A SYSTEM DYNAMICS VIEW OF RURAL COMMUNITY DEVELOPMENT IN INDONESIA

by :

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ABSTRACT

A system dynamics approach is applied to explore sociological dynamics on rural community development of a traditional rural in Indonesia namely Wamena. The model is used to explain the causalities relationship of the decision making process of rural communities in responding to the development implemented by the government. The model consists of five main sectors : native population, migrant population, land, food, and agricultural technology. The simulation shows that the dynamics of development pattern is greatly influenced by the interactions of natives and migrants in market activities.

INTRODUCTION

This paper is an inception of a two-year research project on modeling rural community development in Indonesia. Rural community development is aimed to function the technology, in a transformation process affected by community decision-making process. It involves many aspects which respond to the development activities. The activities usually apply sectoral approach which are not integrated and are usually imposed by the top management not based on the interests of the community as the development target. An alternative approach, that is, multi-sectoral development is modeled in this research project by considering the decision making structure of the communities.

The research project is focused on studying the rapid change of a traditional rural transformed to a less-traditional rural as the results of transformation process in multi-sectoral development. System dynamics methodology is applied to see how it affects the socio-economic life of the communities, especially the impact on income distribution and adoption of agricultural technology. As an initiation step, the model developed in this paper is a simple one focusing the interactions of natives and migrants in market activities of food.

SYSTEM DESCRIPTION OF RURAL WAMENA

The Baliem Valley of Irian Jaya Province - where rural Wamena is located - was discovered in 1938 occupied mostly by Dani speaking tribes [1]. The Wamena people is about 45,000 (statistics 1992) and consists of several clans who live primarily on self-subsistence. The rural possesses about 1272 km2 of arable land. The region is highland and is still rather isolated from the outside world. The Dani have practiced a primitive form of shifting agriculture where the fallow period has been shortened from 15 years into 5 years, as the consequences of the increase in food needed. They usually plant sweet potatoes for their main food. The birth rate is relatively low, since a woman usually has 2-3 children [2]. The men practice polygamy, especially among leaders [3]. Their native characters could be identified from their way of life, which is simple and have not too many wishes. For instance,

they do farming only for the primary needs no matter that they could have produced more. Although they have already practiced market activities, yet, barter trade is still exist.

Changes have been introduced not only by missionaries but also by the government firstly establishing a station in 1956 [1]. They introduce agricultural technologies like rice planting, extensification and intensification. They also give counseling, training, moral lessons which somehow have been effective in eliminating some harmful habits like clan-wars.

Although the people is quite adaptive to the new things introduced [2], however, at the beginning, natives were suspicious and did not welcome the outside people. Years after the migration flow started, a new civilization began to show up. Their traditional manners have been changed to be more industrial. The development has shown its impacts as seen from the interactions between natives and migration people in economic activities.

Migration people mostly come for business. They become traders or work at public service sector like transportation. Positive interaction with natives is in market activities where the natives gain the market share by selling their farm production to traders. This interaction has made natives exposed to market economy.

THE MODEL

The model employed in this first step of the study is a generic system dynamics model. The model structure was inspired by the models developed by Shantzis and Behrens [4] and Saeed [5]. It consists of five main sectors, i.e., native population, migrant population, land, food, and agricultural technology as shown in Figure 1. Simulation starts at the stipulated time of the migration intervention. The model is proposed to acquire the understanding of the long-run behavior of the natives responding to the intervention of migrants.

The population is divided into natives and migration people. Migration is assumed as exogenous variable. Native population change rate is influenced by food availability for natives and intensity of cultivation, as shown in Figure 1. It is assumed that frequent cultivation would bring pressures for fighting to get food, which then could reduce the native population.

Land sector is focused in the study since 86% of population live in rural areas and earn from agriculture. The migration flow decreases the arable land since the land is used for industrial and housing purposes. The larger the arable land, the more the food production as the result of increasing yield-per-hectare. This is followed by increase in food supply for migrants allowing the natives to advance the adoption of agricultural technology.

Interactions with other communities regarding transaction process have made the natives become acquainted with outside world. Natives involvement in market activities is their market share to supply part of the food needed by migrants. Increase in market share of natives will raise the income which in turn will accelerate the adoption level of agricultural technology. Increase in population will increase food needed which then will accelerate the intensity of cultivation. This more frequent cultivation reduces yield per hectare.

Figure 2 shows that more involvement of natives in the economic activities of migrants could improve the population pattern. This involvement would save the population from the fast extinction at year 200. However, arable land decreased by migration move down relatively slow. Food availability figures could also be improved by market activities of natives as shown in Figure 3. The more food that the natives could sell, the income is raised allowing the natives to accelerate the adoption of agricultural technology. Intensity of cultivation is increased significantly as the natives are more active in market activities, since the market requires more food to distribute (Figure 4). Although yield per hectare degenerates as the intensity increases, however, involvement of natives in market activities and with the adoption of technology could increase the yield-per-hectare as shown in Figure 5.

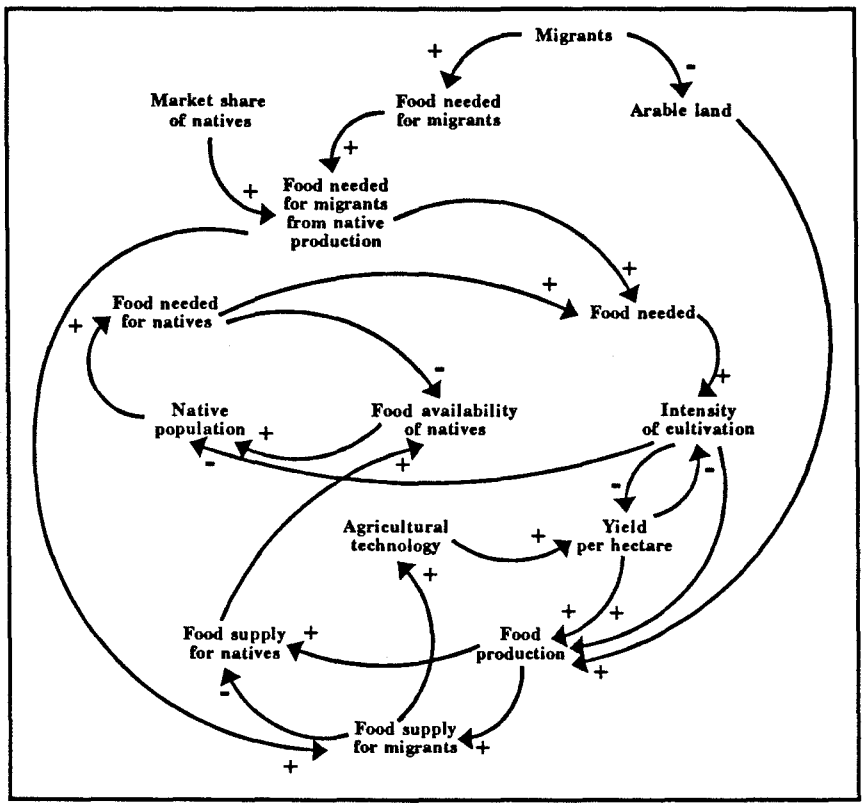

Figure 1. Causal-loop diagram of the Model

CONCLUSION

1. Interactions between natives and migration people within market activities are important in developing the model since they significantly influence the whole model structures.
2. Involvement of natives in economic activities of migrants by supplying them part of their food needed would improve the population pattern and increase food availability of natives. These activities allow the natives to gain more income to afford for food, and to accelerate the adoption of agricultural technology.
3. The study shows that the adoption of agricultural technology through natives involvement in modern economic activities could be critical-paths in socio-economic development of natives.

REFERENCES

1. Nazif, Amru H. 1989. *Social Aspects of Rural Development in Wamena, Irian Jaya.* Paper presented at Regional Seminar on Technology for Rural Development. 23-24 October 1989. Bandung, Indonesia.
2. Savitri Dyah. 1990. "Mengenal Masyarakat Dani Baliem Pegunungan Jayawijaya Irian Jaya", in *Prosiding Seminar Pengembangan Wilayah Pedesaan Wamena.* LIPI. Subang, Indonesia.
3. Hayward, Douglas. 1980. *The Dani of Irian Jaya Before and After Conversion.* The Region Press Sentani. Irian Jaya, Indonesia.
4. Steven B. Shantzis and William W. Behrens III. 1973. "Population Control Mechanisms in a Primitive Agricultural Society", in *Toward Global Equilibrium : Collected Papers.* Wright-Allen Press, Inc. Cambridge, Massachusetts.
5. Khalid Saeed. 1991. "A Re-Evaluation of the Effort to Alleviate Poverty and Hunger" in *Toward Sustainable Development : Essays on System Analysis of National Policy.* Progressive Publishers. Pakistan.

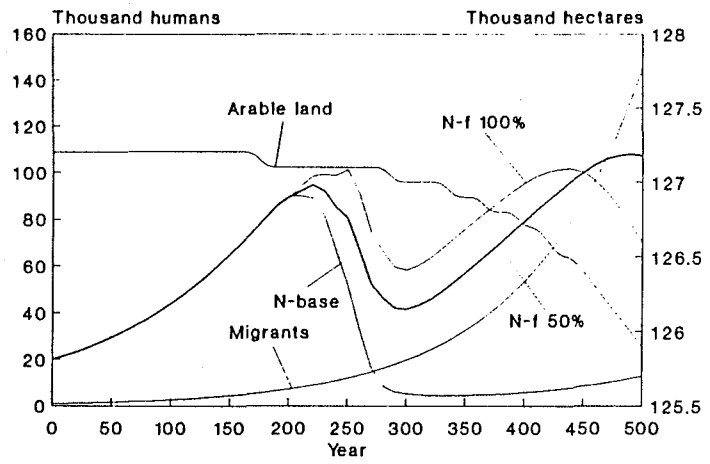

Figure 2. Population and arable land

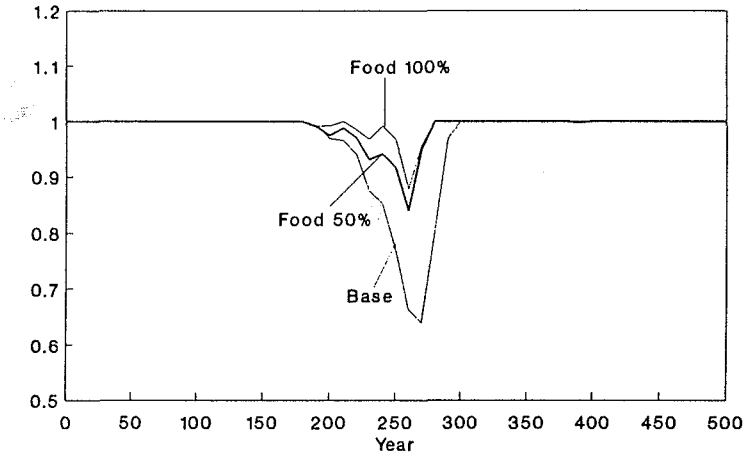

Figure 3. Food availability

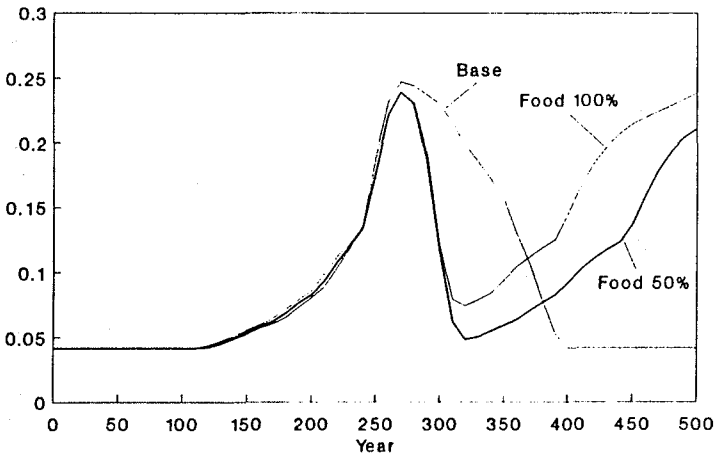

Figure 4. Intensity of cultivation

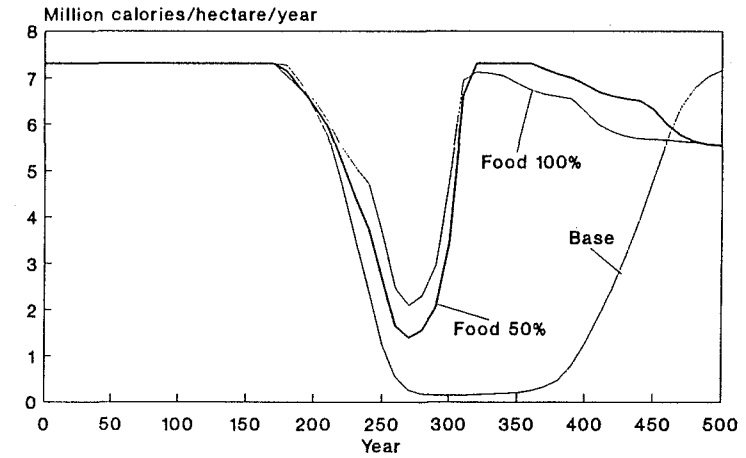

Figure 5. Yield per hectare