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AGRICULTURAL UNIVERSITY OF SZCZECIN
FACULTY OF ECONOMICS AND ORGANIZATION OF FOOD ECONOMY

MODELLING OF ECONOMY IN SPECIALLY PROTECTED REGIONS

Proceedings of the international conference held on 9-11 june 1994 in Drawno, Poland

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prof. dr hab. Stanisław STACHAK

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MODELLING OF ECONOMY AND ENVIRONMENTAL PROTECTION

Bogdan Krawiec

Systems Research Institut, Polish Academy of Sciences, Szczecin Department

1. Models and Decisions

Systems analysis belongs to rather new scintific disciplines that came about during the Second World War. It dominated over the entire group of disciplines having common features such as: operation research, management cybernetics, artificial intelligence and expert systems. One should see the systems analysis as something which makes it possible to tie the various science disciplines together. It provides an instrument for modelling and a procedure for explaining systematic problems - in a complete and complementary way.

According to *Vidal* (1989) the systems analysis is characterized by:

- methodology based on system approach,

- interdisciplinarity,
- use of computer techniques for the processing of large quantities of information describing the complete situation.

A big task which now stands before the systems analysis is to carry out theoretical and applied research on the modeling of economic development of business systems taking into account a rational use of national resources and norms of environmental protection.

Economic - social systems belong to complex systems. The inclusion of the characteristics of such systems in a single large system is very difficult or even impossible. The same holds true when it comes to describing the functioning of such large systems.

For the description of the structure and functioning of systems one utilizes various models such as iconographic, analog or symbolic ones.

When the design problems in the process of building models are overcome, the models not only serve as representation, but also allow testing of how the system would look like in the future.

Most often mathematical decision models (analytical, numerical, and symbolic) are used for this purpose and they are supported by computer. A mathematical model of a system must be constructed so that it exactly enough describes the qualities of the system and is a comfortable instrument for analysis. There which the results have to be exact enough. Unfortunately, mathematical models can produce errors which result from the following reasons:

- There are too far from reality, which causes that the model

has a limited applicability or produces useless results.

- Too many details are taken into account, which have no influence on the modelled process which enlarges the model, makes calculations more difficult, and gives too many results which are useless.
- The modelled situation is so complicated that one can describe it only approximately. Then the results are often uncertain, and there is a danger that one can make a bad decision based on them.

In spite of difficulties in the mathematical modelling of systems, such models no doubt give the most precise information on the behaviour of systems.

Most often one uses such models in decision making in various economic systems. The process of decision making consists of the following:

1. Formulation of the decision problem, i.e. determination of the goals, structure of the decision problem, practical use of the results.
2. Construction of the model, formulation of the decision problem and restrictions in which the decisions should be made in a model, mathematical, logical, or computational.
3. Solving the model through the selection and use of real optimization, simulation, prognostic, economic, graphic, etc. procedures.
4. Looking over a model which can be carried out by comparing the calculated results with the real system.
5. Implication of the obtained results in practice. This step is the most difficult to carry out, because the following aspects

must be adhered to at the same time: organizational, technical, and economical.

As stated earlier, one of the most important tasks is to reach a decision in that natural resources are rationally used and the environment is protected or even improved.

The utilization of natural resources and environmental pollution belongs to the ecological politics at the state or regional level.

In the modelling of business of a land or region the following main rules of ecological politics must be taken seriously:

- Maintenance of the structure of ecological systems.
- The same attitudes to environmental protection as to economical, social and technical aspects of business.
- Maintenance of system assimilation in the utilization and multiple transformation of resources (recirculation).
- Control of the business activity and early warning of dangers for the environment.

2. Project of the economy model assumptions in especially protected areas

In the especially protected areas like: national parks, community parks, drinking water areas, spa areas etc., one must adhere most exactly to the environmental protection rules.

From the viewpoint of system analysis, especially protected areas and their surrounding areas comprise agroforestry systems *(Mendoza and others 1987)*. Such systems have at the same time

various roles: economic (production), social (jobs), environmental (environmental protection), and recreational (tourism).

Because of the realization of several goals at the same time, which are normally against each other, one can use only multicriterial models to describe such systems. Models that have found use in the planning of agro and forest development, had most often the linear form, were determined statically or dynamically, and normally held the two branches of business separately *Dykstra (1984), Krawiec and others (1991), Romero, Rehman (1989).*

One sees in the agro systems on the microregional or regional scale that they border forest systems and coexist. Because of this it is natural to see both systems together.

While researching the development of agro forest systems one should not forget their main qualities:

- time and area,
- alternative ways of ground usage,
- multifaceted and integral agro and forest production,
- localization and direction of the processing industry,
- dangers for the environment which are possible through the business activity,
- production of "healthier food products",
- opportunities for the development of tourism.

It is recommended that the construction of the model contains three major submodels:

- economic, which describes the most important production activities (especially the production of ecological food stuffs),

- submodel of utilization which describes the labor market and results of restrictive rules of environmental protection,
- submodel of the environment that describes the actions for environmental protection in especially protected systems.

The model must have three criteria:

- maximization of profit from business in specially protected systems and their surroundings,
- minimization of unemployment,
- minimization of cost from the exploitation of resources and environmental degradation,
- maximization of income from tourism.

The proposed model can have linear, determined and dynamic form. It is recommended to solve it with the help of interactive, multicriterial methods of optimization such as STEM, HSJ, DIDAS-L, or IMGP.

In the model there are conflicts between the maximization of profit and size of engagement like minimization of costs of the use of resource deposits, etc. Because of this one must find strategies that make a compromise between the most important goals of the model, while selecting ways of development for business in protected areas.

The solutions to the model obtained as determined in the dialog allow a decision to be made which reaches all these goals of the modelled systems.

A practical utilization of the presented proposal requires the undertaking of work leading to:

(1) elaboration of the construction of mathematical models in which economical, social, and tourist aspects as well as environmental aspects of different special systems of special ecological values are included,

(2) elaboration of a project of computerized system, which would assist making economical decisions as well as enable preliminary tests on real data,

(3) economic analysis of the results due to strict requirements concerning the environment protection in agriculture, forestry and agricultural industry,

(4) elaboration of a project of alternative directions of agricultural and forest production, alleviating (reducing) their damaging influence on the environment.

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