The dynamic of rice production in Kalimantan Selatan: A policies study

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The dynamic of rice production in *Kalimantan Selatan*: A policies study

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Abstract

Rice is the staple food for the people of Kalimantan Selatan, Indonesia. The inability of the government to meet the needs of rice will lead to regional and national instability. Fortunately, the Government of Kalimantan Selatan has stated through statistical data that the production of rice in Kalimantan Selatan has surplus. Therefore, Kalimantan Selatan serve as one of the national food barn area. An interesting point is Kalimantan Selatan which has a wetlands as a majority of paddy field capable to achieve surplus production in rice, where the wetlands can only be planted with rice once a year. This study aims to provide an alternative policies to maintain a surplus in rice production through policy analysis approach based on system dynamics model. The resullt of the simulation that Kalimantan Selatan will capable to maintain their rice production in surplus condition if the Government can push the paddy field conversion and endorse the production insentives for the farmers. In 2027, Kalimantan Selatan potentially has a surplus 1 million tons per year for rice.

Keywords
Rice, System dynamics, Policy Analysis, Simulation

1. Introduction

The government has to capable to manage availability of rice as a staple food fo Kalimantan Selatan people in order to avoid political instability and social conflict. Therefore, rice in Kalimantan Selatan has engaged on the list of strategic commodities (Irawan. 2005). Population is increasing every year lead rice demand. The government established several policies to meet the rice need, such as increased productivity policies, price determination for governemnt purchases, determination of the lowest retail price, farmers incentives and import.

The availability of food involves food quality, entity integrity, safety and health (Hu et. al., 2013), the sustainability of production, diversification of products, price affordability (Wibowo et. al., 2016) and related information services of foodstuffs (Vorst et al., 2009). It is to be important to focus not only on quantity of rice but also in quality and services. Unfortunately, the government today has a priority only on rice quantity and services, although rice quality remains a government consideration.

An interesting point is Kalimantan Selatan which has a wetlands as a majority of paddy field capable to achieve surplus in rice production, where the wetlands can only be planted with rice once a year. Kalimantan Selatan is a

province that has a land structure is less suitable for rice (Kinardi and Firahmi, 2010). The method of planting rice in Kalimantan Selatan is not as easy as most farmers in Java. The majority type of land in Kalimantan Selatan is peat soil. Therefore, special treatments is required in cultivating rice in Kalimantan Selatan. The cultivation methods in Kalimantan Selatan according to (Kinardi and Firahmi, 2010) are: (a) tides (41,38%), (b) lebak (7,76%), (c) rainfed (48,27%), (d) mooring (0.87%), and (e) irrigation (1.72%). Rice commodities contribute big impact to the inflation rate composition in South Kalimantan. The influence of rice commodities on regional inflation leads providing the best policies on rice availability by the government. The good handling on rice will endorse economic performance of South Kalimantan to be more excellent (Kinardi and Firahmi, 2010).

This study aimed to provide an alternative policies to maintain a surplus in rice production through policy analysis approach based on system dynamics model. The outcomes of this study is provide an alternative policies for the government, to help them control the regional stability through generate the policies which will provide the availability of rice in the market, with affordable price and the quality of rice. The all of outcomes considers Kalimantan Selatan will be the best national food barn. The government of Kalimantan Selatan facing the critical condition in which they have to reasonable in generate the policies to accommodate the food security concern and industrial growth at the same time, considering Kalimantan Selatan has expanded the industrial growth especially in plantation (e.g. palm oil) and mining although in 2015 the mining sector has been declined (Wibowo et al., 2016).

According to the Bank Indonesia Annual Report that rice is one of the commodity that listed on 20 commodities contributor to inflation in Indonesia especially in Kalimantan Selatan. In Kalimantan Selatan, rice has the most influence on the inflation rate. Bank Indonesia also stated that supply and demand of rice in controlling the inflation rate needs to be studied further. In other hands, the Gross Domestic Product number field and horticultural crops occupy the top two positions under the mining and quarrying as a contributor to the economic value (Wibowo et al., 2016). According to the (BKP, 2012), the addition of acreage, harvested area and productivity show rice production improvement. However, production growth remains to be watched. The rice deficit can be threatening because of land conversion, farmers turn over, and bad management in farmers insentives (Wibowo et al., 2016).

2. Methods

Policy analysis was used in this research to provide a picture to figure out of decision making consideration for all stakeholders (problem owner). The policy analysis comprises of indepth explanation of policy alternatives, annotation systems, as well as comparisons, including the advantages and disadvantages of each policy alternatives (Wibowo et al., 2016). According to (Walker, 2010) policies analysis can be arranged through eight stages, which are (a) Problem identification: identifying the problems and define limitations of problem analysis; (b) Determination of objectives: define the objectives of each actor in the system; (c) Determination of criteria: the criteria described in the testing advantages and disadvantages of alternative policies; (d) Selection an alternative: to construct scenarios that can be applied; (e) Alternatives analysis: conduct a comprehensive review of the scenarios that will be implemented; (f) Comparison of alternatives: the outcome of each alternative compared to the benefits and disadvantages, it is used as a basis for selecting one of the policy alternatives; (g) Application of new procedures: policies implemented directly elected both internally and externally; (h) To monitor the implementation of the measures taken and ensured in accordance with the objectives to be achieved.

Model will be evaluted by two approach which are model verification and model validation. Model evaluation is used to ensure that the model can quite represent the actual condition (Setiawan and Sukriana, 2010). Model verification is used to test the whole model whether there is any inconsistency dimensional of variables. The correct dimension and unit lead good model for the simulation and decrease the error probability. Model validation in this research using three approaches which are historical fit, extreme condition test, and sensitivity analysis. Historical fit is used to show the model performance through comparing the parameters. The model is valid when the deviation actual data-simulation is less than 10%.

The extreme condiition test is used to ensure that the developed model does not provide irrational behavior (Wibowo et al., 2016). This test performed by giving the highest and lowest extreme value in the driver variable.

If the model is well-developed then the test will show the rational behavior. Conversely, the test result will show the irrational behavior if the model is not well-developed. The last but not least of the test is sensitivity analysis. This analysis is used to find which a sensitive variables that will impact to the whole of model extremely. By knowing the sensitive variables it could be provided the alternative of policy approach in the policies design processes.

3. Result and Discussion

The first step in modeling the case in this study is through causal loop diagram construction. It shows causality impact in system model. The construction of causal loop diagram is enhanced by mental data processing. It is done by defining the relationship among the variables. The diagram indicates many variables impact the system and have any behavioral structures. Causality diagram of this research is presented in Figure 1.

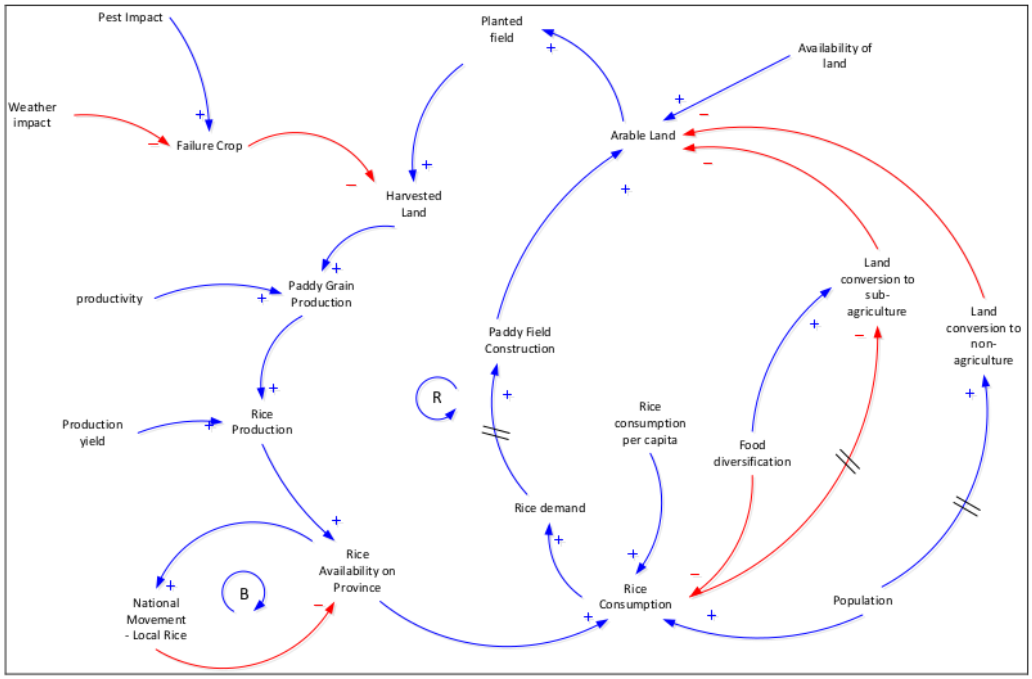

Figure 1. Causal loop diagram

The numerical data processing is used to enanced stock and flow diagram. Majority of data gained by the previous studies or secondary data. The diagram is defining the detail of relationship among the variable through mathematics languange which shows in model algorihtm. This study comprises the model of four modul which are production modul, population modul, consumtion modul, and land modul. Initial step of policy alternatives formulation is defining all actors in the system. The result of actor analysis in this study is presented in Table 1.

Table 1. Actors in system

Actors	Role	The Main Concern
Kalimantan Selatan Governor	Decission Maker (Problem Owner)	Undeficit rice and surplus in a sustainable manner. The achievement of a surplus of more than 1 million tonnes of rice per year.
Department of Agriculture	Stakeholder	Increased Production reach 3-5% each year.
Food Security Agency of Kalimantan Selatan	Stakeholder	Supervising the distribution of rice, rice consumption reduction efforts targeted per capita in 2015 will run next at 1.5% each year.
Bulog Divre Kalimantan Selatan	Shareholder	Undeficit rice buffer stock

Scenarios were developed, which are: (a) push the land conversion (LC) near 0%(ha) per year and increasing the rate of paddy field construction near 5% per year constantly. The government will give alternative option to use land for industrial purposes in another land. (b) Intensification approach through System Intensification of Rice (SRI) implementation which is the productivity targeted at the level of 2,5% per year. (c) The status quo of system is written as business as usual (BAU) scenario, wwhich do not apply the new policies.

3.1. Model Evaluation

Verification of the model performed by the consistency dimension of each equation and parameters. As the result of the test the model is verifiied based on units, parameters, dimensions and logical algoritm. Validation is conducted with four different types of tests on models that have been developed which are historical fit, comparison of the behavior of the model, extreme conditions test and sensitivity analysis.

Based on historical fit tests on three important variables in this system which are deviation on paddy dried grain production variable is 2.30%; deviation on population variable is 0.57%; and rice stock variable is 3.13%. The all of the results are less than 10% deviation, therefore it could be declared thatt the model is valid. The extreme conditions test was performed on the variable of new paddy area and production variable. Based on result of the test, there were not show irrational behavior, therefore it could be declared that the model is valid. On sensitivity analysis, the variable rate of rice consumption per capita has been tested. By the changing of the rate of rice consumption per capita 10% gives a deviation of 21%, meanwhile the reduction in rate of rice consumption per capita arround 10% gives a deviation of 31.40%. The result shows small changes can give significant impact on the system. The all of the tests show that the model wich was developed as a rice produuction system model was valid and could be represent the existing system on providing rice in Kalimantan Selatan.

3.2. Simulation

Simulation results are performed on all policy alternatives and consider to year 2027 which presented in Table 2.

Table 2. Results of simulation

Variable	Unit	Simulation			
		BAU	LC	SRI	LC+SRI
Production	**Ton**	**2.196.070**	**2.742.683**	**2.911.423**	**3.402.896**
Rice Balance (Surplus/Defisit)	Ton	402.873	636.558	835.698	1.141.356
Increased Productivity	%	0,35	2,47	2,97	4,65
Rice Reserve	Ton	80.973	95.989	120.761	129.017
Land productivity	Ton/ha	4,21	4,21	4,78	5,02
Population	**People**	**4.852.017**	**4.852.017**	**4.852.017**	**4.852.017**
The decerease in rice consumption per capita	%	0	0	0	0
Rice demand	Ton	475.498	475.498	475.498	475.498
Land conversion rate	**%**	**1,78**	**0**	**1,78**	**0**
Land conversion	Ha	10.010	0	10.010	0

Based on simulation results, the combination LC and SRI gives the best results in the effort to achieve sustainable surplus on rice in Kalimantan Selatan. Both in terms of the rate of increase in production, a surplus of rice, the consumption of rice, and rice reserves. However, the powerful scenario will not work properly if the government fail in policies supervision.

This research also show some findings, such as related the price of rice. It must be considered while discussion regarding to availability of rice policies development, especially for regional policies. The price of local rice is always more expensive rather than the price of non-local variety of rice. Consumer preferences are become a driver varible to encourage local rice market continues to grow. It may trigger the volatility of rice price in the market. This paper was define that price as exogenous variable in the model, therefore the further research the price variable should be endogenous factor in the system. It is evidenced by rate of inflation in Kalimantan Selatan significant influenced by the price of rice, especially as a price of local rice volatility. Consequently, the highest retail pricing policy is not working properly in order to control the price of local rice, yet it must be control at production cost.

The local rice distribution has been disrupted by delay behavior. Over and over it is related to consumer preferences. As the finding, that local people like to eat outdated rice, even the price of outdated rice is more expensive than fresh rice. This is a unique finding, the delay that occurs can reach the period of one year. Delay behavior will change the pattern of rice distribution routines. This will have an impact on safety stock, price, and rice stock overall. Therefore, in this model stock of rice aggregate also represent the total of outdated rice stock a year earlier. At the same time, the government also has to ensure that the distribution of rice can reach remote areas in Kalimantan Selatan, although the price may more be expensive, yet the rice must be available. As the further research, detailed rice distribution from granary to the remote areas will be developed, with the intenton of rice distribution pattern investigation. The rice distribution also concern on rice flows, trade in and trade out from Kalimantan Selatan to other provinces.

4. Conclusion

Rice production model in Kalimantan Selatan gives an point of view of the policies in order to provide rice availability. Based on the result of simulation, Kalimantan Selatan rice stock will be safe for up to 10 years with the provision of land conversion evaluation and supervision on intensification program. Even though the stock will safe for up to 10 years, quality and price aspect will be the main focus for up the 10 years. Finally, as the investigation that Kalimantan Selatan capable to support as national rice supplier.

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Biographies

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