PROCEEDING

International Workshop on Agribusiness

Entrepreneurship and Innovation for Food Security and Rural Development

IPB International Convention Center, Bogor - Indonesia,
5 - 6 December 2012

BOGOR AGRICULTURAL UNIVERSITY

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MSM MAASTRICHT SCHOOL OF MANAGEMENT

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FACULTY OF ECONOMICS AND MANAGEMENT
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FOREWORD

With deep satisfaction I was writing this foreward to the Proceedings of International Workshop on Agribusiness that brought forth an interesting topics of **Entrepreneurship and Innovation for Food Security and Rural Development** held in IPB International Convention Center, Bogor Agricultural University, Indonesia, on 5 -6 December 2012. Planned to be held annually in the future, the workshop has been conducted with the support of NICHE – a project at Department of Agribusiness Bogor Agricultural University funded by NUFFIC, the Netherlands.

Diverse papers and discussion represent the thinking and experiences of mixed and various scholarship, students and professors of their particular interest and fields. Of valuable was the presence of prominent scholars from the Netherlands, Germany, Australia, England, and Asian countries, including Indonesians who brought their newest findings out of their research works. Their contributions helped to make the Workshop as outstanding as it has been.

Special thanks are due to the invited speakers Prof. Onno Omta of Wageningen University and Research Netherlands, Prof. Stephan von Cramon Taubadel of Goettingen Unversity Germany, Prof. Peter Warr and Dr. Budy Resosudarmo, of Australian National University, Dr. Luca Cacciolatti of Kent Business School England for their valuable contributions and shared knowledges. We would like to also to thank the editor of the proceeding, Dr. Amzul Rifin, Dr. Suharno, Yanti N. Muflikh. Siti Jahroh PhD, and Hamid Jamaludin for the layout of the proceeding.

It is my hope that this proceeding will contribute to the development of entrepreneurship in agribusiness and rural development in the world and in Indonesia especially.

Dr. Nunung Kusnadi
Head of
Department of Agribusiness
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MILK SELF-SUFFICIENCY POLICY IN INDONESIA: DYNAMIC SYSTEM MODEL APPROACH

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ABSTRACT

At the present, the dairy import amounts to around 70 percent of the national demand. The government is planning to reduce it to 50 percent. This study aims to assess the current condition of dairy farming and the possibility of achieving that government's target. It employed the dynamic system model with initial condition in 2011 and the prediction estimated until 2025. If there was no policy intervention or the existing condition in 2011 continued (business as usual), the prediction in the period of 2011 to 2025 for total national milk demand and production will tend to be higher. However, the increased demand is still higher than production, so in 2020 the target is still not achieved. Through the policy intervention I, the target will be achieved in 2021. On the other hand, through the policy intervention II, it can be achieved on time in 2020.

Keywords : *national milk, production, consumption, demand, import, and policy*

INTRODUCTION

One of the goals of the national development is to improve the quality of human resources. Based on the Human Development Index (HDI), the position of the quality of human resources in Indonesia tended to decrease where it ranked 112 out of 147 countries. It is determined among others by the quality of food consumed such as milk which is the primary animal protein source product that has very good quality. In 2011, per capita milk consumption per year in Indonesia was around 11.09 liters (Dirjen Peternakan dan Kesehatan Hewan Kementan, 2012 in Republika, 29 Mei 2012). This milk consumption is still much lower compared to other countries, such as 31 liters in Bangladesh, 40 liters in India and 12.97 liters in Cambodia.

In terms of domestic milk production, the country still cannot meet the domestic demand, so it should import in large quantities and tends to increase over the years. The national milk production is only able to fulfill around 30 percent of Indonesia's total demand, the rest 70 percent remains to be imported (Ditjenak, 2010). In terms of international trade of dairy products, Indonesia is now in a position as a net-consumer. Up to the present, Milk Processing Industry (IPS) is still highly dependent on this imported raw materials that account for around 70 percent (Daryanto, 2012).

Indonesia has the rich natural resources potentials that can be used for the development of dairy farming agribusiness that can increase the national milk production. Yet, it is important due to the government's target, especially the Ministry of Agriculture, in order to achieve the national milk self-sufficiency by 2020 through the national dairy industry development program. The objectives of this study are: (1) to investigate the actual condition of the dairy farming agribusiness, (2) to identify policies of milk self-sufficiency in Indonesia, and (3) to develop the dynamic system model of national milk availability.

METHOD OF THE STUDY

This study aims to formulate the model of national milk supply and demand in Indonesia by conducting policy simulation in order to balance the supply and demand of national milk where the milk self-sufficiency target can be achieved by 2020. This study has been conducted from June to November 2012. The dynamic system model of national milk availability is developed in order to describe the relationship between elements in the milk availability system of Indonesia in the future. It divided the overall system into two sub-systems which are the sub-systems of milk demand and supply.

Milk demand was analyzed through the demand of dairy milk for household consumption and milk processing industry. The data used are the national aggregate data such as (1) milk consumption per capita, (2) population, (3) population growth, (4) the demand for the milk processing industry, and (5) the national milk demand. Milk supply was identified by the amount of domestic milk production and the imported milk. The data used are the national aggregate data such as (1) dairy cattle population by age, (2) dairy cows mortality rates by age, (3) productivity of dairy calves and fresh milk productivity of lactating cows by age, (4) the slaughtering rate of productive dairy cows, and (5) the amount and rate of imported milk.

The data are secondary data that are collected from various sources from the Directorate General of Livestock Ministry of Agriculture, Cooperative Milk Indonesia (GKSI), National Dairy Council, Central Bureau of Statistics, local government agencies and other relevant references and institutions. Information regarding national milk supply and demand and also milk self-sufficiency policies were collected through literature study and interview to dairy agribusiness stakeholders in Indonesia.

Dynamic system model was originally developed by Forrester (1968). Dynamic systems model is an abstraction and simplification of a complex system but trying to represent the system properly. The selection of the dominant variables and relationship identification among variables in the system will determine the accuracy of a model. Simulation of milk self-sufficiency policy in Indonesia on dynamic system model of national milk availability was conducted after the dynamic system model was developed with good validity. Stages of the modeling process are as follows.

IDENTIFICATION OF NATIONAL DAIRY AGRIBUSINESS

The need of each of the business player (stakeholders) in the national milk availability system is different. Dairy farmers expect the feed and medicines are available at stable and affordable prices, the price of fresh milk is stable and high enough to provide an incentive for farmers to develop their dairy farming. Dairy cooperative has the interest in helping dairy cooperative members (dairy farmers) in the feed procurement and marketing of their milk, good milk storage technology so that the quality of milk can be kept in good condition, which in turn will give the selling price of fresh milk good and stable. Dairy processing industry requires raw material (fresh milk) in a sufficient amount and continuous whereas the purchasing price that is relatively cheap and in turn can increase their income. The household consumers have interest in affordable milk prices with good quality products. Financial Institutions have the interest to increase their income and in a small risk of loan repayment. Government is concerned with the increase in national milk production so that imported milk could be reduced and ultimately give a reduction in foreign exchange, increase revenue, improve the stability of the prices of feed, medicines and milk.

Basically, all business players want income increases, which will provide incentives for the development of the dairy farm that ultimately, provide a positive direction for the attainment of national milk self-sufficiency. In addition to the synergistic needs, it also appears the contrast needs of them, i.e. price, where dairy farmers and cooperatives want higher selling prices while the processing industry wants low purchasing price of fresh milk, meanwhile the government wants the stability of prices. The contrasting interests in price determination among business players will likely lead to a conflict and eventually it will hamper the efforts of national milk provision system. Price agreement that is a win-win solution is generally chosen as the alternative. In the context of milk agribusiness, it is expected that the dairy farmers will get a higher price than the price offered Milk Processing Industry, but the two sides still get the benefits, where the farmers get a better incentive to develop their dairy farms and the milk processing still get a good profit from the business of processing fresh milk into its derivatives. However, taking into account the availability of funds, manpower and time, this study is limited only to formulate the system dynamic model that is used to predict the availability of national milk in the future. Problem solving of prices between business players through a win-win solution is assumed to work well so the on-going price does not impede the development of the dairy farm in order to achieve national milk self-sufficiency.

Government policy in the dairy sector will determine the development direction of the national dairy agribusiness in the future. Internal and external conditions that are conducive for dairy farming agribusiness development will ultimately determine the direction of increasing milk production to achieve the government's aim for milk self-sufficiency by 2020.

IDENTIFICATION OF NATIONAL DAIRY AVAILABILITY SYSTEM

Understanding the mechanisms that occur in the system is a very important stage. The approach used in this study is to construct a causal structure system of national milk availability in the form of causal-loop diagram. Causal structure of the system of national milk availability consists of two subsystems, i.e. the subsystems of the national milk demand (Indonesian people) and the national milk supply. Each subsystem was built by typical factors and interacted dynamically according to time and circumstances.

The ability of understanding of the system will determine the dynamic model to be generated. The diagram illustrates the circumference of a causal relationship between the variables involved in the system. All variables are connected by arrows, where the variable that is at the origin of the arrow is a variable that affects (independent variable) and the variable at the end of the arrow is a variable that is affected (dependent variable). At the end of the arrow is added a positive (+) or negative (-) signs in accordance with the direction of the relationship between the two variables. Positive sign indicates a positive correlation and a negative sign indicates a negative relationship. Figure 1 is a causal-loop diagram that illustrates the movement of the population.

Figure 1 shows that the higher the average life expectancy will lead to lower mortality rate, lower mortality rate will cause the higher population. In the middle of the loop, there is a letter B (Balancing) in a circle counter-clockwise arrow, which shows a decrease in population. Increased fraction birth rate will lead to the higher birth rate, the higher birth rate will also lead to the higher population, the higher the population, the birth rate will also be high. In the circle there is a letter R (Reinforcing) with clockwise arrow, indicating the increase in population over time.

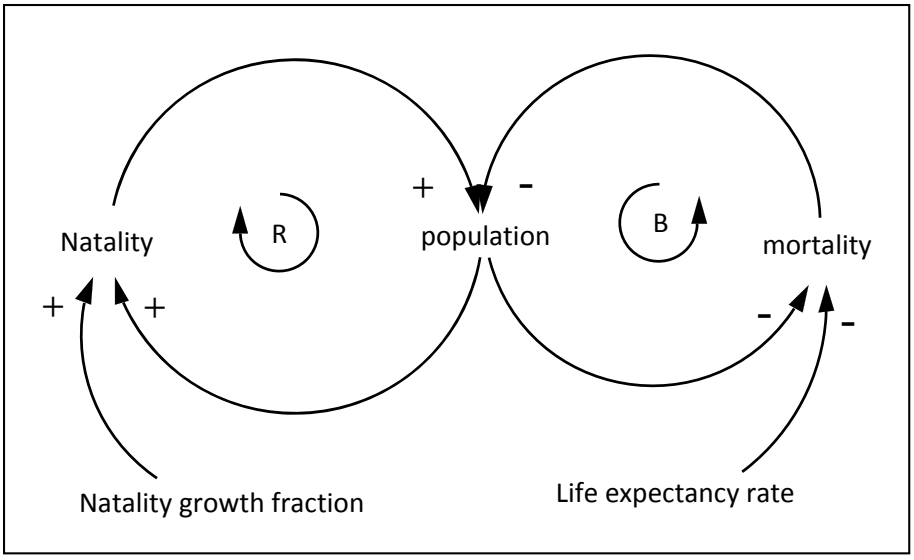

Figure 1. Causal Loop Diagram to Predict the Population
Source: Sterman (2000)

MODELING THE NATIONAL DAIRY AVAILABILITY SYSTEM

Modeling the system aims to simplify the system so it can represent the actual condition of the system well. Dynamic model is developed based on the availability of national milk in the causal loop diagram with the basic assumptions of dynamic models. The model is expressed in the form of graphic (flow chart) and mathematical equations. The flow chart will show the relationship between variables in the system. To construct a model of the national milk availability in this study, computer program of VenSim is employed (Ventana Systems, 2007). VenSim Program is chosen due to the consideration that it has been sufficient to build the model. The symbols used in the flow chart of VenSim program are illustrated in Figure 2.

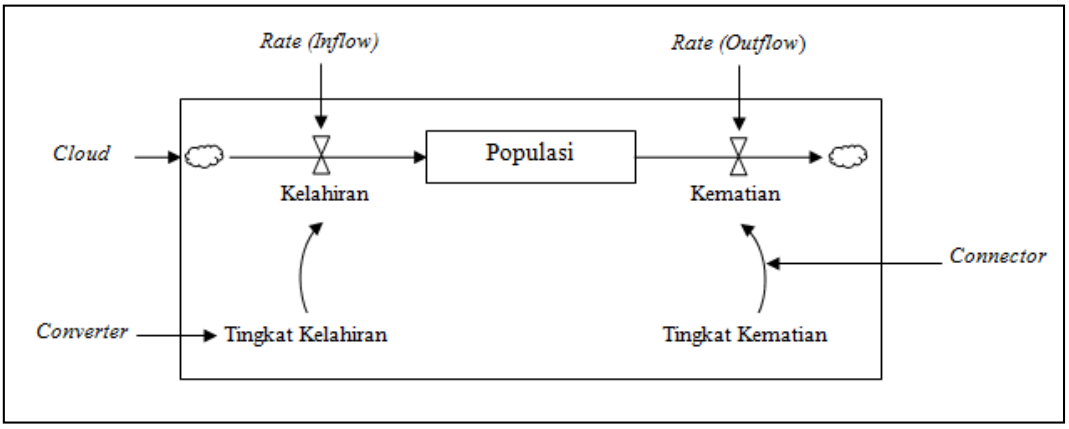

Figure 2. Language Graphics of System Dynamic Model
Source: Sterman, 2000

The symbols in the VenSim program of dynamic model in the graphical language is illustrated in Figure 2 that are stated in the five symbols, namely: (1) “Stock” (box) states the accumulation of a flow in the system (e.g. population), (2) “Rate” states the increase level (inflow) (i.e. the number of births) or reduction level (outflow) (e.g. number of deaths) of

stock in each period that shows the activity of the system, (3) "Converters" state the input that can be expressed in numbers or formulas or graphs (the "number" is determined by the model builder), (4) "Connectors" (arrows) indicate the flow of information (relations) in the system (the variable at the beginning of the arrow indicates the variable that affects and the variable at the end of the arrow is a variable that is affected), (5) "Cloud" states the system boundaries.

Stock is the accumulation of a flow system. Net flow of the stock is the change in the stock. Mathematically, the amount of Stock at the time t is expressed into the following integral equation.

$$Stock\ (t) = \int_{t_0}^{t} [Inflows(s) - Outflows(s)]ds + Stock\ (t_0)$$

Where Inflow(s) is the amount of inflow (additional Stock) and Outflow(s) is the reduction of stock during the period (s) between the initial times (t_0) to the present (t) (Sterman, 2000). Time horizon of the dynamic model system in this study was determined in fifteen years.

Based on the flow chart of system dynamic model of national milk availability, it was formulated the quantitative relationships among variables or equations in the system. The determination of the parameters in the mathematical equation is built based on assumptions that based on a theoretical study from the secondary data and mostly sourced from the Directorate-General of Livestock Ministry of Agriculture. The assumptions set out will determine the outcome of the prediction model, or in other words, different assumptions will provide the different prediction of national milk availability.

VERIFICATION AND VALIDATION SYSTEM OF NATIONAL DAIRY AVAILABILITY MODEL

The model has a high validity when the model can represent the actual condition well. The validity of the model can be done in two ways. First method uses the indicator of MAPE (Mean Absolute Percentage Error) which is formulated as follows:

$$\sum_{t=1}^{n} \frac{\left|\frac{\epsilon_t}{Y_t} * 100\%\right|}{n}$$

where Y_t is the actual value of the national milk availability in period t, ϵ_t is the difference between the actual value of the models and prediction errors. The smaller the value of MAPE, the higher the validity of the tested model because generally the actual value of the evaluated variables (Y) is getting closer to the Y value predicted by the dynamic model. Second method uses the expert judgment, where the constructed model is presented to the expert in Indonesian dairy industry to get an appraisal. Assessment includes the logic of the system, the parameters in the mathematical equation system and model output.

SIMULATION OF NATIONAL MILK SELF-SUFFICIENCY POLICY

Once the national milk availability system model is obtained with the good validity, then we do the simulation of milk self-sufficiency policy to that model. Simulations are carried out using several milk self-sufficiency policy scenarios, so the impact of milk self-sufficiency policy on the behavior of the system in achieving national milk self-sufficiency in the future can be obtained. Simulation technique is flexible to the changes, so it is suitable for the purpose of the actual system.

RESULTS AND DISCUSSION

INDONESIAN DAIRY AGRIBUSINESS

Livestock development is implemented through the concept of agribusiness with the concept of people's dairy industry (*innayat*) that conducted since procurement and distribution of the means of production (upstream sub-system), culture or raising activity (sub-system on farm), processing to marketing (downstream sub-system) through the approach to handle all sub-systems of agribusiness as a whole. Institutions involved in the upstream sub-systems such as dairy cow breeding agency, provider of dairy calves, feed industry and medicine industry. Upstream agribusiness industry that needs to be developed is the supply of mother cows and good bulls for the artificial insemination or bulls for natural mating.

In sub-systems on farm, more than 95 percent of the milk produced from dairy cows of Fries Holland or FH which developed since the Dutch government. It spread in an area that has a height of 750-1250 meters above sea level with temperatures 17-22 degrees Celsius. Mostly the dairy cows are spread out in Java, where outside of Java the largest dairy cattle population is in North Sumatra. Raising dairy cows starts from the development of dairy cows (virgins) that will produce milk after breeding where it can be naturally mated with the bull or artificial insemination (AI). To be successful, it is important to consider the reproductive phenomena.

In 2010, Indonesia imported dairy products as much as 302.158 tons with a value of 925 billion USD, this volume increased 12 percent compared to 2009. Europe (EU), New Zealand (NZ) and America (USA) are Indonesia's largest import country of origin, with a market share amounted to 32, 23 and 21 percent, respectively. Meanwhile, the market share of Australia was 13 percent in 2010, the volume decreased compared to 2002, reaching 30 percent.

Since the last five years the export of dairy products fluctuated from 37,000 tons in 2007 to 61,500 tons in 2008. In 2010, Indonesia exported 48,229 tons of dairy products with a value of 89 billion USD. Approximately it was two-thirds of exports, including other dairy groups, especially sweetened condensed milk. Approximately 82 percent (7,636 tons) of dairy products were exported to Singapore and Hong Kong using fresh milk products Greenfield Indonesia that is supplied by Australia. Import tariffs on dairy products is 5 percent, while for processing products such as yogurt and some milk concentrates and cream concentrates the import tariffs are 10 percent.

NATIONAL DAIRY AVAILABILITY SYSTEM

National milk availibility system is built based on two sub-systems, i.e. sub-systems of national milk production and consumption. The number of national milk demand that can not be fulfilled by the national milk production is covered by imports. The results of causal construction of national milk availibity system are drawn into the form of a causal loop diagram that is presented in Figure 3.

In the sub-system of the national milk consumption, total national milk consumption is determined by the number of population and milk consumption per capita in Indonesia. The greater the number of population and milk consumption per capita, the total national milk demand will increase. Meanwhile, Indonesia's population is affected by the population growth rate (death rate and birth rate of population). The higher the rate of population growth, the population will increase. The increase in milk consumption per capita is influenced by the efforts and success of government in incerasing income, education, social welfare and socialization programs that aimed at increasing the consumption of fresh milk nationwide, such as through the milk program for school children.

In the sub-system of national milk production, milk production of dairy cows is affected by the population of cows, especially the number of cows aged 2-7 years and their productivity. The greater the number of cows aged 2-7 years and milk productivity, the greater the total national milk production. In addition, poor handling system on milk, which causes the milk spilled and or damaged, will also weaken the capacity of the national milk supply.

The addition of the cows population is determined by the mature cows population of dairy cows, calf crop and mortality. The higher number of mature cows and calf crop and the lower mortality, the population increase of lactation cows will be greater. In general, female calves produced are not sold or kept as replacement stock, to enable the sustainability of the production cycle. Besides that, the government programs to increase lactation cows (dairy sires) of 2900 heads in 2012 will increase the population of productive cows.

In this study, the issue of the selling price of milk by farmers was not included in the model as the variable that affects the national milk production. The selling price of milk by farmers is closely related to market structure, institutions, supply and demand. Favorable prices for farmers so that farmers are encouraged to expand their businesses are covered in an efficient marketing system and government policies.

Availability of national milk is the difference between the total national milk production and consumption, which the shortage will be fulfilled from imports. Milk self-sufficiency is targetted to be achieved in 2020, in which the self-sufficiency target occurs when the total national milk production is able to meet the minimum 50% of the total national milk consumption or in other words the total dairy imports only make up to 50% of the national milk demand (Direktorat Jenderal Peternakan Dan Kesehatan Hewan, 2012b). Causal relationship among the variables in the system of national milk availability that described above can be seen in form of causal-loop diagram in Figure 3.

Causal relationships in the form of causal loop diagrams are expressed in five symbols, namely: (1) the arrows indicate the direction of causal relationships, the origin of the arrow is the cause, while the variable at the end of the arrow is the response variable or the effect, (2) a positive sign (at the end of the arrow) indicates if the cause variable increases, the effect will tend to increase, (3) the negative sign indicates the contrast relationship of positive sign, (4) the notation R (Reinforcing) shows the growth and (5) the notation B (balancing) shows a decrease in the long run in the loop.

MODELING THE NATIONAL DAIRY AVAILABILITY SYSTEM

Dynamic model of national milk availability system is built based on the existing condition in 2011 as the year of the beginning of the simulation, with a consideration that these data are the last data collection of dairy cows (PSPK, 2011). Simulations are carried out for 15 years or from 2011 to 2025. Milk self-sufficiency is achieved when the total national milk production reach at least 50 percent of the total national milk or the maximum amount of imports only 50 percent of the total national milk consumption.

VALIDATION OF NATIONAL DAIRY AVAILABILITY SYSTEM MODEL

The validity of the national milk availability model in this study was conducted using the expert judgment, which the model is presented to the expert in livestock/dairy Indonesia to get an appraisal. Assessment includes the logic of the system, the parameters in the mathematical equation system and model output. The validity of the expert judgment is sufficient, because the selected source persons are the experts in dairy cows sector in Indonesia due to their expertise and practical experience as a dairy farmers.

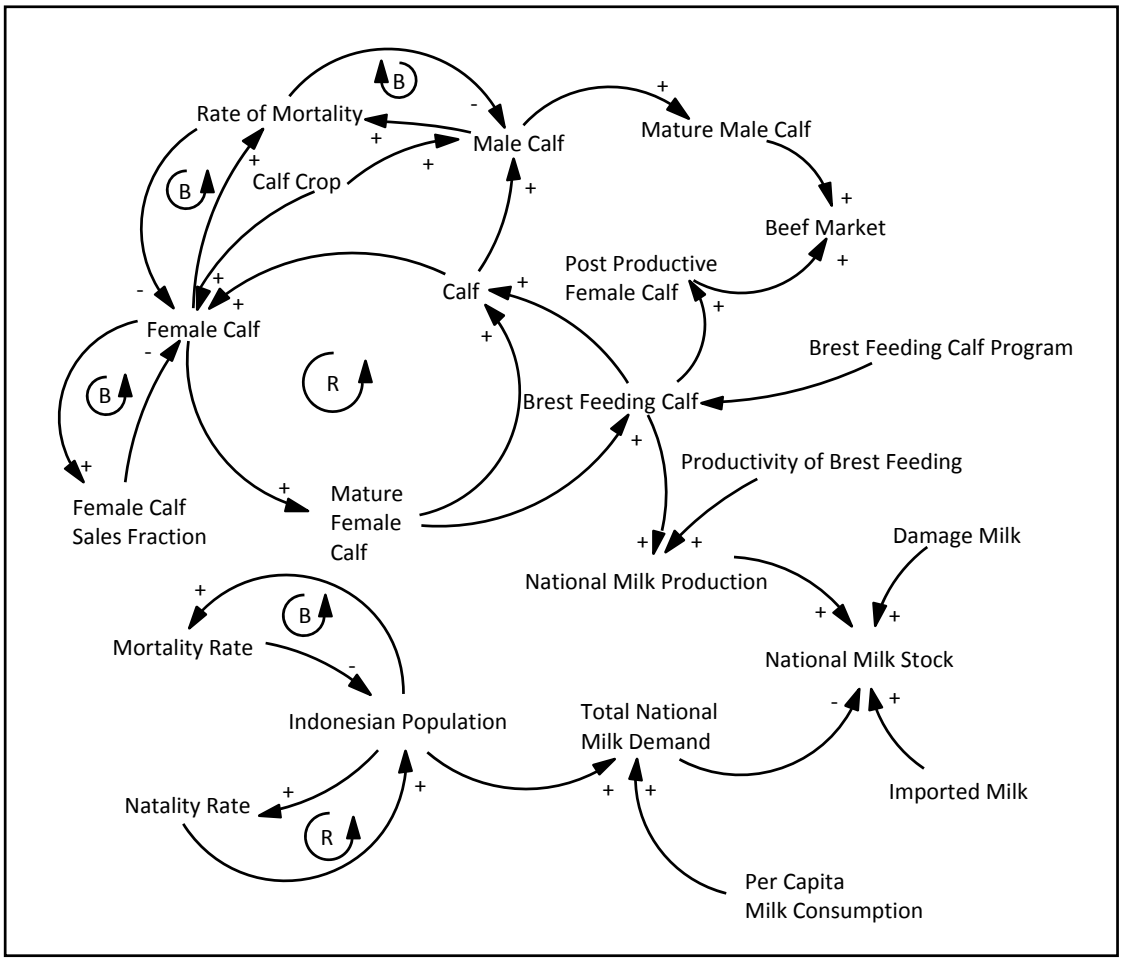

Figure 3. Causal Loop Diagram of National Dairy Availability System

SIMULATION OF NATIONAL MILK SELF-SUFFICIENCY POLICY

Policy simulations are categorized into three scenarios, namely: (1) Scenario of Existing Condition, the simulation on the dynamic model of the milk availability system, in which the existing condition in 2011 to continue as it is (business as usual), (2) Policy Scenario-1, the simulation in which the government's policy to increase national milk production in order to achieve self-sufficiency in milk in 2020 (minimum 50 percent of national milk requirement can be fulfilled by domestic production), (3) Policies Scenario-2, the simulation when the program launched by the policy scenarios-1 for milk self-sufficiency cannot be achieved.

Scenario of the Existing Condition

Simulation model of national milk availability system scenario aims to predict the achievement of milk self-sufficiency based on existing condition of dairy cows in 2011 that assumed to continue as it is (business as usual). The results of dynamic model simulations are determined by the parameters of the model. In the existing condition of dairy cows in 2011, the dynamic model parameters of national milk availability are determined as follows: (1) the average milk consumption of household in Indonesia, (2) the population growth rate of 1.49 percent per year, (3) Without any increase of cows population through imported productive cows (based only on the population of dairy cows in 2011), (4) calving rate of 70 percent, (5) survival rate of 85 percent, (6) reduction of productive cows 0 percent, (7) average productivity of 10.82 liters of milk per cow for the lactation period of 247 days or

milk productivity assumed to 2,672.54 liters of milk per cow per year; (8) the amount of milk that are damaged or spilled due to the poor handling after milking process at 1 percent.

Predictions of national milk availability in 2011-2025 are presented in Table 1. From Figure 4 and Table 1, it appears that if the existing condition of dairy cows agribusiness in 2011 continues (business as usual) then in the future (year 2011-2025) the total national milk demand and the total national milk production is likely to be higher, but the increase in total national milk demand is higher compared to the total increase in national milk production, so the percentage of total national milk production to total national milk consumption will tend to shrink up to 24.99 percent in 2020, but after the year 2020 it is likely to increase gradually.

Meanwhile, the availability of national milk showed a negative value, which means the total national milk demand is higher than the total national milk production. The deficit of national milk is generally covered by the import of milk that is generally carried out by the dairy processing industry.

Policy Scenario-1

From Table 2, it appears that if existing condition of dairy cows agribusiness in 2011 continues, then in Indonesia from 2011 to 2025 it is expected to be a deficit of milk with a greater value and milk self-sufficiency program achievements are getting worse (which is indicated by the increasingly smaller percentage of total milk production to the total milk demand). Policy Scenario-1 is intended to accommodate the government's policy efforts to achieve milk self-sufficiency that has been launched into the dynamic model. Policy scenario-1 is prepared by improvements in several parameters of dynamic models of the system of national milk availability listed in the existing condition scenario.

The changes in dynamic model parameters on the policy scenario-1 were determined based on the strategic objectives to be achieved through dairy farming policy (Direktorat Jenderal Peternakan dan Kesehatan Hewan, 2012). When the operational measures implemented well then at the farmer level, they will directly get sufficient incentives to develop their dairy farming business that in general will affect population increase of dairy cows and ultimately will increase the national milk production. Policy scenario-1 can be determined as follows:

1. Target program for additional mature cows population in 2012 of 2,300 heads
2. Increased Calving Rate. At the initial model (existing conditon scenario) the calving rate is 70 percent. If the government program succeeded, it is expected that the calving rate can increase gradually until it reaches 75 percent in 2016 and afterwards. Increasing calving rate by 5 percent in the five years at the national level still has the potential to be achieved (Budi Satoto, 2012, Personal Comm.)
3. Milk Productivity Improvement. In the initial model (existing condition scenario) the average productivity is 10.82 liters of milk per cow per day of productive lactating cows and in one year there is an average of 247 days of lactation so that in one year it is produced 2672.54 liters per mature cow.
4. Survival Rate Improvement Program. In the initial model (existing condition scenario) the average survival rate is 85 percent. Increased survival rate through breeding village and through a various technological innovations, so it is expected that the survival rate will increase gradually, reaching 90 precent by 2020. Increasing the survival rate of 5 percent in five years at the national level still has the potential to be achieved (Budi Satoto, 2012, Personal Comm.)

Policy Scenario-2

Based on the simulation of the national dairy availability dynamic model with the parameters of policy program launched by the government (as listed in the policy-1), it turned out that milk self-sufficient cannot be achieved on time, where in 2020 only 44.02 percent of the total national milk demand can be met from domestic production or in other words Indonesia still has to import milk by 55.98 percent. Therefore, it is required an alternative program of government policy where the target should be higher and faster than the target achievement program on the policy-1, where the program is scripted as policy scenario-2. Policy scenario-2 is carried out some improvements in target program and accelerated the implementation of the program (Table 3). The programs that are still a realistic target for enhancing and accelerating their implementation are:

1. Program of increasing the population of mature cows through import
2. Calving Rate Improvement Program
3. Survival Rate Improvement Program

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION

1. Dairy cows agribusiness is divided into upstream, on-farm and downstream sub-systems.
2. Strategic objective is achieved through dairy cows farming policy.
3. If the existing condition of dairy agribusiness in 2011 continues (business as usual) then the target program of milk self-sufficiency cannot be achieved in 2020 (percentage of total national milk production to the total national milk consumption is 24.99 percent).
4. If the program in policy scenario-1 implemented on time, national milk self-sufficiency will be reached in 2021 with the percentage of total national milk production to the total national milk consumption of 50.84 percent.
5. Milk self-sufficiency can be achieved on time in 2020 where at least 50 percent of the national milk fulfilled from domestic production, if the implementation of the policy scenario-2 program conducted on time.

RECOMMENDATION

To achieve milk self-sufficiency (by 2020 at least 50 percent of the national milk demand fulfilled from domestic production), the government should pursue the implementation of policy scenario-2 on time.

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ATTACHMENT

Table 1. Predictions of National Milk Availability in 2011-2025 Based on Policy The E*xisting Condition*

Year	Total National Milk Demand (Liters)	Total National Milk Production (Liters)	Percentage of National Milk Production to Demand (%)	Availibility of National Milk (%)
2011	2.675 B	805.11 M	30.1	-1.870 B
2012	2.957 B	865.05 M	29.26	-2.092 B
2013	3.267 B	924.99 M	28.32	-2.342 B
2014	3.613 B	1.003 B	27.77	-2.609 B
2015	3.992 B	1.100 B	27.55	-2.892 B
2016	4.412 B	1.214 B	27.51	-3.198 B
2017	4.879 B	1.292 B	26.47	-3.587 B
2018	5.393 B	1.398 B	25.92	-3.995 B
2019	5.959 B	1.519 B	25.5	-4.439 B
2020	6.588 B	1.646 B	24.99	-4.941 B
2021	6.686 B	1.787 B	26.73	-4.899 B
2022	6.785 B	1.940 B	28.6	-4.845 B
2023	6.887 B	2.103 B	30.54	-4.784 B
2024	6.989 B	2.274 B	32.53	-4.716 B
2025	7.093 B	2.467 B	34.77	-4.627 B

Notes: M = Million; B = Billion

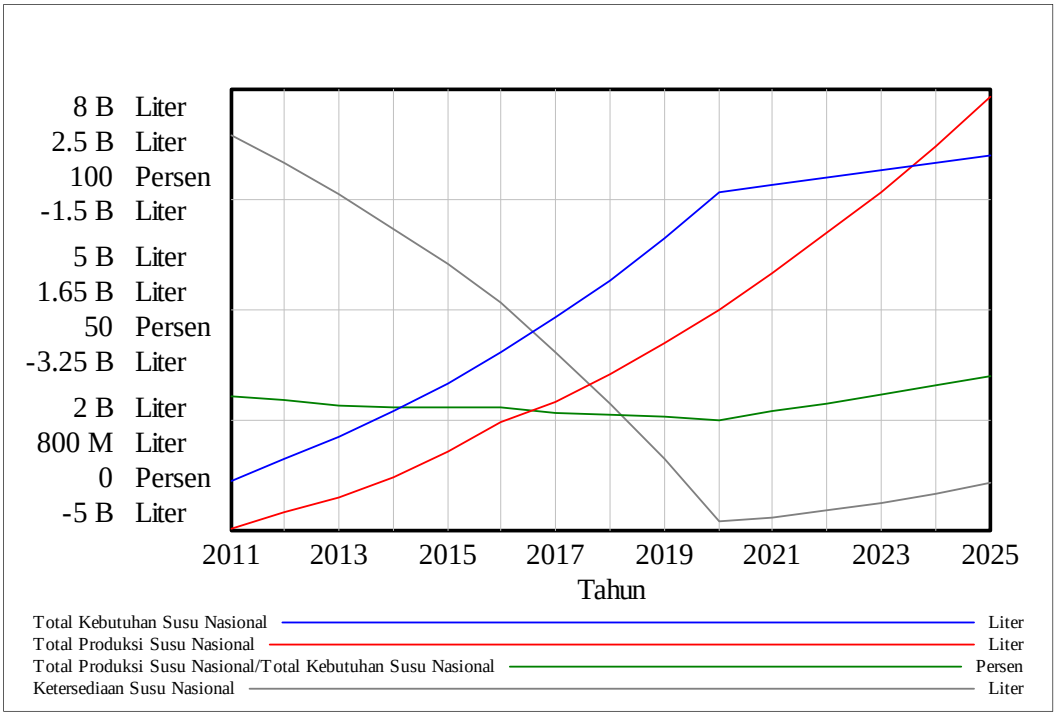

Figure 4. Predictions of national milk availability in 2011-2025 based on e*xisting condition*

Table 2. Predictions of National Milk Availability in 2011-2025 Based on Policy Scenario-1

Year	Total National Milk Demand (Liters)	Total National Milk Production (Liters)	Percentage of National Milk Production to Demand (%)	Availibility of National Milk (%)
2011	2.675 B	805.11 M	30.1	-1.870 B
2012	2.957 B	897.24 M	30.34	-2.060 B
2013	3.267 B	1.034 B	31.64	-2.233 B
2014	3.613 B	1.120 B	30.99	-2.493 B
2015	3.992 B	1.317 B	33.00	-2.675 B
2016	4.412 B	1.564 B	35.44	-2.848 B
2017	4.879 B	1.794 B	36.77	-3.085 B
2018	5.393 B	2.098 B	38.91	-3.295 B
2019	5.959 B	2.474 B	41.51	-3.485 B
2020	6.588 B	2.900 B	44.02	-3.688 B
2021	6.686 B	3.399 B	50.84	-3.287 B
2022	6.785 B	3.784 B	55.76	-3.002 B
2023	6.887 B	4.214 B	61.2	-2.672 B
2024	6.989 B	4.677 B	66.92	-2.312 B
2025	7.093 B	5.212 B	73.48	-1.881 B

Notes: M = Million; B = Billion

Tabel 3. Predictions of National Milk Availability in 2011-2025 Based on Policy Scenario-2

Year	Total National Milk Demand (Liters)	Total National Milk Production (Liters)	Percentage of National Milk Production to Demand (%)	Availibility of National Milk (%)
2011	2.675 B	805.11 M	30.1	-1.870 B
2012	2.957 B	897.24 M	30.34	-2.060 B
2013	3.267 B	1.034 B	31.64	-2.233 B
2014	3.613 B	1.126 B	31.18	-2.487 B
2015	3.992 B	1.335 B	33.44	-2.657 B
2016	4.412 B	1.608 B	36.43	-2.805 B
2017	4.879 B	1.886 B	38.67	-2.992 B
2018	5.393 B	2.272 B	42.13	-3.121 B
2019	5.959 B	2.754 B	46.21	-3.205 B
2020	6.588 B	3.305 B	50.17	-3.282 B
2021	6.686 B	3.962 B	59.26	-2.724 B
2022	6.785 B	4.501 B	66.34	-2.284 B
2023	6.887 B	5.097 B	74.01	-1.790 B
2024	6.989 B	5.768 B	82.53	-1.221 B
2025	7.093 B	6.556 B	92.42	-537.36 M

Notes: M = Million; B = Billion