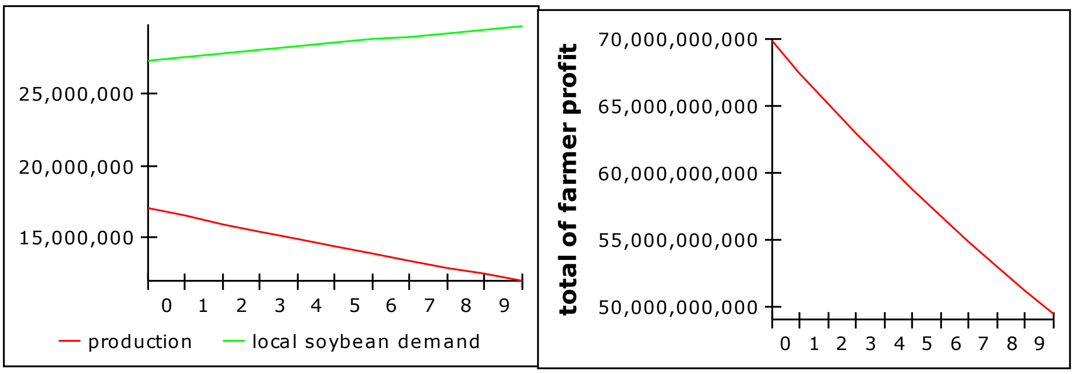
Variable	**Formulation**	**Units**	**References**
Export	IF(Production - Demand for local soybeans >= 0, Production - Demand for local soybeans,0)	Kg	Oktyajati et al (2018)
Demand for local soybeans	Industrial soybean consumption	Kg	Aminudin et al (2014)
Production	Harvested area *Producivity	Kg	Krisdayanti et al (2017)
Productivity	Productivity (t-dt) + productivity changes	Kg/ha	Putra dan Nugroho (2016)
Productivity changes	Productivity index*productivity	Kg/ha	Putra dan Nugroho (2016)
Farmer profit	((soybean sales*farmer level price)-cost of farming activity ')	Rp/people	Hasan et al (2015)
Import demand	IF(production - Demand for local soybeans >= 0,0, Demand for local soybeans '-production)	Kg	Hasan et al (2015)
Planting costs	Fertilizer costs + Pesticide Costs + Seed costs + Land costs + total labor cost	Rp	Rizki et al (2017)
Industrial soybean consumption	Population* soybean consumption level	Kg	Krisdayanti et al (2017)
Planting Area	Planting area (t-dt) + (Extencification land– convertion land)	Ha	Mahbubi (2013)
Harvested area	Planting area - (level of damage to soybean*luas tanam)	Ha	Hasan et al (2015)
Local soybean sales	IF(export <= 0,production, Demand for local soybeans l'+export)	Kg	Oktyajati et al (2018)
Fertilizer costs	Fertilizer costs per ha*planting area	Rp	Massiri et al (2017)
Pesticide Costs	Pesticide Costs per ha'*planting area	Rp	Hasan et al (2015)
Seed costs	Seed costs *planting area	Rp	Massiri et al (2017)
Land costs	Land costs per ha'*planting area	Rp	Nabilah et al (2015)
Soybean Prices	IF(export <= 0,(((production/ Demand for local soybeans)*farmer level price'))+((Import demand/' Demand for local soybeans)	Rp	processed by the writer
Import purchase price	Import soybean price*percentage of import tax	Rp	Gourdon et al (2017)
Selling price of	Import purcase price+distributor	Rp	Gourdon et al (2017)

distributors	profit margin		
Population	Population (t-dt) + growth	people	Garside and Asjari (2015)
Growth	Population*growth rate	people	Mahbubi (2015)
Land conversion	Planting Area *conversion rate	Ha/year	Wibowo (2016)
Land extensification	Planting Area *extensification	Ha/year	Garside and Asjari (2015)
Labor need	Planting Area *Labor per ha	People	Oktyajati et al (2018)
Total Labor cost	Labor need*labor cost	People	Aminudin et al (2014)

Development of Scenarios

Scenario 1 (Without policy changes)

This scenario does not make changes to the model so that the system runs according to the current real conditions. This Scenario 1 serves as the basis and comparison of the following improvement scenarios. Simulation results in this scenario show a declining trend in soybean production and farmer profits. The trend of simulation results of scenario 1 on farmers' production and profits can be seen in Figure 3 (a) and (b).



(a) (b)

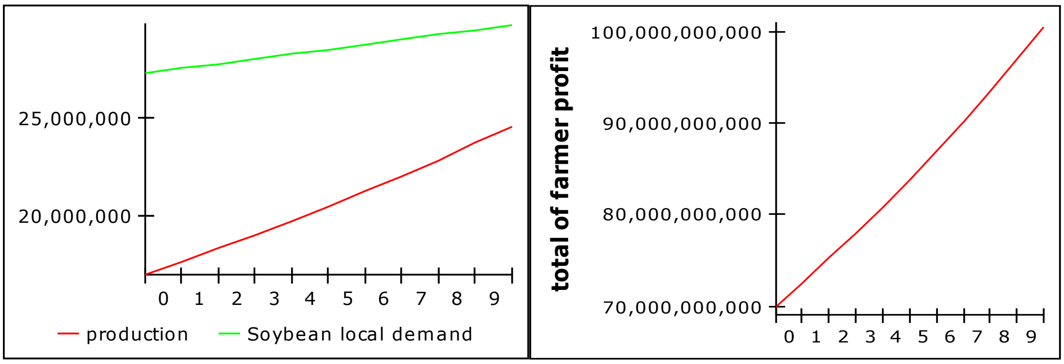
Fig.4. Scenario simulation results 1. Figure (a) production, and Figure (b) farmers' profit

During 2018-2028 soybean production is estimated to decrease 29%, from 17,068,742 kg to 12,077,382 kg. The decline in production was due to soybean planting area which was declining due to the conversion of soybean fields at an average rate of 3.4% per year. According to Aldillah (2015), land area significantly influences production. Low soybean production is caused by a decrease in soybean harvest area that is not offset by increased productivity. Farmers' profits are estimated to decrease 29%, from Rp. 69,914,431,508 to Rp. 49,469,565,375 during the simulation period due to decreased local soybean production. According to Hasan et al (2015) farmers' profits are influenced by soybean production, the higher the soybean production, the higher the farmer's income.

Scenario 2 (Land extensification)

Land expansion can be done by utilizing land that is not yet productive for planting soybean commodities. Conversion control is done up to 0% per year and intensification is increased to 3.7%. This value is applied based on the reference to Law No. 41/2009 concerning Protection of Sustainable Agricultural Land in Article 29. Article 29 explains that land intensification is carried out on abandoned land. According to BPS East Java (2018) Malang Regency has an abandoned land area of 1781 Ha, so that the area of intensification determined by researchers does not exceed that area. The results of simulation of soybean supply chain can be seen from the production and profits of farmers can be seen in Figure 4 (a) and (b).

During 2018-2028 soybean production is estimated to increase by 43.8% from 17,068,742 kg to 24,546,472 kg. This increase in production was due to the control of land conversion and land intensification increased at an average rate of 3.7% per year. According to Syafa'at and Maulana (2007), efforts that can be made to increase agricultural production are to reduce the conversion rate and increase the government's ability to print new rice fields. During 2018-2028 it is estimated that farmers' profits will increase by 43.8% from Rp. 69,914,431,508 to Rp. 100,543,591,502 as an increase in soybean production. However, soybean demand in scenario 2 was still not fulfilled until the 10th year because the increased local soybean production in the simulation results has not been able to balance the increased soybean demand.

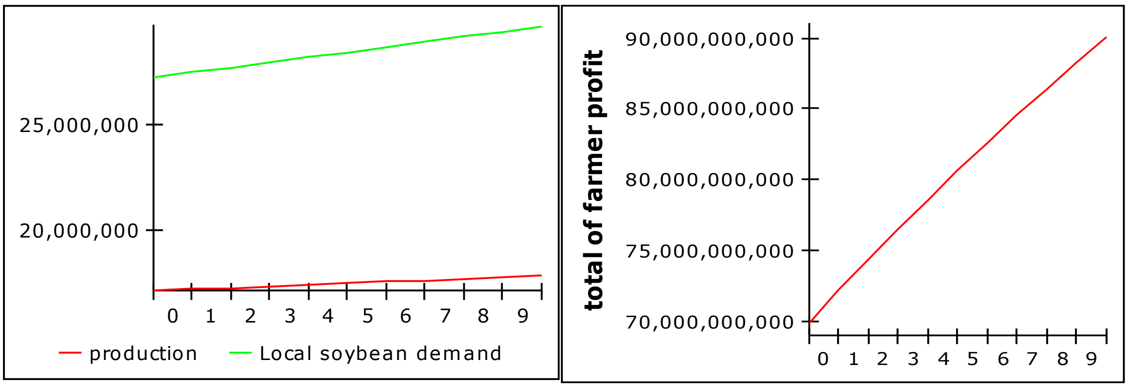


(a) **(b)**

Fig.5.Simulation scenario results 2. Figure (a) production, and Figure (b) farmers' profit

Scenario 3 (Increased productivity)

Increased land productivity can be done by using agricultural machinery, selection of seeds and fertilizers, as well as farmer training by the government conducted by agricultural extension officers in each district (Muhammad, 2014). Increased productivity is done from 0% to 3.95% per year. This value is determined based on the average productivity growth rate of soybeans in Java in the last 5 years which is 3.95% per year (Ministry of Agriculture, 2016). The results of the simulation of soybean supply chain can be seen from the fulfillment of demand can be seen in Figure 5 (a) and (b).



(a) **(b)**

Fig. 6.Scenario simulation results 3. Figure (a) production, and Figure (b) farmers' profit

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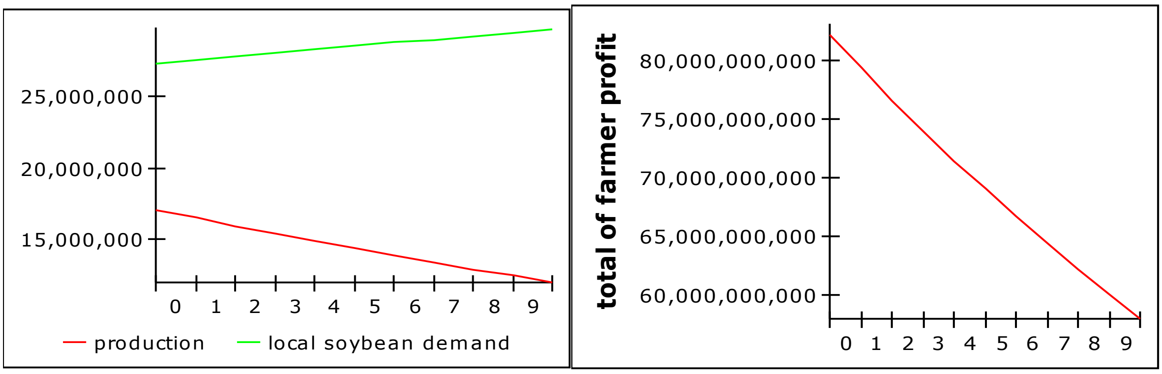
During 2018-2028 soybean production is estimated to increase 4.2% from 17,068,742 kg to 17,791,711 kg. This increase in production was due to increased productivity at an average rate of 3.95% per year. According to Krisdayanti et al (2017) productivity can affect the amount of production of a commodity. However, soybean demand is still not fulfilled because the increased local soybean production in the simulation results has not been able to balance the soybean demand which has increased higher. This is due to the still widespread decline in soybean planting. According to Aldillah (2015) low soybean production can be overcome by increasing soybean productivity and offset by an increase in planting area. The profits of farmers in 2018-2028 are estimated to increase by 28.8% from Rp. 69,914,431,508 to Rp. 90,041,306,952. This is because productivity has a positive effect on farmer's income (Purnomo et al, 2018).

Scenario 4 (Soybean fertilizer and seedlings assistance)

One of the efforts to increase farmers' income is by setting a policy to help fertilizer and soybean seeds by the government. The distribution of this assistance can be through Gapoktan in each district in Malang Regency. The results of simulation scenario 4 of the soybean supply chain seen from the production and profit of farmers can be seen in Figure 6 (a) and (b)



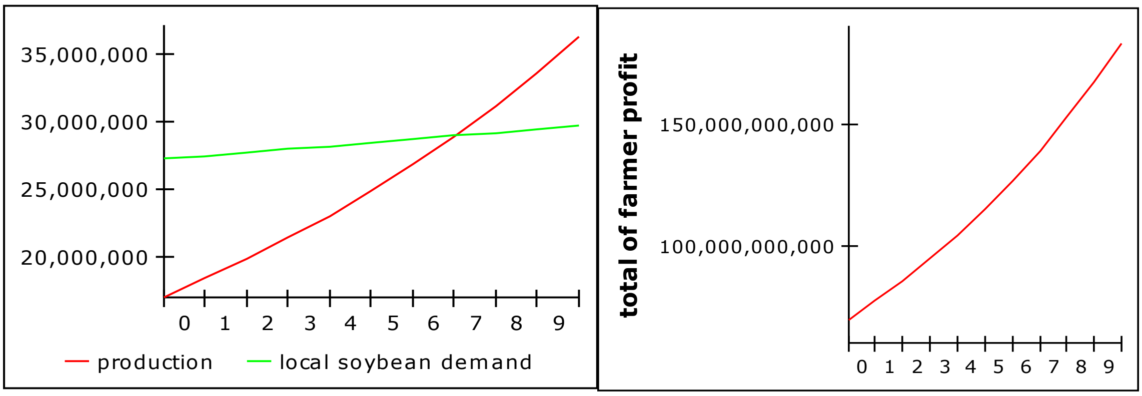
(a) **(b)**

Fig.7. Simulation results of scenario 4. Figure (a) of production, and Figure (b) of profits

Soybean fertilizer and seedlings aid does not affect soybean production because the aid only affects the cost of planting. Scenario 4 results have not reached equilibrium because local soybean production has decreased and soybean demand has increased. During 2018-2028 it is estimated that soybean production will continue to decline 29%, the same as the results in scenario 1, from 17,068,742 kg to 12,077,382 kg. The decline in production was due to soybean planting area which was declining due to the conversion of soybean fields at an average rate of 3.4% per year. The results of scenario 4 have more impact on the profits of farmers because of the cost of planting soybeans. The cost of planting can be reduced by 23.7% compared to the scenario without the help of seed and fertilizer distribution. This scenario causes farmers to increase profits in the 10th year by 12.7% from Rp. 49,469,565,375 to Rp 58,065,869,983 compared to scenario 1, but the resulting profit trend is still declining because there are no measures to control the reduced soybean land area. According to the Ministry of Agriculture (2016), the subsidy aims to ease the burden of soybean farmers in buying seeds so that it will increase farmers' incomes.

Scenario 5 (Land control and productivity improvement)

An increase in land productivity of 3.95% was carried out in scenario 5 accompanied by land control which prevented land conversion (resulting in land conversion to 0%) and an extension of 3.7%. According to Muhammad (2014), an increase in land productivity can be done by the use of agricultural machinery, the selection of seeds and fertilizer, as well as farmer training conducted by agricultural extension workers in each district in Malang Regency. According to Law No. 41/2009 concerning Protection of Sustainable Food Land Farms explains that intensification can be done by utilizing unproductive land. The simulation results of scenario 5 of the soybean supply chain seen from meeting the demand can be seen in Figure 7 (a) and (b).



(a) **(b)**

Fig.8.Result scenario simulation 5. Figure (a) production, and Figure (b) farmers' profit

The results of simulation scenario 5 show the trend of increasing soybean production up to the 8th year can meet the demand for soybeans and subsequently production continues to increase until the 10th year. This causes soybean imports not to be carried out from the 8th to the 10th years due to local soybean production that has met soybean demand in Malang Regency. According to Budhi and Aminah (2010), imports were carried out because soybean demand was not matched by soybean production. Soybean production is estimated to increase 111.8% from 17,068,742 kg to 36,160,467 kg during 2018-2028 This increase in production is due to productivity and planted area that is increased together (Hasan et al, 2015). The results of scenario 5 shows the pattern of increase in farmers' profits by 161.7% from Rp.69,914,431,508 to Rp. 183,002,949,710. Increased profits for farmers due to land expansion and increased productivity (Oktyajati et al, 2018).

Scenario 6 (Land control, increased productivity and distribution of fertilizer aid and soybean seeds)

The results of scenario 5 shows that soybean demand was fulfilled in the 8th year, but the disturbed agroecosystem increased by 43.8% due to land extensification of 3.7% which caused an increase in the use of pesticides. According to Husnain et al (2016), the use of agrochemicals in general increases with the expansion of agricultural land. Therefore, in scenario 6 an increase in land productivity of 3.95% was accompanied by prevention of land conversion to 0% and extensification with a value below the scenario 5 of 2% to reduce the use of pesticides. Scenario 6 also distributes fertilizer and soybean seedlings assistance because the emphasis on planting area will have an impact on farmers' incomes. According to Susila (2010), fertilizer subsidy policy has a positive impact on increasing

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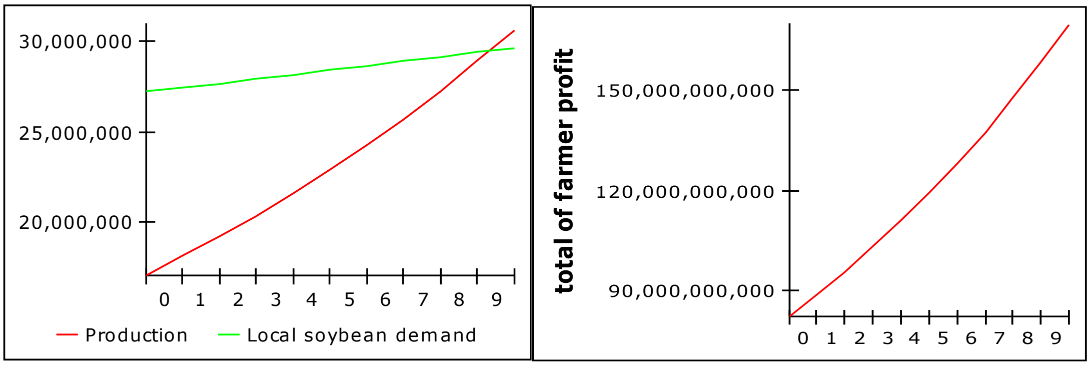
farmers' incomes. The results of the simulation of scenario 6 of the soybean supply chain on the production and profit of farmers can be seen in Figure 8 (a) and (b).

The results of simulation scenario 6 show the pattern of increase in soybean production to meet demand in the 10th year. This causes soybean imports not to be carried out starting in the 10th year due to local soybean production that has met soybean demand in Malang Regency. According to Handayani et al (2016), import activities are carried out when production has not been able to meet demand. Soybean production is estimated to increase 79.6% from 17,088,742 kg to 30,651,249 kg during 2018-2028. This increase in production was due to productivity and increased planting area (Mahbubi, 2013). Farmers' profits also increased by 107% from Rp. 82,063,431,508 to Rp. 169,931,151,785 which have a positive impact on the sustainability of soybeans on economic aspects. The increase in farmers' profits in this scenario is due to increased productivity, land extensification and distribution of seed and fertilizer assistance.



(a) **(b)**

Fig.9. Simulation results of scenario 6. Figure (a) of production, and Figure (b) of farmers' profit

Scenario 7 (Land control, increased productivity, distribution of fertilizer and soybean seed assistance, determination of import tariffs and changes in soybean supply chain flow)

Extensification treatment, increased productivity and distribution of seed and fertilizer assistance in the previous scenario had a positive impact on economic aspects. But the price of imported soybeans is still cheaper than the price of local soybeans. Local soybean prices that are less competitive with imported soybean prices can influence industrial purchasing decisions. Therefore, in scenario 7 an import tariff policy is added by the government which was initially 0% (Ministry of Finance Regulation No. 135 / PMK.011 / 2012) changed to 10%. Determination of import tariffs of 10% based on previous government discourse, but has not been realized (Sudaryanto and Swastika, 2016). The purpose of setting import tariffs by the government is to equalize the price of imported and local soybeans. Another problem that needs to be considered is that increased local soybean production in scenarios 5 and 6 causes the role of imported soybean distributors (KOPPTI) to die because imports are not carried out in the 10th year. So the policy on soybean flow change is added to scenario 7, where soybeans from farmers are channeled to industry through distributors without going through gapoktan. The dynamics model of soybean supply chain system with changes in soybean flow can be seen in Figure 10. This change in soybean flow aims to improve supply chain flow in Malang Regency. It can also make it easier for farmers to sell increased yields. The results of a simulation of scenario 7 of the soybean supply chain seen from the production and profit of farmers can be seen in Figure 11 (a) and (b).

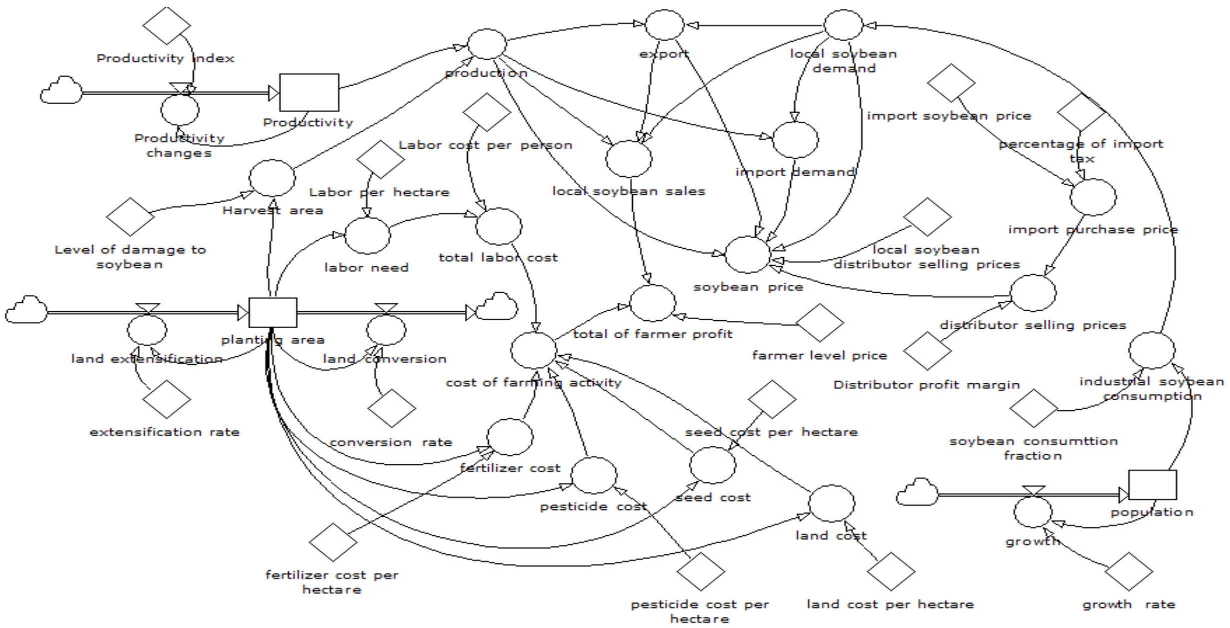
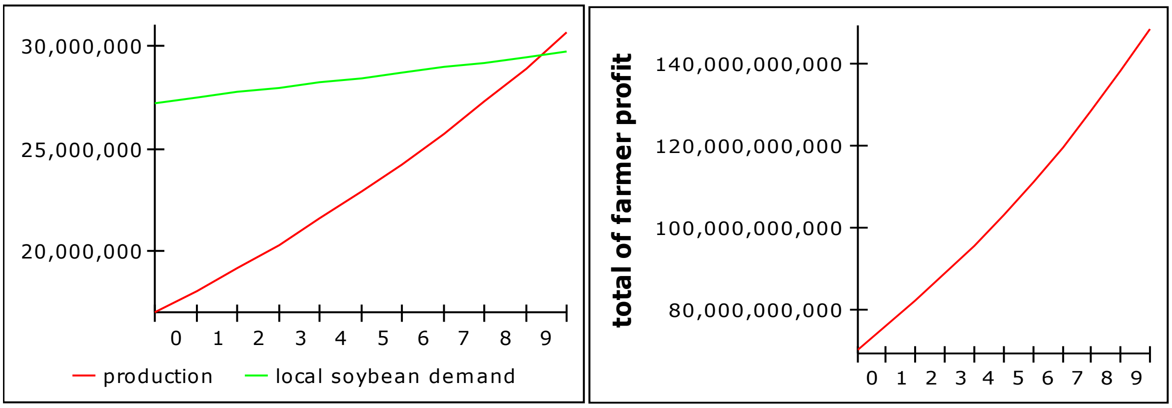


Fig. 10. SFD changes in soybean supply chain flow in Malang Regency



(a) **(b)**

Fig. 11. Simulation results of scenario 7. Figure (a) production, and Figure (b) farmers' profit

The scenario 7 simulation results show an increasing pattern in soybean production to meet demand in the 10th year. Soybean production is estimated to increase 79.6% from 17,088,742 kg to 30,651,249 kg during 2018-2028 as the results of scenario 6. This increase in production is due to increased productivity and planting area (Mahbubi, 2013). The profits of farmers in scenario 8 increased 111.8% from Rp. 69,944,624,397 to Rp. 148,168,764,871 in 2018 until 2028, but this profit is lower than the profits of farmers in scenario 7. Farmer-level soybean prices that initially were Rp. 7100 lowered 10% to Rp. 6390 to provide profit margins for distributors. The 10% percentage is determined based on the reduction in the cost of planting soybeans by farmers due to the addition of government assistance in the form of seeds and fertilizer. The provision of profit margins in scenario 7 is done so that each actor benefits from increasing soybean production. According to Zhang et al (2012) the revenue sharing system has proven to be effective in improving supply chain performance.

IV Policy Recommendations

The results of 7 scenarios show land control, increased productivity, import tariff policies, distribution of seed and fertilizer assistance, and changes in soybean flow provide the greatest

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benefits when viewed from the aspect of economic sustainability. Extensification in scenario 7 of 2% is carried out based on Law Number 41 Year 2009 concerning Protection of Sustainable Food Agricultural Land by utilizing unproductive land for soybean cultivation. Extensification can increase local soybean production and benefit farmers. Based on the results of interviews with the head of Gapoktan, the application of extensification can be done by providing counseling to farmers to plant soybeans on unproductive land, such as planting soybeans in embankment areas or as intercropping plants. The government also needs to allocate agricultural land to plant soybeans by utilizing unproductive land in Malang Regency. According to Mulyani and Agus (2017), potentially available land is abandoned land covered by shrubs and open land that is agronomically suitable for agriculture. According to the Department of Agriculture and Horticulture Malang Regency (2018), one of the government programs in agricultural land extensification is a rice field print program by utilizing abandoned land owned by farmers. First the identification of prospective farmers and prospective locations (CPCL) is carried out, then an identification and design survey (SID) is carried out at a predetermined location. The results of the SID can be the basis for the design of rice paddies, for example the construction of drainage canals, land management and others. Paddy printing can be carried out with self-managed government or through contracts with third parties.

The increase in productivity in scenario 7 is based on the average soybean productivity growth rate in Java in the last 5 years which is 3.95% per year (Ministry of Agriculture, 2016). Increased productivity can increase local soybean production and benefit farmers. Increased productivity can be done by maximizing the use of agricultural machinery, selecting seeds and fertilizers, and counseling and training farmers in each district (Muhammad, 2014). Based on interviews with the Chairperson of Soybean Gapoktan in Kromengan District, the main problem affecting soybean productivity is the lack of quality agricultural machinery and seed facilities in Malang Regency. Counseling and training must also be carried out to improve the competence of farmers related to soybean plants accompanied by optimization of farmer groups and improve the performance of field counselors.

The government can apply import tariffs on scenario 7 with the aim of equalizing the price of imported and local soybeans. The determination of the import tariff for soybeans is based on government discourse of 10%, but it has not been realized (Sudaryanto and Swastika, 2016). The number of imported soybeans is increasing and making local soybean prices do not compete with imported soybeans if the government does not apply import tariffs (Zakiah, 2012). According to Kustiari and Dermoredjo (2013), soybean import tariffs can affect soybean prices. Local soybean prices that compete with imported soybeans can influence industrial purchasing decisions. According to Aritonang et al (2015), raw material prices and quality are the variables that influence the industrial purchasing decisions. Price and consumption volume are two determinants of income (Daneshzand et al, 2019), therefore, determining the right price is important to do.Local soybean processed products have better taste advantages than imported soybeans (Efendi et al, 2015). The advantages of local soybeans can be used as a basis for implementing import tariff policies. Government escort to local soybeans is also expected to increase soybean farming business activities in Malang Regency [38-41].

The change in local soybean flow in scenario 7 aims to improve supply chain flow so that each actor benefits from increasing soybean production. According to Zhang et al (2012), revenue sharing systems have proven to be effective in improving supply chain performance. This change in soybean flow can optimize the role of each soybean supply chain actor, namely

Gapoktan as a channel of government assistance to farmers and distributors as distributors of soybean crop yields to industry.

The results of changes in several components in the dynamics of the soybean supply chain system implies that policies that can be carried out are land control and extensification by 2%, increased productivity by 3.95%, enactment of import tariff policies by 10%, distribution of seed and fertilizer assistance, and changes in soybean flow to maximize soybean supply chains in Malang Regency. The role of government is also needed in every process of optimizing soybean farming. This policy is expected to be able to overcome the soybean supply chain problems that occur in Malang Regency with a firm commitment from every stakeholder involved.

V CONCLUSION

The best alternative policy is to apply extencification by 2%, increase in productivity by 3.95%, controlling imported prices of soybeans by enactment of import tax policies by 10%, distribution of seed and fertilizer assistance and changes in soybean distribution flow. This policy resulted in an upward trend in local soybean production of 79.6% and overall farmer profits of 111.8% in 2018 to 2028. However, commitment from soybean supply chain stakeholders is needed so that soybean supply chain can be sustainable in economic aspects. Further research is needed to perfect variables that can measure all aspects of sustainability with more complete quality and quantity of data.

VI ACKNOWLEDGEMENT

We gratefully acknowledge support from Department of food crops and horticulture and all of soybean supply chain stakeholders in Malang Regency. We gratefully acknowledge support from the University of Brawijaya.

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