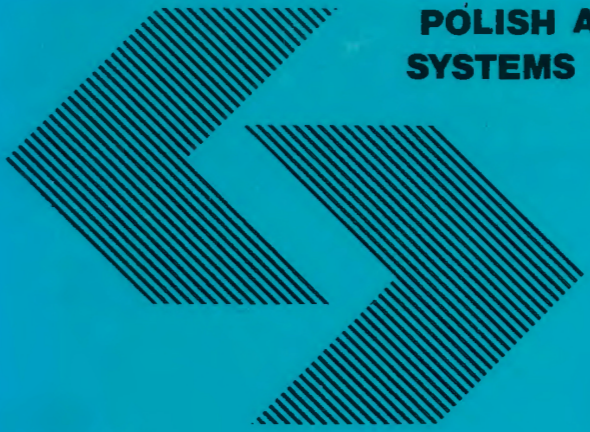
POLISH ACADEMY OF SCIENCES
SYSTEMS RESEARCH INSTITUTE



STRATEGIC REGIONAL POLICY

A. STRASZAK AND J.W. OWSIŃSKI
EDITORS

PART II

WARSAW 1985

SYSTEMS RESEARCH INSTITUTE
POLISH ACADEMY OF SCIENCES

STRATEGIC REGIONAL POLICY

Paradigms, Methods, Issues and Case Studies

A. Straszak and J.W. Owsiński
editors

Documentation of the workshop on "Strategic Regional Policy", December 10 - 14, 1984, Warsaw, organized by the Systems Research Institute, Polish Academy of Sciences and the International Institute for Applied Systems Analysis

PART II

WARSAW 1985

IV. CASE STUDIES

A CASE OF ENERGY-RELATED DEVELOPMENT IN AN AGRICULTURAL REGION

Jan W. Owsiński

Systems Research Institute
Polish Academy of Sciences
Newelska 6
01-447 Warszawa
Poland

Kazimierz Hołubowicz

Field Research Station
Environmental Engineering Institute
Polish Academy of Sciences
Słowackiego 15/17
97-300 Piotrków Trybunalski
Poland

Large-scale lignite strip mining and related power generation development in a predominantly agricultural region of central Poland has brought about important changes in the socio-economic and natural resources environment. It therefore had become necessary to generate and analyse potential policies for coping with these changes and their consequences, regarding, in particular, agriculture. Within a range of studies on geology, land reclamation, hydrology, etc., carried out for the above problem, a modelling study was also undertaken, meant for pointing out the possibilities efficiency and directions of agricultural development under given changed environmental conditions, and for suggesting policy options securing chosen development directions.

1. Regional characteristics

The area in question is located in central Poland. It is characterized by traditional family farming, with farm sizes equal to Polish averages, that is small, and little diversified production based upon rye, potatoes and milk. Soils are light and precipitation is low. Forest area is slightly lower that the national average, and wood quality is not too high.

Industry is much less developed than in most of the surrounding areas. There are no important urban centers, no university tradition. In fact, this region was, but for a short

period, a second-rate Poland throughout history, although it always was in its geographical centre.

Delimitation of the area considered is defined by the influence of a large-scale lignite strip mining and power generation related to it. There is a number of such influences, environmental, economic and social. Some of them shall be commented upon further on. Each of them has a different geographical stretch.

Ideally, in delimiting the area of concern, one would take into account all the geographical stretches of various influences exerted by the strip mining and related developments. Adaptation of such a strict approach, however, would require: quantification of all the influences over the geographical space, determination of appropriate thresholds of influence and spatial aggregation. This seems to be quite a formidable task.

It is, therefore, convenient to take certain proxies in order to represent the region. Thus, Fig.1 shows the maximum area of the envisaged groundwater table drop resulting from strip mining of at least 1 meter, as located against the local (voivodship) administrative boundaries. This area shall be referred to as "groundwater crater". Since the rest of the Piotrków voivodship, in which approx. 85% of the creater is located does not differ substantially in its features from the crater area, therefore some of the characteristics given at the beginning of this section are illustrated with data for the Piotrków voivodship in Table 1 (Piotrków voivodship may, for some purposes, be also taken as a proxy for the region in question).

When assessing the data of Table 1 one should remember that Poland is a flat central European country, relatively evenly developed, with the most industrialized and densely populated areas surrounding the Piotrków voivodship.

2. Strip mining and related developments

Poland is devoid of oil resources and has quite limited gas fields and therefore, to a large extent, Polish energy is oriented towards coal. Poland is, besides that, traditional exporter of anthracite, which is treated as a financially very

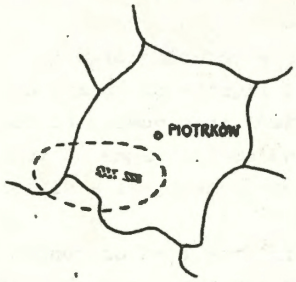


Fig.1. Schematic view of the maximum area of the envisaged groundwater level decrease of at least 1 meter

——— voivodship boundaries
– – – boundary of the groundwater drop area
strip mine, actual and planned

Table 1. Some indicators relating Piotrków voivodship to Polish averages

Item	Polish average	Piotrków voivodship	
		average	as % of national average
1. Urban population share	59.1%	43.1%	73%
2. Population density, persons per sq. km	115.3	97.8	84.8%
3. Employment in state economy per 1000 inhabitants	333	301	90.3%
4. Value of capital assets per capita, in 10^3 zlotys	214	207	96.7%
5. Global value of annual state-controlled production per capita, in 10^3 zlotys	66	57	84.4%

important export item. In conditions of shrinking coal resources and increasing costs of exploitation it becomes expedient to find and put in operation new reserves. Luckily enough, the Central Plain, stretching from the Rhine beyond the Vistule has in its upper part several rich lignite fields. These lignite fields are exploited as strip mines in FR of Germany, German DR and Poland.

The opencast mine in question in one of the biggest in Europe. Its depth reaches 300 metres while the total length will near 20 kms. It is composed of two parts, of which only the first one is now in operation. The first part is supposed to contain more than 10^9 tons of lignite, while the second - a little more than $0.5 \cdot 10^9$ tons. It is anticipated that, under the presently assumed operation conditions, the lifetime of the whole mine will reach approximately 40 years. Most probably, after the operation is finished, some 80% of the mine surface shall be covered by lakes. Meanwhile, the "brown hole" draws water from the surrounding aquifers.

In the vicinity of the mine a lignite-fueled power plant is in operation. Its capacity is 4200 MWatts. Another power plant is planned to start generating when the second part of the mine starts producing coal. The capacity of the other power plant is envisaged at 1500-2100 MWatts.

Direct employment in power generation and mining is envisaged to grow in the next few years from the present 5 thousand to 8 thousand. This would account for approximately 10% of the overall voivodship's industrial employment and proportionately more for the direct influence area considered.

The "groundwater crater" surface is now approaching 450 sq kms. Its envisaged maximum is 1300 sq. kms. (Compare with 6250 sq. kms of the whole Piotrków voivodship).

3. Agriculture

As mentioned, regional agriculture is relatively little diversified and technologically traditional. Rye, potatoes and fodder crops make up for most of the cultivated area. Permanent grasslands occupy, typically for Poland, about 15% of the whole agricultural surface. In some parts of the region vegetable and

fruit cultures become more important. Livestock breeding is not very intensive neither. It is less-feed-oriented, i.e., for instance, more towards milk (dairy cows) than quick meat (hogs, poultry). Soils are relatively poor, sandy and clayey for the most part. Average annual precipitation - approximately 55-58 cms.

Some important indicators describing the position of local agriculture are given in Table 2. To the picture thus formed one should add three important remarks. It should be empasized first, that in spite of its low intensity and traditional character this local agriculture is an important net food exporter to other regions. Besides that, this traditional agriculture is, with respect to many resources - exception land and labour - very efficient. This feature enables subsistance of this sector in conditions of a heavy underinvestment. Third, it must be remembered that at present agriculture is still providing jobs and incomes for quite an important share of regional population, someplaces exceeding even 50%.

Two comments are due on the numbers given in Table 2. They concern items 2. and 10. Farm size >15 hectares indicates the greatest private farm category in Polish statistics. On the other hand it is a widely accepted conviction in Poland that a farm can secure appropriate income and development capacities (closeness to market, start up capital for installing highly specialized production etc.), if it is at least 10 hectares large, with appropriate spatial organization. This, it seems, quite applies to the regional situation considered, for there is only a very limited farm subpopulation who can afford e.g. construction of greenhouses in order to sell vegetables or flowers in agglomerations some 60 kilometers away. Thus, the margin shown in Table 2 represents, provided all necessary resources are there and economic situation does not change sharply, the farms which can ensure jobs, adequate income and economic resilience. It can be estimated that the total of such farms in the region does not exceed, under the present economic situation, some 35-40% of all farms. Other farms secure income lower than national average and do not allow important investments to be made.

I t e m	Polish average	Piotrków voivodship	
		average	as % of national average
1. Cereal net yield, in tons per hectare	2.6	2.2	85%
2. Potato net yield, in tons per hectare	17.7	16.5	93%
3. Cattle number, per 100 hectares*	67	60	90%
4. Milk production, in tons her hectare	0.87	1.03	118%
5. Meat production, in tons per hectare	1.6	1.4	87%
6. No. of tractors per 100 hectares	3.7	2.8	76%
7. Share of agricultural area in private farming	74.9%	92.5%	123%
8. Average surface of a private farm** in hectares	5.0	4.7	94%
9. Surface share of private farms above 15 hectares	5.7%	2.3%	40%
10. Share of population in post-productive age	11.8%	13.8%	117%

Table 2. Some indicators relating the Piotrków voivodship agriculture to Polish averages.

* here and further on: hectares of the overall agriculture area

** this indicator errs on the lower side, since "farms" having surfaces 0.5 to 2 hectares are also accounted for.

Item 10. of Table 2, although it applies to the whole of local population, has special bearing on agriculature. It is sufficient to compare Item 1 of Table 1 with the domain to see the connection. Rural population there is an old one, at least in Polish terms.

4. Problem structure

There are a number of regional effects resulting from introduction of the large strip mining and power generation developments into the region in question. The most important of them may be listed as follows:

1. Agricultural land appropriation and landscape changes,
2. Employment in industry,
3. Diversion of labour from agriculture,
4. Lack of water and "groundwater crater",
5. Increased personal income,
6. Crop decrease,
7. Ecological deterioration,
8. Crop quality decrease,
9. Changes in human environment.

Fig.2 shows schematically interrelations between various aspects of the regional system, resulting from introduction of the development in question.

It can be noticed that "Changes in human environment" (effect 9.) do not appear in Fig.2. This is caused by the wish to keep the diagram possibly clear, and by the fact that asessment of this effect is highly subjective.

Two general remarks on Fig.2 are due. First, while the general outline of interrelations is as presented, the actual course of events depends as much on the specific strength of these relations and on the magnitudes of causing phenomena. And that is just where the discussion centres. Of main actors on this strip mining/agriculture scene all do agree that such-and-such effect (may) exist, but, in reality... For the sake of this introductory paper assume there are just two actors: local agriculture, as represented by the voivodship department

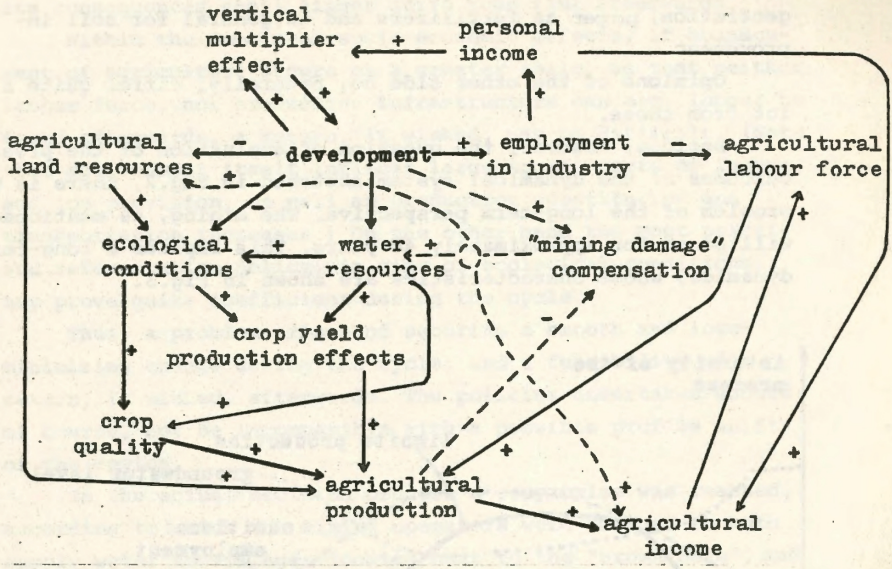


Fig.2. Interrelations among some aspects of the regional development/agriculture interface

——► causal links

)---► links subject to decisions

of agriculture, and mining and energy, as represented by the mine management.

Thus, for instance, the mining side says that although it is true that: the "brown hole" had already consumed several villages, deprived tens of others of their water, destroyed soil and changed landscape on a certain surface, it is nevertheless also true that appropriate compensations were paid, water supply organized and land reclamation set up. Furthermore, they say, the "groundwater crater" is not as of now having any significant effect upon the crop yield in area, emissions from the power plant are by far less pollutant-charged than it was envisaged, and, on the top of all that, agriculture is not using the very valuable by-products of both mining and power

generation, proper as fertilizers and in general for soil improvement.

Opinions of the other side do, naturally, differ quite a lot from those.

Besides, however, the question of evaluation of the present outcomes of the dynamical system sketched in Fig.2, there is the problem of the long-term perspective. The mining, as mentioned, will go on for approximately 40 years. This implies a long-term dynamics, whose characteristics are shown in Fig.3.

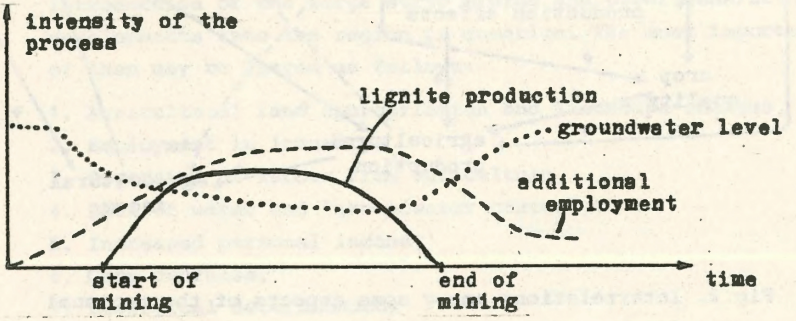


Fig.3. Long-term processes decisive for the regional dynamics.

Thus, it becomes obvious that the effects listed have to be taken in the analysis over the whole cycle of development. For the sake of this presentation it should be mentioned that although some of the effects may have a reversible character, e.g. groundwater level in the vicinity of the mine, most of them are hardly, if at all, reversible.

Groundwater will approximately return, to its previous level when the mine is abandoned and let to be filled with water. In fact, some areas may even become more humid than before. Soil quality, however, will in some places (e.g. peaty areas) deteriorate in an irreversible manner. For the best soils, which can thus degenerate, located either within the mine or close to it, it may turn out cost effective to transport them to other locations or use it for greenhouses. Pollution will certainly diminish at the end of the cycle, but

its consequences shall linger quite some time afterwards.

Within the domain of socio-economic effects, if abandonment of agriculture occurs on a greater scale, so that neither labour force, nor productive infrastructure can any longer be found afterwards, a return, if wished, may be difficult. (Note that abandonment itself inflicts large social costs of income and job provision, as well as production substitution and transportation increases.) On the other hand the most practised reforestation policy, in view of ecological conditions, may prove quite inefficient during the cycle.

Thus, a problem arises of securing a smooth and loss-minimizing change during the cycle, and a feasibility of a return, if wished, afterwards. The policies undertaken should, of course, not be incompatible with a possible profile shift of the region.

In the actual decision process a compromise was reached, according to which the mining operators were obliged to both supply water to villages located next to the "brown hole", and pay the direct mining damage compensations to farmers. Additionally, an important overall compensation was to be paid by mining and energy to voivodship authorities with the purpose of introducing special agricultural operations and policies.

5. Regional agricultural policy model

Whether this region will remain in the future agricultural or not, the problem structure, as seen now, is centered around agriculture, for both the development cycle and afterwards.

In creation of agricultural policies related to the development in question the voivodship authorities may activate their proper policy (e.g. zoning, infrastructural instruments, certain supplies), highly augmented by the mining and energy compensation. Because of the complexity of situation the authorities have contracted a modelling study oriented at production structures and policies related to regional agriculture.

It should be mentioned that, in view of the magnitudes of envisaged changes a number of other studies were also undertaken. These studies concerned geological and hydrological

systems, soil changes, crop yield sensitivities, farm economies etc. In particular, certain studies related to crop yield and farm organization and economy were undertaken and are continued within the Field Research Station of the Environmental Engineering Institute. Owing to these studies the data set necessary for the agricultural model construction was in fact ready prior to model development.

The regional agricultural policy and production structure model is meant for analysis of medium-term development alternatives, for choice of best structures and for evaluation of conditions of agricultural operations and changes. The time horizon of the model results from its linear form. In fact, it is an LP construct, relatively detailed allowing quite precise balancing of resources and products. Thus, the model can presently help in policy setting for the initial stage of the cycle, taking into account such effects of mining development as labour force diversion from agriculture, water deficit, land availability decrease and crop yield decrease, and their consequences (Fig.2). Hence, the model can represent most of the processes related to the development/agriculture interface. Furthermore, if the model is run for the end-of-cycle scennario, it can also be used for long-term policy analysis. In order, however, to obtain an internally consistent end-of-cycle scenario, another, dynamic model would have to be developed and run.

Model structure and functioning

The model, called further on SEMORA B, resulting from a series of previous works on the subject, see Albegov et al. (1982), Owsiński (1982), Straszak et al. (1982), is constructed as a two-level LP problem. The lower level, composed of 7 submodels, represents individual subregions of the area. Subregions are delineated according to administrative breakdown, contiguity and location with respect to the mine (see Fig.4 for the scheme of breakdown). Each submodel describes in quite a detailed way agricultural economy of a subregion. The submodels contain approx. 1700 variables and approx. 500 constraints each. The main groups of variables describe:

1. Crops grown,
2. Livestock kept,
3. Sales of crop products,
4. Own consumption of crop products,
5. Crop products for livestock feeding,
6. Scales of livestock,
7. Scales of livestock products,
8. Own consumption of livestock products,
9. Livestock slaughter,
10. Purchase of crop products for human consumption,
11. Purchase of crop products for livestock feeding,
12. Purchase of livestock products.

These variables are subject to following groups of costraints:

1. Land, crop retation and secondary crop,
2. Crop product balances,
3. Herd balances,
4. Livestock product balances,
5. Feed balances,
6. Labour force balances,
7. Pulling power balances,
8. Fertilizer balances,
9. Water balances (annual and peak period),
10. Sales and purchase balances,
11. Capital investment limits,
12. Minimum income requirements.

Two objective functions were maximized, alternately:

1. Total agricultural net-income from subregional agriculture,
2. Total agricultural subregional production value.

There other criteria/agricultural trade balance of the region, protein trade balance, diet content trade balance) were treated as reference indices.

The variables and constraints were classified according to the following aspects:

a. crop types (16 various crops considered),
b. soil quality types (4 + permanent grassland),
c. crop technologies (3),

d. farm types (5),
e. animals (7),
f. husbandry technologies (2),

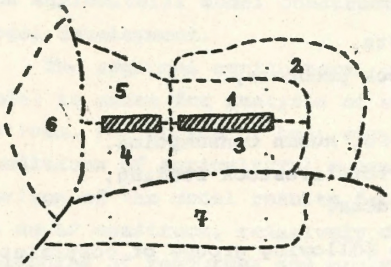


Fig.4. Outline of the breakdown into subregions

mine
voivodship boundaries
subregional boundaries not coinciding with those of voivodships

g. fertilizer contients (4),
h. sales and purchase markets (3).

Within thus detailed specification the submodel are quite accurate, but, simultaneously, rather large. They communicate with the upper level, i.e. the master model, representing a regional policy centre, via a coordination procedure, Owsiński and Zadrożny (1985), see Fig.5.

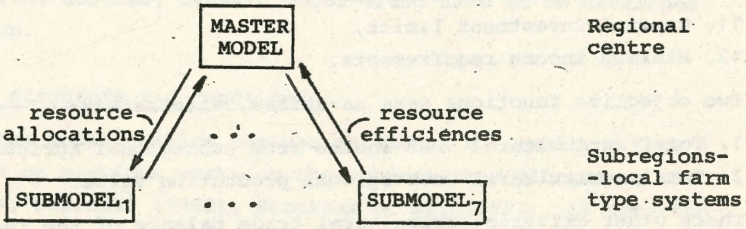


Fig.5. Scheme of cooperation of the master model and the submodels.

The master model is much smaller than the submodels. Its dimensions, however, are not uniquely defined, since they are established in the working of the coordination procedure. The master model operates on the - linearized - resource efficiency

functions of the submodels, thereby determining optimal resource allocations to subregions (farm type subsystems within subregions). Because of the model dimensions the coordination procedure is not iterative, i.e. the above information exchange between levels is not repeated. It occurs just once and an approximate solution is obtained.

The master model contains descriptions of the subregional resource efficiency functions and certain constraints on regionally balanced resources, such as: infrastructural and productive investments, credits for credit schemes, and water. It is with respect to these resources that coordination is primarily performed.

Model application

SEMORA B is meant to provide information for policy construction. Directly, solutions of SEMORA B on the subregional level, specify optimal production structures and product destinations. On the master model level values od "policy variables", i.e. certain resource allocations, are determined. Thus, it is possible to construct functions relating incomes and production levels, to production and exchange structures and these to "policy variables". Evaluation of policies, can also account for other aspects, especially related to these resources, which are affected by the development. Thus, besides coordination, some post-optimal analyses are performed.

The above results and analyses obtained with SEMORA B can serve for elaboration of both internal and external policies. Internal policies are those which lie entirely within the scope of control of the regional authority (notwithstanding their possibly varying efficiency). There are, however, also external policies, oriented at persuading other as to certain items of common interest. As mentioned, the main local partner considered is mining. Another important partner is the central planning body and central bugdet (finance ministry and planning commission). With respect to these two partners the local authority may, with the help of SEMORA B, determine potential losses or gains to regional agriculture, resulting from implementation of their respective policies. Thereby optimal direc-

tions of inducing both partners can be defined.

6. Model results and policy indications

For the sake of shortness and clarity only main features of solutions and policy indications and chosen directions of analysis are presented.

One of the main objectives of analysis, in view of the changes envisaged, was establishment of adequate agricultural income conditions. Their level is decisive for the further fate of local agriculture. Several scenarios were tested, differing by assumptions as to potential water deficit, crop decrease etc. It must be emphasized that simple maintenance of the present income levels is not sufficient to effectively limit labour force diversion from agriculture to mining, since wages in new industries are, on the average, 2-3 times higher than agricultural incomes. Thus, it was shown with SEMORA B that some farm types may attain income levels comparable with those of industrial employment, while others cannot. Attainment of lower income levels does not imply, of course, that labour diversion shall occur automatically. The greater the difference, however, the more important this diversion. On the other hand, attainment of comparable incomes by some farm types is conditioned by adequate increase of capital investments in these farms, i.e. appropriate credits. For an overview of results with this respect see Table 3.

The counterpart of the income situation is the labour force situation. Analysis of this aspect of the regional agricultural system is insofar important as the labour force diversion, already mentioned, is positively evaluated by some agricultural economists. The reasoning behind: agricultural employments are inefficient and unprofitable and there is too much labour force in agriculture. These opinions are formulated on the basis of a global assessment of labour force number, its theoretical productivity and actual produce. The SEMORA B model applied the same parameters as those used in global assessments. Since, however, the model solutions represent optimal rather than average conditions, it could be justly suspected that the

DESCRIPTION OF SCENARIOS:		CAPITAL INVESTMENTS IN FARMS		
		Present level, 100 %	150 %	200 %
WATER DEFICIT CROP DECREASE	NONE	2	2	4
	A.	1	2	4
	B.	0	1	2
	C.	0	0	1
	D.	0	0	0

Table 3. Numbers of farm types, out of the total of 5, in which incomes comparable to those in industry jobs can be obtained under optimum conditions.
A: water cost increase with no deficit and crop decrease,
B: cost increase and water supply out by 30%,
C: as A, with slight crop decrease, esp. in permanent grasslands,
D: as B, with slight crop decrease, esp. in permanent grasslands.

"idle manpower" would come out in these solutions even greater than in the global economic assessment. This would provide arguments for the mining side, which claims that labour diversion helps in rationalization of agricultural production. Actual results are achematically outlined in Fig.6.

The diagram shows that virtually the whole labour margin commes out of one farm type, i.e. small private farms, while the most promising farm type (No.3 in the diagram) is already suffering from the important lack of manpower. Furthermore, it should be emphasized that quite a share of manpower from the farm type 1 are so called double-professionals, i.e. are also employed outside agriculture, which is caused by income shortages in small farms. Thus, even the margin indicated may in reality be lesser.

Hence, while it seems almost sure that certain diversion will occur over the years to come, unless appropriate policies

are undertaken, this diversion would have a negative effect on local agriculture.

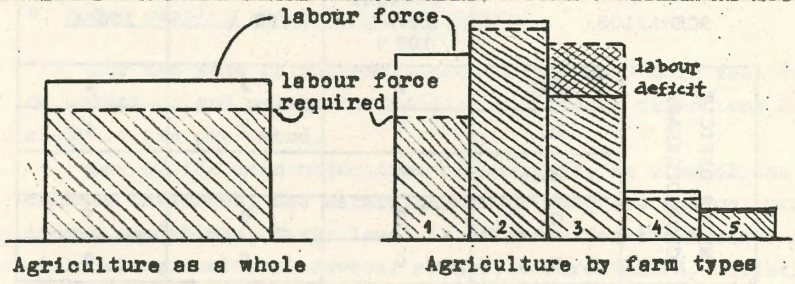


Fig.6. Relation of actual manpower to manpower requirements in the regional agriculture, according to the SEMORA B results.

Farm types: 1. private farms <5 hectares,
2. private farms 5 to 10 hectares,
3. private farms >10 hectares,
4. cooperative farms,
5. state farms.

As already indicated, appropriate infrastructural investments and credits productive investments may help in limiting and controlling the flow of labour from agriculture to industry. Simultaneously, such durable investments will make it easier in the future to make an agricultural come-back, if wished. Third, these investments will make it possible for fewer people to operate on the same agricultural area. Thus, there is a synergic policy action of infrastructural and productive investments to be performed in the process.

This direction has been taken, at least partially, by local authorities. These are, however, some obstacles, stemming from the same ground as the agricultural difficulties, like e.g. lack of manpower. Because of that mainly land reclamation and water supply works are well underway. It seems that the policies adopted should be applied to themeselves in

order to make them applicable.

Naturally, capital investments is not the only direction to go. Fig.6 implies another way, i.e. that of labour force shifts among farm types within agriculture. Such shifts can be performed in two manners: first by land, or even better, farm buying or renting, and second, by labour selling. Both these processes occur now, but not in volumes sufficient for offsetting labour diversion and land abandonment. First of these processes looks more promissing, its enhancement, though, would require an action which is outside of the local authority power scope. Efficiency of an optimal policy of this kind is illustrated in Fig.7.

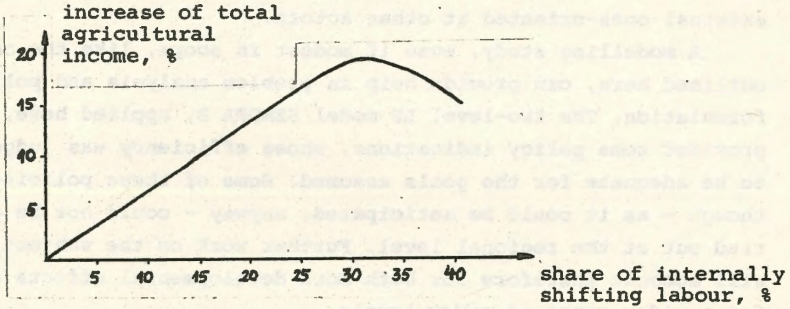


Fig.7. Effects of an optimal labour shift policy within the regional agriculture.

Thus, further managerial policy action would be needed in order to ensure a smooth transition period and secure and open return option.

There is, though, another question, which was not addressed in this modelling study, related to the effect. No.8 of the development, i.e. crop quality decrease. Namely, in view of increased loads of pollutants their contents in some crops may cause a decrease in price or even inhibit their selling for human consumption. This question was not treated in detail, primarily because of lack of data and of specification in the contract. Some preparatory work has been done, however, indi-

cating that in conditions of low efficiency of reforestation and forest-oriented economy, a change in crop specialization towards more industrial crops and products is feasible. This alternative, though, would have to be explored in more detail.

7. Concluding remarks

It is natural that a large-scale undertaking, having multiple consequences, implanted in a relatively economically passive region is hard to control from the regional level. Because, however, of magnitudes of possible losses and gains, an attempt at making and implementation of appropriate regional policies has to be made, both in terms of own, internal, policies and external ones-oriented at other actors.

A modelling study, even if modest in scope, like the one outlined here, can provide help in problem analysis and policy formulation. The two-level LP model SEMORA B, applied here, has provided some policy indications, whose efficiency was judged to be adequate for the goals assumed. Some of these policies, though – as it could be anticipated, anyway - could not be carried out at the regional level. Further work on the subject will account therefore for both more developmental effects and for a wider range of policy levels.

References:

Albegov, M., J. Kacprzyk, Wm. Orchard-Hays, J.W. Owsiński, A. Straszak (1982): A General Regional Agricultural Model (GRAM) Applied to a Region in Poland. RR-82-86, IIASA. Laxenburg, Austria.

Owsiński, J.W. (1982): Agriculture, population, environment and balanced regional development: a modelling project in Poland. Agricultural Systems, 8, 87-104.

Owsiński, J.W. and S. Zadrożny (1985): On a practical noninteractive method of approximate coordination in large scale linear systems. To appear in Proc. of the 2nd Int. Symposium on Systems Analysis and Simulation, Berlin, 1985. Academie-Verlag.

Straszak, A., M. Kurowski, J.W. Owsiński (1982): Two-level model of regional agriculture. In: Integrated Rural/Spatial Development: Elements of Systems Analytic Approach. A. Straszak, J.W. Owsiński, eds. SRI PAS, Warsaw.

DISCUSSIONS

Paper by K.P. Moeller

Discussions participants: D. Boekemann, G. Bianchi, K.P. Moeller.

The question of long-term implications of the modelling study results was analysed, especially from the point of view of the demographic situation. Thus, possible changes of in-migration rates were discussed together with their impact on both employment and demand, and with their dependence upon the appropriate legal regulations. It turned out that the model can incorporate most of these aspects.

Another question concerned the input/output core model used in the modelling study. This model was said to contain 11 numerically distinguished sectors.

Paper by G. Bianchi

Discussion participants: R. Espejo, L. Lacko, U. Loeser, G. Bianchi.

First question concerned the region definitions used, i.e. the distinction of "physical" and "random" spatial units. Thus, the latter ones may not refer to physical composition of space, and are often said to be formed arbitrary on some other premises, like e.g. states in the U.S.A. or regions in Italy, but irrespective of definitions such entities which are hierarchically located between the family and the state are to a large extent arbitrary determined.

Then the question on the kind of variables accounted for in factor analysis was asked. There were 40 variables such as: numbers of university professors and of R and D researchers, number of scientific journals, activity in promotion of international trade, etc.

The last point concerned the IRPRT's role in allocation of state funds to particular regions. Inasmuch as the allocation is a result of bargaining and negotiations, conflicts were said to be treated as a normal part of the planning procedure. Regional authorities are responsible for the conduct of negotiations,

and it is for their needs with that respect that IRPET prepares background information.

Paper by J.W. Owsiński

Discussion participants: T. Vasko, L. Kairiukštis, G. Bianchi, S. Dresch, J. Owsiński.

First, the question of the scope of agricultural restructuration admitted for in the model and proposed in results was taken up. The model can incorporate both the production profile changes and the shares and cooperation rules of various producer types (state, cooperative and private farms). Of special importance is shaping of cooperation among the variously specializing producer types, which can importantly enhance both production and revenues. Another point of interest was optimum allocation of land among producers, involving different manners of land allocation.

Environmental problems were also looked at, i.e. whether the model in question considers forests and surface water resources, and the pollution effects. The model accounts, as it turned out, for surface water whenever it can be used for agricultural purposes, but leaves out forests. As far as additional pollution is concerned, generated by the power plants, it was taken into consideration through varying assumptions as to crop yields etc. In fact, additional pollution (emissions) proved to be lower than initially expected. As to the whole range of effects only a longer period of observation may allow firmer statements to be made.

The case studied was said to be typical in some of its aspects (large-scale mining development, employment, infrastructure, land reclamation etc.), but also exceptional as to its magnitude. Hence, some experiences from Czechoslovakia, Fed. Rep. of Germany or German Dem. Rep. could be applied, but with very strict reservations.

The final question concerned the role of the analysing group in the multi-party process. Quite naturally, being a technical one, it still has a very important bearing for the participants of this process. There is a variety of views on the subject and

the analysis could not but corroborate, at least partly, some of them.

Paper by T. Kawashima

This paper, as presented after the sessions, was not discussed.

ADDRESS
6, NEWELSKA ST.
01-447 WARSAW
Tel. 36·44·14 , 36·81·50
Telex: 812397 ibs pl