

# Model production of corn development for industrial needs and increasing economy

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**Abstract.** Regional economic development has many aspects that continue to change dynamically, planned and coordinated when viewed from a planning framework of the regional economic development, whether regionally, nationally or internationally. The regional economic development is aimed to the achievement of national development sub-system targets that organized territorially or spatially. The research method that was used is a dynamic system approach. The data used are secondary data obtained from various instances. Method of data analysis used dynamic system software. The results showed exponential growth trend of maize production. The pattern illustrates that an increase in national maize production over time. Model simulation results were acquired by using government intelligence strategy capable of increasing corn production and increase province economy. From extensification increase simulation results of 1.6 eh / year, it is capable of increasing corn production exceeding government's target of 24,8 million ton in 2020, unable to fulfil the requirement of corn that increasing faster than corn production. The increase of national corn production will chip in towards farmer income, which indirectly contributes towards PDB until national economy.

## 1. Introduction

The regional economic development is an increase of people's income which is the increase of entire added value that occurred in that region. The increase of the income measured in riel value which means that it is expressed in constant price. Besides, it also illustrates the recompense for production factors that are operating in the area (land, capital, labor, and technology). The prosperity of the region also depends on how much of transfer-payment that occurred which is part of the income that flows out of region or gets the fund from outside of region. It also states that economic development is the increase proses of per capita output in the long term [1, 2]. Furthermore, the regional income is the income level in the analysis area. The income level can be measured from the total income of region or the average income in that region. The development region should be concerned with the increase of the income in that region and commonly it means the average income (income per capita) of the community.

Basically, the development of region was done by utilizing natural resources optimally through the development of local economy, based on economic activity occurred in the region. Broadly, the development of region defined as an attempt to formulate and apply a theoretical framework into economic policy and the development program including the consideration of regional aspect by integrating the social aspects and environmental aspects toward the achievement of optimal and sustainable prosperity.

The regional economic development has many aspects that continue to change dynamically, planned and coordinated when viewed from a planning framework of the regional economic development,



whether regionally, nationally or internationally. The regional economic development aimed to the achievement of national development sub-system targets that organized territorially or spatially. Although practically, the regional economic development needs to enforce the theoretical basic explanation which has a relationship between the regional economic development and spatial planning. In other words, the process of regional economic development must consider the approach of spatial planning aspects such as region, geographical, human resources, interaction between regions. The increase of regional income should prioritize the use of local resources, especially on labor. Due to the use of existing resources, it results in a lower margin cost for the provision of labor operations and it has an impact in reducing the unemployment rate of the region. Utilization of domestic resources should be adjusted to the characteristics and potential of a region so that the formulation of policies accord with the type of region. The regional development is an integral part of national development to achieve the development targets adjusted with potential and development problems in the region. By such treatments, the paradigm of regional economic development is expected to be created, namely the strengthening of the economic base which has a principle of balance (equity) supporting economic growth (growth), and sustainability (sustainability), thus the core of development, namely sufficiency, self-esteem and freedom can be achieved by each person and the community through construction.

## 2. Method

### 2.1. Data Collection Method

The data used in this research are secondary data, concerning with national maize production. Sources of data obtained from reports, agricultural statistic books, and other secondary data. Methods of data collection, detailed as follows:

**Table 1:** Types and sources of data

No	Type of Data	Source of Data
1	National maize production data (2010-2015)	Agriculture Ministry
2	Maize hectarage data (2010)	Agriculture Ministry
3	Productivity level of national maize land (2011-2015)	Agriculture Ministry
4	Land potential extensive of national maize	Agriculture Ministry
5	National maize price at the farmer level	CBS
6	The volume of maize consumption demand	CBS
7	The volume of maize demand as the raw material of feed and food industrial	CBS
8	Import and export volume of maize	CBS
9	The volume of national maize demand level (2011-2015)	CBS
10	Maize retributitional value	CBS
11	Land tax value (PBB)	CBS
12	value-added tax (PPn)	CBS

### 2.2. Data Analysis Method

Data analysis method used in this research is dynamic system method. The use of dynamic system is more focused on the goal of the improved understanding about how the behavior arises from the policy structure in the system [5]. Furthermore, it mentions that this understanding is very important for effective policy planning. According to [6] that the dynamic system is more than the goal to understand about how the behavior arises from the policy structure in the system, to design the effective policy that defines a system as an entity, consisted of a part related to each other to achieve goals in complex environment. The analysis stages of dynamic system are as follows: Organizing causal loop diagram, which is the description of the relationship or structure linkage (between elements) in the model. The relationship can be unidirectional/semi direction (S) or opposite (O). Besides, it also shows the loop of the model that was built, is it reinforcing (R) or balancing (B).

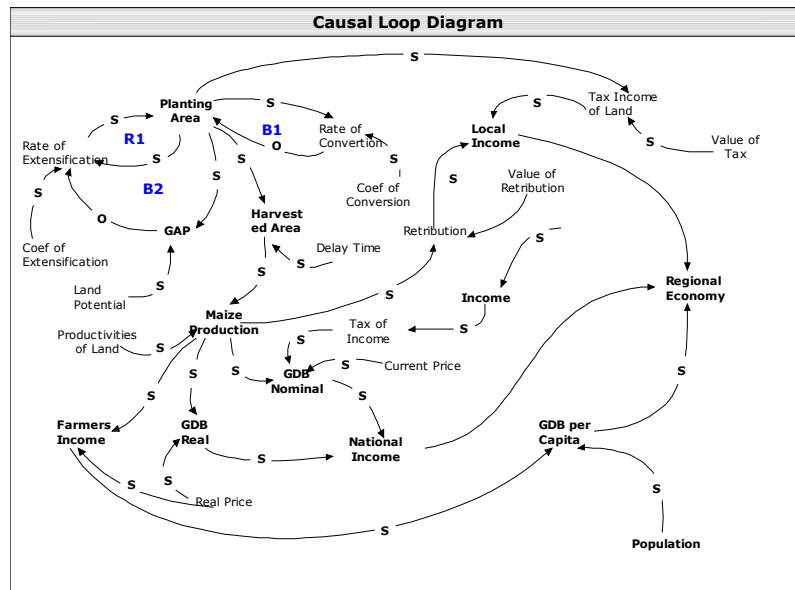


Figure 1. Causal Loop Diagram

- Organizing the flow diagram; which is a description of causal loop diagram arranged in the form of a flowchart.

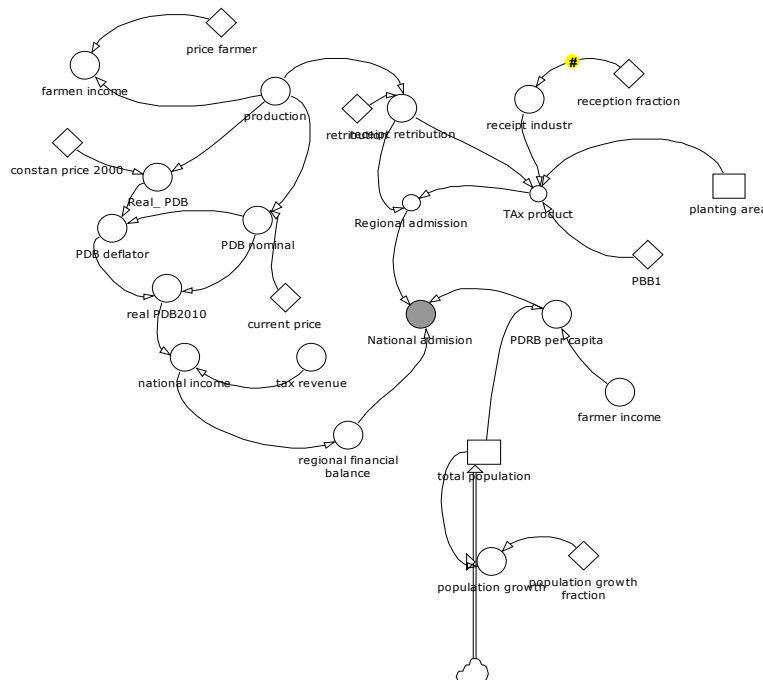


Figure 2. Flowchart economic sub model

**Table 2.** Organizing a mathematical equation; which defines existing variables in a mathematical unit.

No	Variabel	Defenisi Operasional	Unit	Nilai	Sumber Data
1	Reception_farmer	The total revenue received by corn farmers is estimated from the total corn production multiplied by the price of corn at the farm level	Rp.	Farmer Price * 'Production_JN	Calculation result
2	Regional_admission	Total acceptance that District diporoleh from Jagung sector represented retribution and lease earth and building ( UN)	Rp.	PBB_Region + Revenue_Retribution	Calculation result
3	National_admission	Total acceptance achieved by Nasional from Jagung sector represented PDB and lease	Rp.	(PDB_Nominal / Deflator) + Product_Tax_Payments + PBB_Nasional	Calculation result
4	Receipt_retribution	Total acceptance achieved from diestimasi retribution based on by total multiplied production with retribution blow-up fixed for Jagung sector	Rp.	'Production_JN' * Retribution	Calculation result
5	Industry_reception	Total acceptance achieved from corn manipulation industry (feed and food)	Rp.	Multi_Products * Fr_Edit_Products	Calculation result
6	Land and building tax receipts	Total acceptance lease earth and building for areal corn	Rp.	Ls_Lahan UN	Calculation result
7	Tax product	Total acceptance lease from treatment corn	Rp.	Industry_Tax * Product_Tax	Calculation result
8	PDB_Riil	PDB (bruto domestic products) based on in riil price	Rp.	Real Price * 'Production_	Calculation result
9	PDB_Nominal	PDB (bruto domestic products) based on in konstan price	Rp.	Constant_Price * 'Production_JN	Calculation result
10	PBB_National	National acceptance resemble lease earth and un building from corn sector	Rp.	PB_Income * 0.2	Calculation result
11	PBB_District	District acceptance resemble lease earth and un building from corn sector	Rp.	PB_Income * 0.8	Calculation result
12	Magnitude_PBB	The value / amount of the land and building tax set for the corn farming area	Rp./Ha	12.500	CBS, 2015
13	Tax_Produk	Value / amount of tax set for processed products	%	0,02	CBS, 2015
14	Multi_Product	Price of maize worn as mould price for Riil PDB	Kg/hr	Industry_Count_360/360	Calculation result
15	Price_Riill	Price of maize worn as mould price for Riil PDB	Rp./kg	2.900	CBS, 2015
16	Price_constan	Price of maize worn as mould price for Nominal PDB	Rp./kg	2.000	CBS, 2015
17	Price_Farmer	Price of maize which occurred in floor farmer	Rp/kg	2.900	CBS, 2015
18	Deflator	The amount of changes in the price of goods (corn) include; local production goods, finished goods, and services	%	PDB_Riil / PDB_Nominal	Calculation result

- Input data in each variable, flow and stock/level.
- Running the software
- Validating structure which is a test of validity against the real condition. The test was carried out by using statistical methods [5]. [7], one of them is the test method of MAPE (Mean Absolute Percentage Error) or the median value of absolute percentage error by the formula:

$$MAPE = \frac{1}{n} \sum \frac{X_m - X_d}{X_d} \times 100\%$$

The model very accurately depicts the actual condition if the value of MAPE is <5%, between 5%, to 10% includes quite right, and >10% is not accurate in describing the actual condition [8].

- Policy simulation (scenario model). A scenario was included to obtain the best model by making changes in the structure and variable as well as considering the time. In this research, the scenario made in two parts, namely a) Scenario 1 actual condition without intervention, b) Scenario 2; is assumed that the productivity increases, experience increases as big as 1 tone / hectares, c) extensification wide land is assumed corn experienced increase as big as 2.5 eh / year, d) total population growth declines from 1.4 % to 1.32 %, e) The decline of imports is 60%

### 3. Result and Discussion

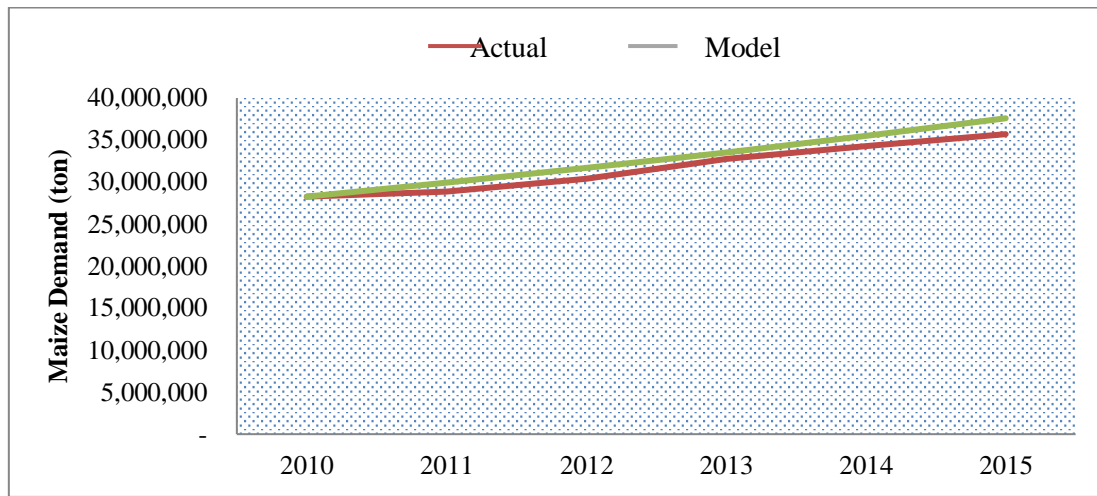
#### 3.1 Model Validation

The validation of production sub-model was intended to see the similarity between the data of actual production and the production data simulation results. Similarities between actual and model showed the validation level of the model. More detail can be shown as follows:

**Table 3:** The validation of maize production sub-model

Year	Actual Data (tonne)	Model Data (tonne)
2010	18.327.636	18.344.641
2011	17.643.250	17.937.671
2012	19.387.022	19.362.755
2013	18.511.853	19.899.187
2014	19.008.426	21.488.925
2015	21.621.435	23.721.387
	MAPE	3,19%

The MAPE value of maize need sub-model validation gained 1,89%, showing a value of less than 5%. It can be concluded that the simulation of maize needs sub-model that was done was valid and very appropriate to the real world. [8] stated that when a model has the MAPE value which is less than 5%, it means that the model can be classified as very accurate to depict the actual condition. It can be shown in the graph between actual data and model data in the period of 2010 to 2015. The graph can be shown in the figure below:

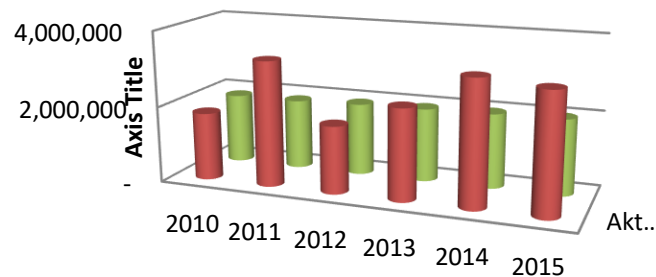


**Figure 3.** Graph of maize demand Sub-Model Validation

*3.2 Model Validation Sub-economic model*

MAPE validates import value of corn, 9.02 percent which demonstrates that the value is less than 5 percent. Visible in Figure 3, is simulation sub requirement model corn carried out by valid and very precise suit with his real world. Morecroft (2007) names is MAPE value <5 %, so a model can be classified very precisely describe condition indeed. The case also appears in graphic between actual data and model data in time century year 2010 to 2015. Graphically like Figure MAPE validation import value corn 9.02 % which demonstrate value that less than 5%.

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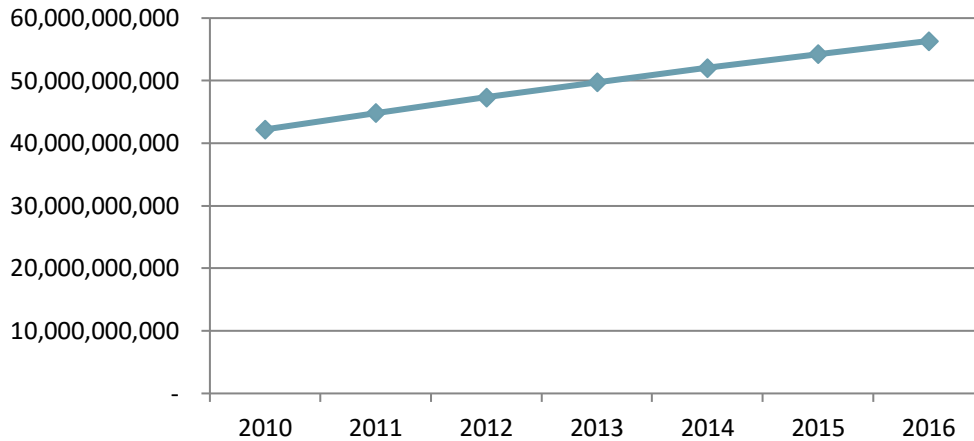
	2010	2011	2012	2013	2014	2015
■ Aktual	1,78	3,30	1,77	2,39	3,29	3,14
■ Model	1,85	1,85	1,91	1,94	1,97	1,99

**Figure 4.** Validation of maize import in Indonesia

*3.3. Submodel behaviour economy*

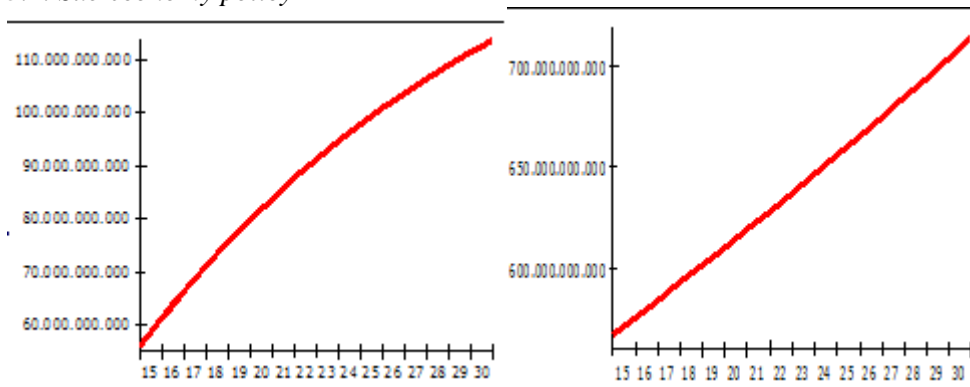
The sub model behavior of regional economy is intended to see the dynamics pattern of income simulation (benefit acceptance) from corn production activity, within 2010-2025. The sub model of regional economy becomes very important, particularly in national decision making relating to the increase of social welfare and regional development. Reviewed from a macro-economic standpoint, the

role of the agricultural sector is conventionally demonstrated by the gross percentage of value added (NTB) created by the agricultural sector to total gross domestic product. The prevailing GDP by applicable illustrates the level of added value created by all production factors in the economy. In this study, corn price and the production value of corn produced indicators.



**Figure 5.** Sub model behavior economy (rupiah)

3.4. Sub economy policy



**Figure 6.** Farmer income and industry revenue in the actual 2015-2030

Farmer income and industry acceptance in Figure 6 showed improvements in accordance with exponential growth in actual scenarios in the period 2015-2030. The behaviour shows that the sub-model of the national economy relies heavily on the growth of national corn production, where the growth of the production relies heavily on the increase of corn planting area. Increased economic contributed by the acceptance of corn farmers as farmers, and the acceptance of the industry as an income PAD. Farmer's income occurs due to the acceptance and cost of sugarcane farmers in the cultivation of corn crops. The results of the farmer's revenue simulation amounted to 55.98 billion at the start of the simulation in 2015 and at the beginning of the simulation of 96.49 billion. As for industry acceptance at the beginning of the 2015 simulation year of 371.12 billion and the end of the simulation in 2030 amounted to 466.90 billion.

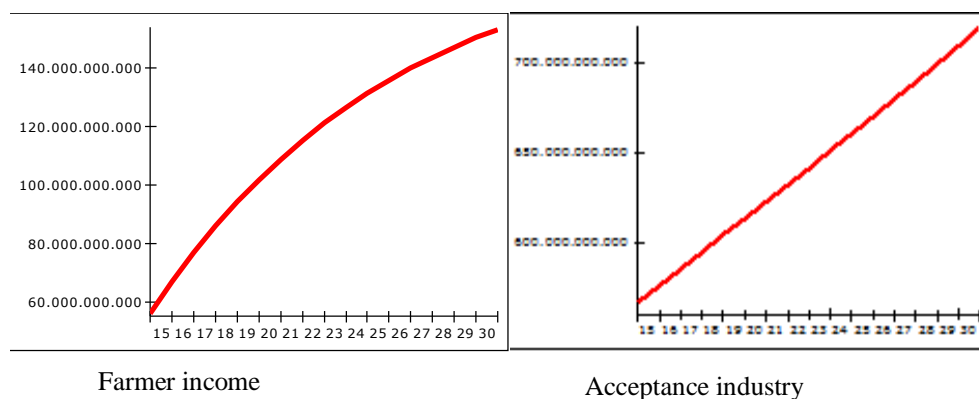
Low revenue in a region will lead to low development of an area due to low income for shopping and development. The area's economic wheels will largely depend on growth and increased revenues from various sectors including the agriculture sector for Corn commodities.



The amount of national corn production becomes an important factor in the national corn development model towards the regional economy contributed by the increase of national corn. The donations of GDP and income earned by corn farmers. The increase in the national economy was contributed by the increased corn production. With the increase in the amount of corn production, it is expected that the contribution to GDP increases. In 2015 food crop contributions to GDP amounted to 277,773 billion.

### 3.5 Model Simulation

Farmer income and industry acceptance in Figure 7 showed improvement in accordance with exponential growth in productivity enhancement scenarios in the period 2015-2030. The behavior shows that the sub-model of the national economy relies heavily on the growth of national corn production, where the growth of the production relies heavily on the increase of corn planting area. Economic enhancement contributed from the acceptance of corn farmers as farmers' income, and the acceptance of industry as an income PAD. Farmer's income occurs due to the acceptance and costs of corn farmers in the cultivation of corn crops. The results of the farmer's revenue simulation amounted to 60.59 billion at the start of the simulation in 2015 and at the end of the simulation of 104.42 billion. As for industry acceptance at the beginning of the 2015 simulation year of 371.70 billion and the end of the simulation in 2030 amounted to 467.90 billion.

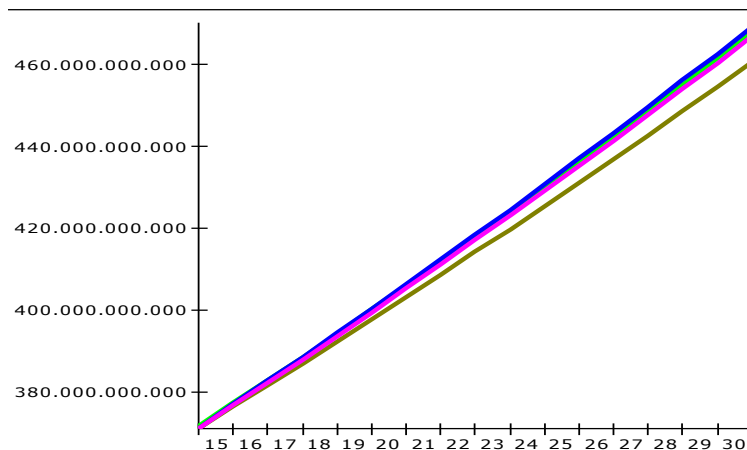


**Figure 7.** Farmer income and extensification scenario industry acceptance 2015 – 2030

The national economy in shows the exponential growth pattern, this is due to the acceptance derived from the industry acceptance from the industry generated raw materials and the acceptance of farmers has also improved. Farmer's income at the beginning of the 2015 simulation of 55.98 billion and at the end of the simulation in 2030 amounted to 113.84 billion while industrial acceptance in 2015 amounted to Rp 371.12 billion and in 2030 amounted to Rp 469.07 billion.

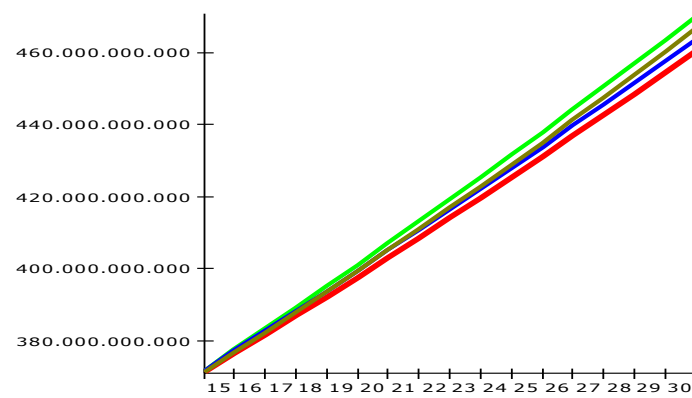
The simulation results of the region's economy in Figure 9 show that the land extensibility scenario shows the largest acceptance of the agricultural sector, especially on corn commodity food. In the year 2015 the reception amounted to Rp 371 124 billion and increased in the year 2030 As Rp 466.90 billion. The increase in the economy nationally is the impact of the increase in corn production and the acceptance of feed industry. Policy of provision only or the need side not enough to make Indonesia to meet the needs of national corn according to the target that is proclaimed by the Government, assuming if only one of the policy scenarios is successful. To anticipate this, a policy scenario is a combination of several scenarios.





**Figure 8.** The comparison of actual scenario 1, 2, 3, and 4 in the availability and impact of the increased towards national economy

The simulation results of the region's economy in Figure 9 show that scenario 6 shows the largest acceptance of the agricultural sector, especially in the commodity sub-food corn. In 2015 the reception amounted to 371.70 billion rupiah and an increase in 2030 amounted to 463.83 billion. The increase in the economy nationally is the impact of the increase in corn production and the acceptance of feed industry.



**Figure 9.** The comparison of actual scenario 5, 6, and 7 in the availability and industry acceptance

#### 4. Conclusion

The results of simulated models using government policy strategies are able to increase corn production and increase the region's economy. Of the simulated extensibility increased by 1.6 ha/year, able to increase the production of corn exceeds the government target of 24,8 million ton in 2020, although it has not been able to meet the needs of corn that increased faster than corn production. Therefore, it takes some alternative policies to produce better policies in the effort to increase production.

Alternative policies with a combined increase in land extensibility, increased productivity, decreased imports and decreased population have better performance than other scenarios. The increase of national corn production will contribute to farmers' income, which indirectly contributes to GDP so that the national economy will increase. GDP is also assessed to provide information regarding performance assessments.

### Acknowledgements

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