

COMPLEX SYSTEMS RESEARCH  
ON  
SOCIO-ECONOMIC PROBLEMS OF THE RURAL AGRICULTURAL  
SECTOR IN THE SOVIET UNION

Tatiana Zaslavskaya

July 1978

WP-78-22

Working papers are internal publications intended for circulation within the Institute only. Opinions or views contained herein are solely those of the authors.

2361  
Laxenburg  
Austria

International Institute for Applied Systems Analysis

## Preface

Dr. Tatiana Zaslavskaya, a sociologist with broad interests in problems of migration, agricultural change, and rural development, visited IIASA in June-July to work on the Comparative Migration and Settlement Study. A Corresponding Member of the National Academy of Sciences in the Soviet Union, Dr. Zaslavskaya presented this description of her current work at Novosibirsk at an informal seminar held in the Human Settlements and Services Area.

Andrei Rogers  
Chairman  
Human Settlements  
and Services Area

July 1978

## Complex Systems Research on Socio-Economic Problems in the Rural Agricultural Sector in the Soviet Union

The team of Siberian sociologists which I have been leading for the last few years is making a study of the development of rural areas. As far as I know it is the only Soviet scientific team which consistently bases the study of a complex social system upon the methodology of systems analysis.

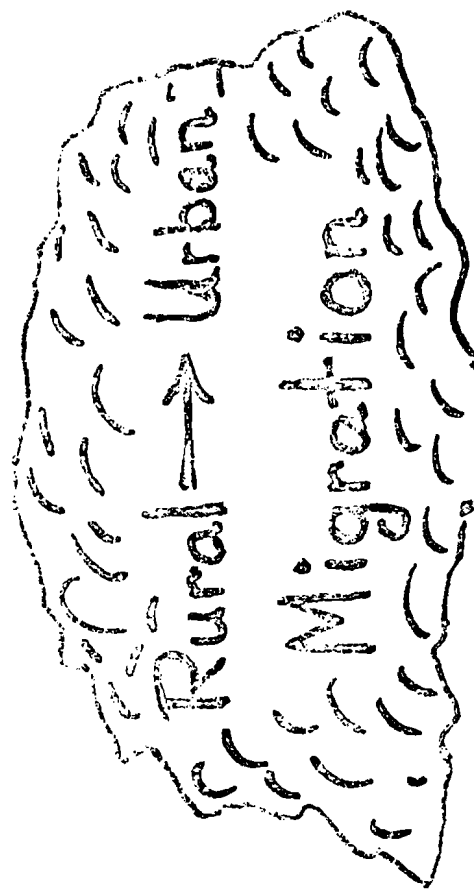
In doing this study, the first question needed to be answered is: why are we obliged to use this extremely complex methodology?

The primary target of our team was to investigate the reasons for rural-to-urban migration and to look for policies which would discourage out-migration and therefore provide rural areas with the needed labor force. A complex multiform study was conducted, but not one major reason for intensive rural-to-urban migration was discovered. This kind of migration resembles a tree: its roots being elements of living conditions (Fig.1). Among the factors affecting migration processes are; much less diversity of jobs in rural areas in comparison with cities, worse labor conditions and housing, less developed leisure facilities, and many others.

The main conclusion of this first study may be illustrated with the following picture. (Fig.2). It shows, that the real problem is a gap between rural and urban areas in the whole complex of population living conditions.

Cities are very attractive for rural people, especially for the youth. That is why the labor force demand of rural areas is not being satisfied in recent years. Under these conditions only one relevant policy may be recommended. It is the policy of closing the gap between rural and urban living conditions and raising the conditions of rural areas to the level of cities. This policy is shown in our picture with the help of a pulley.

# 1. Factors affecting a rural to urban migration in the U.S.S.R.



- 2 -

Push factors

Pull factors

Availability of jobs

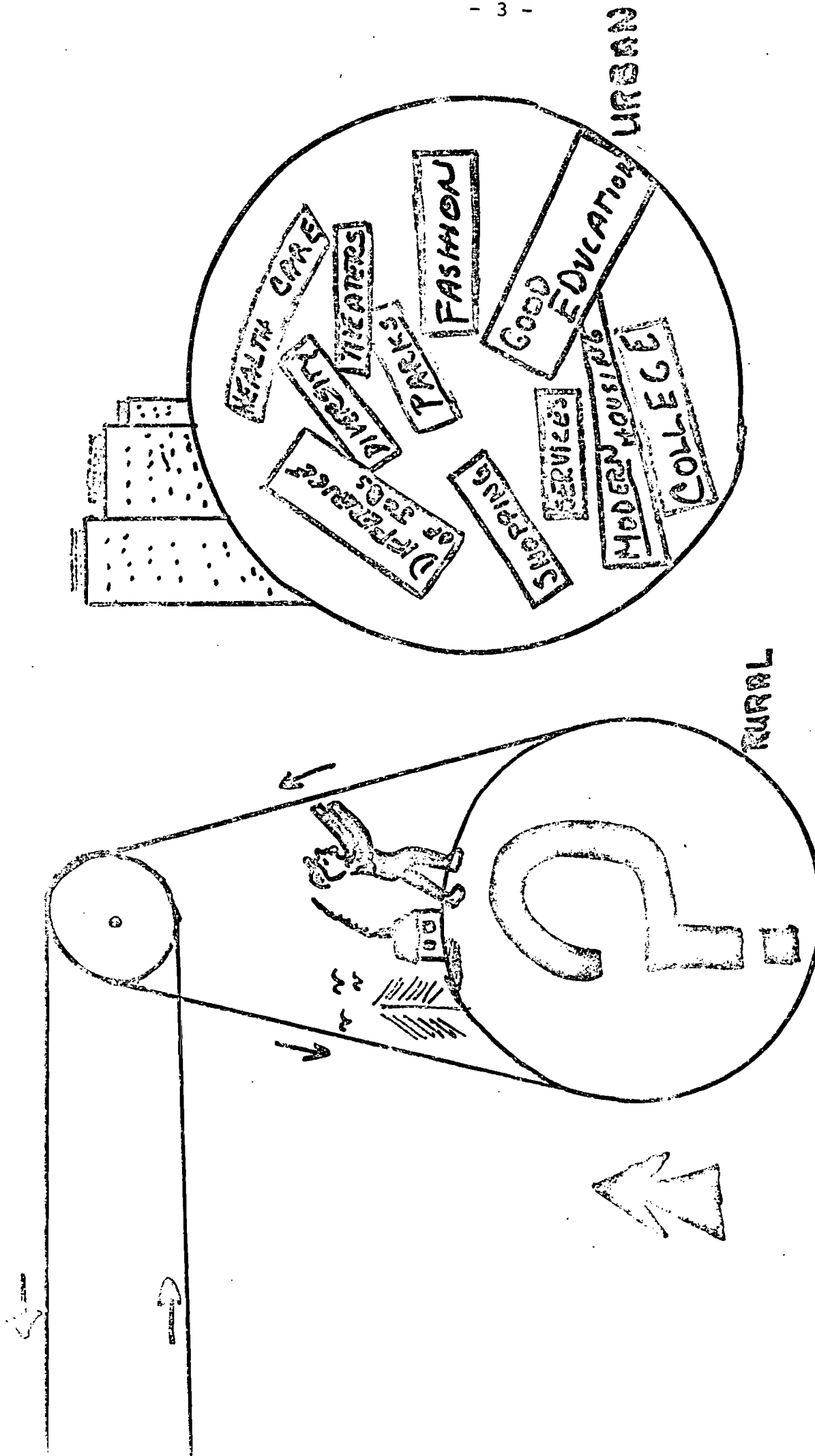
Living conditions

Leisure

Health care

Educational facilities

Other



2. Why do rural people migrate to cities? Can their migration be reduced?

One can ask, whether it is necessary and practical to make rural areas similar to urban ones? Naturally, it is not and we do not have such an intention at all. But we believe that it is necessary to make rural and urban conditions comparable, as shown in the picture (Fig.3).

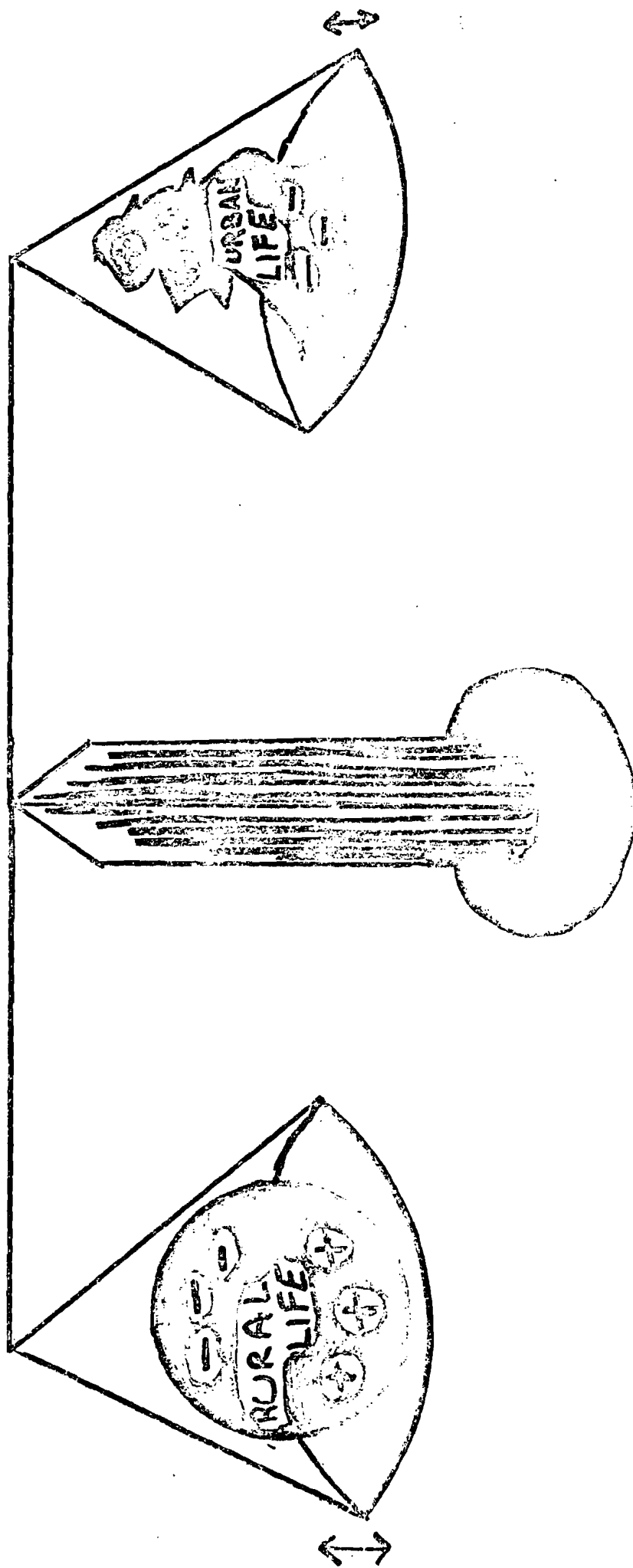
Having come to this conclusion, we were obliged to transform the main target of the study. Now we have to work out and suggest to policy-makers a long-term policy, which would provide the best ways of development of rural areas and the appropriate solutions to their main problems. Research of migration became only one of the aspects of a much more generalized study. To meet the new targets with the former methodology apparently is impossible. That is why we must know and use the new methodology - systems analysis.

The first difficulty which we met was the lack of a common definition of the central notion of our study - the notion of "rural areas". As far as we are aware, different groups of scientists in the USSR and some other countries had different opinions on the question. This picture (Fig.4) presents answers to the question "what is a rural area?" from four points of view, from philosophers, economists, geographers and sociologists.

Philosophers consider rural areas to be historically a remote and underdeveloped part of the society which must be continuously brought up to the cities' level. Economists think of rural areas as a part of society dealing with agriculture and agro-industries. For geographers, rural areas are the multitude of dispersed small settlements with a specific infrastructure and organization of services. Sociologists consider rural areas to be a multitude of communities, characterized by a specific rural mode of life and rural patterns of inter-community relations. All these definitions are not relevant to the systemic study of rural areas. Therefore we had to define its subject ourselves. There were and still are many discussions on the topic. However, we have agreed upon a definition for our own use.

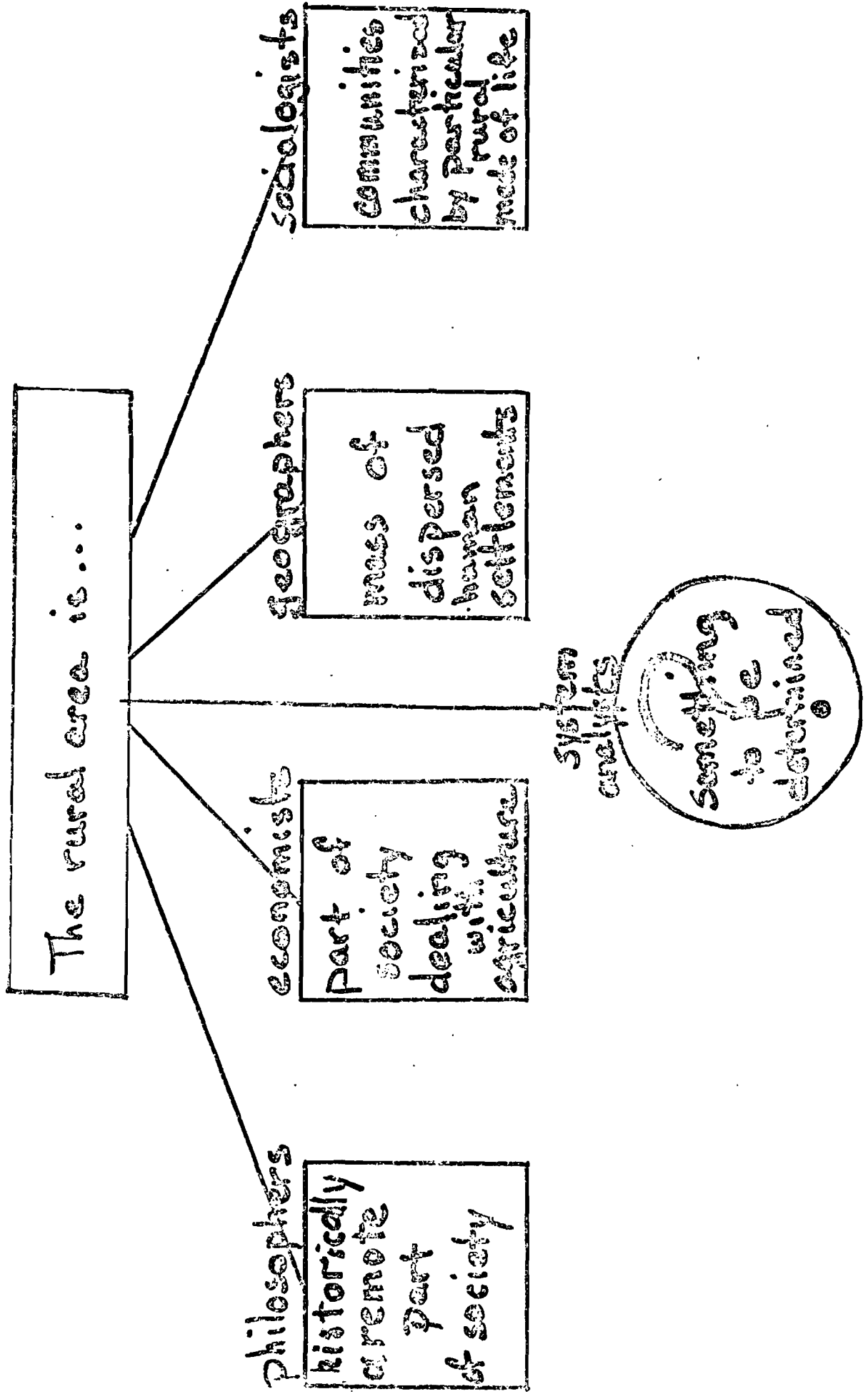
---

3. What is needed?



rural and urban lives are different  
but comparable

4. The rural area: what is it?





We believe that the most relevant way to define the subjects of complex systems research is to define them by their functions, affecting a wider framework - in our case the society as a whole. After long discussions, six functions of rural areas affecting the development of a society were identified (Fig.5). The names of these functions are: productive, social, demographic, spatial, recreational and cultural.

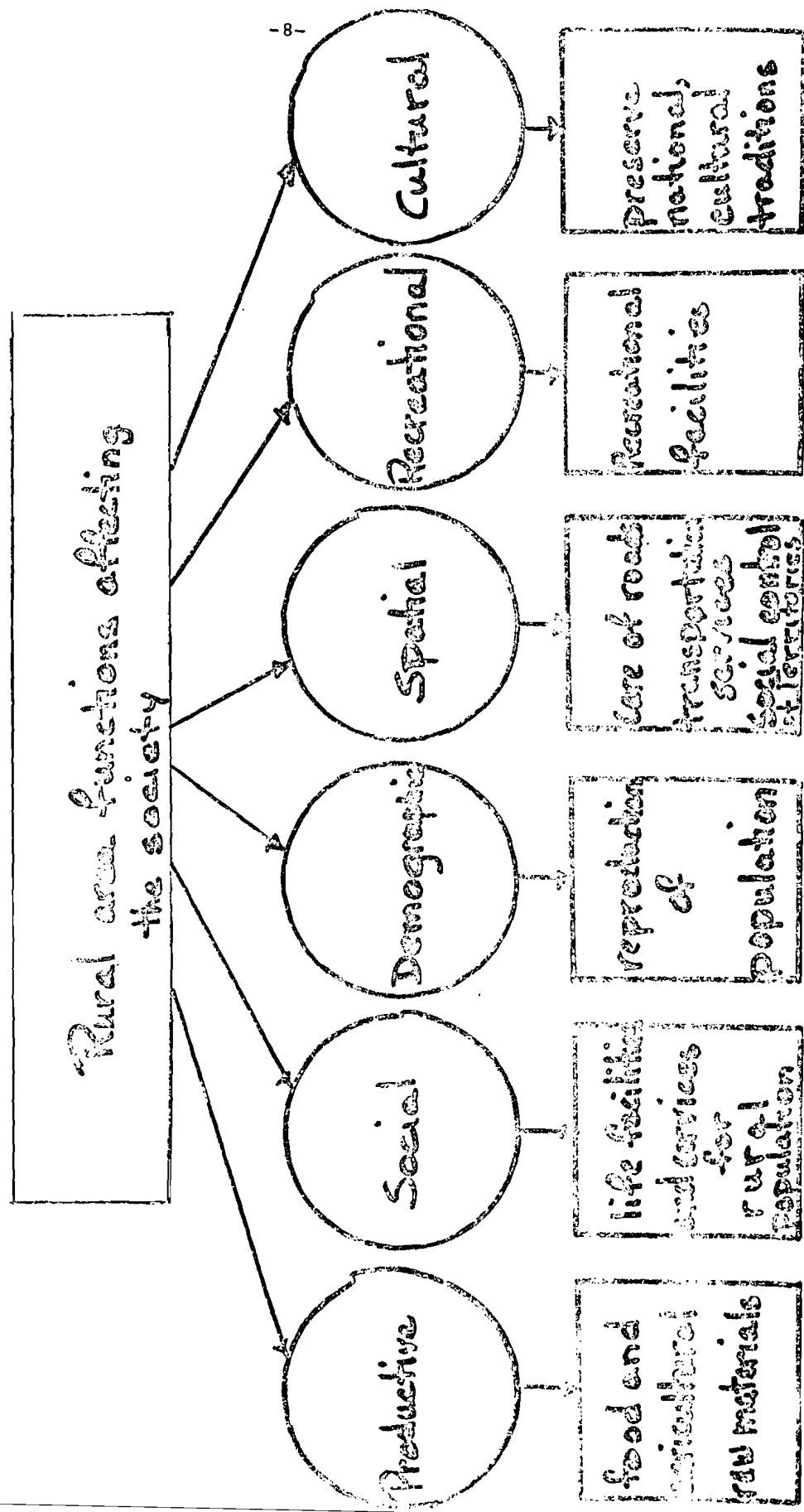
The content of every function is explained in the squares. Thus, the productive function of rural areas is to provide a society with food and other agricultural production, the social function is to supply different life facilities and services for the rural population, and so on.

To know the functions of rural areas is important for at least three reasons. Firstly, we must have a correct determination of boundaries for rural areas. A clear answer must be given to the question of what social objects (settlements, territories, enterprises) belong and do not belong to what we consider "rural areas". Secondly, it is important for the determination of long-term targets of development of rural areas because the most general target of this development is to provide an ideal fulfillment of all functions that affect society as a whole. Lastly, to know the functions of rural areas is important for the study of linkages of rural areas with the rest of society.

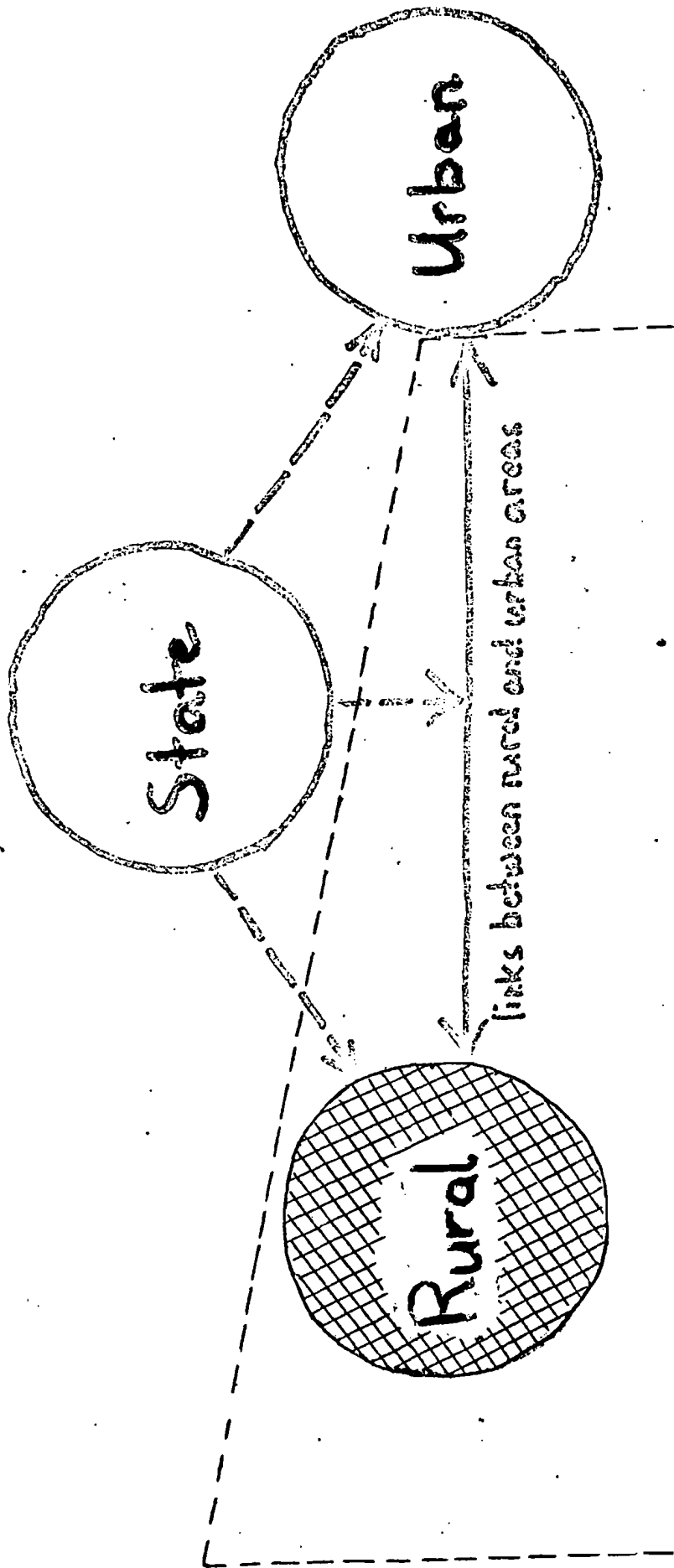
If the rural areas are one of the functional sub-systems of the society, what are their linkages with the rest of the society? Fig.6 demonstrates our general approach to the question. We can see three blocks on the scheme: on the one hand we have the rural and urban parts of the society and on the other hand we have a state which controls their development. Rural and urban areas are closely linked by many ways. The state controls the development of rural areas and cities, as well as the links between them.

Thus, the relevant subject of the systems' approach has to include not only rural areas themselves but also their links with urban areas and the state. This methodological demand is carefully fulfilled by our team.

5. Ways in which the functions of rural areas affect the society as a whole



6. What needs to be studied?

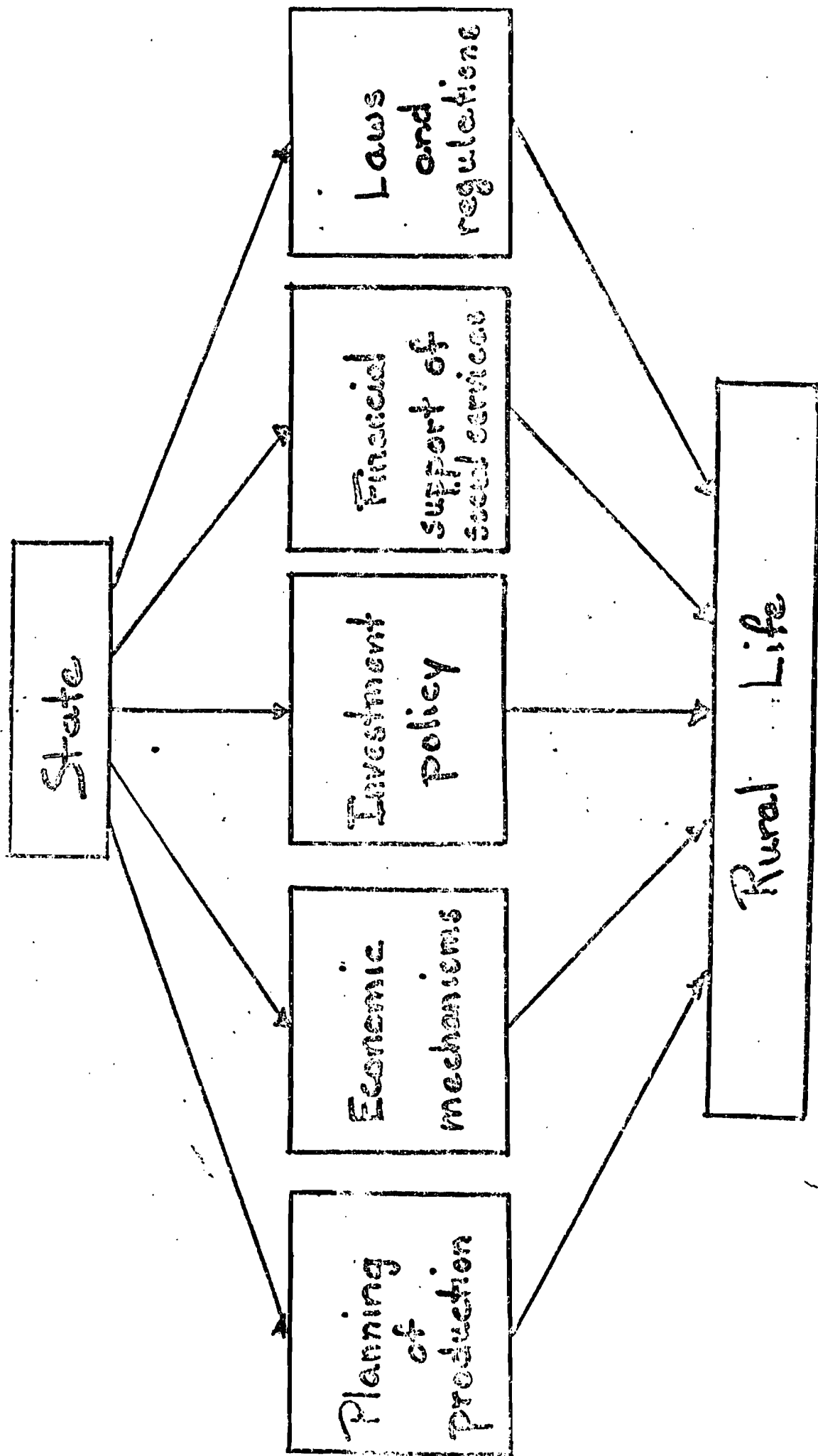


↑  
the field to be studied

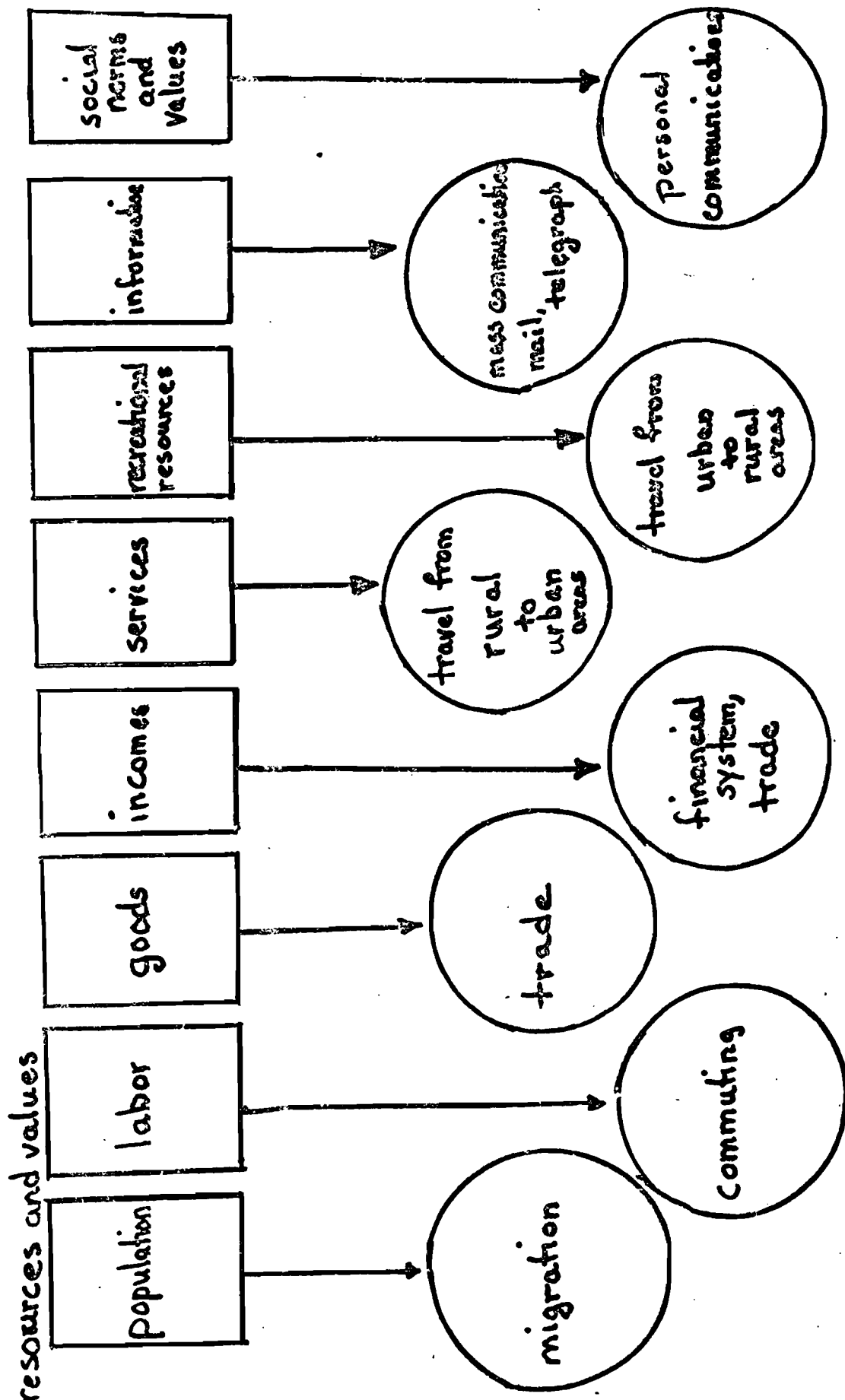
What are the main social and economic mechanisms which help the state control the rural development processes? There are many of them: the main ones are shown in Fig.7. They are: the central planning of the volume and structure of material production, particularly of agriculture; the system of prices for the agricultural and industrial production, taxation and credit systems, and so on; the policy of the state's investment distribution between regions and branches of the economy; current financial support of rural social services, such as health care services, schools, cultural facilities and others; and finally, judicial regulations of private human behavior, for example, the laws for obligatory education, regulating migration processes and labor mobility, the control of private plots, sizes, etc. This entire phenomena must be taken into account when a systems analysis of rural areas is undertaken.

Links between rural and urban areas are diversified and multiform. Therefore, there are some different approaches to their identification and study. For those interested in quantitative characteristics of these links the most relevant approach seems to be their presentation as an exchange between rural and urban areas of different forms of resources and values (Fig.8). We believe that the main kinds of these resources and values are: population, labor, goods, incomes, services, recreational resources, information, social norms and psychological values. It is to be stressed that an exchange of every kind of resource and value is based on specific social mechanisms. Thus, the exchange of population is based on migration processes, the exchange of labor on commuting, the exchange of goods on the trade relations, the income mobility on the financial relations and the like. In a systems analysis, all these mechanisms are to be taken into account because each of them is responsible for an important aspect of the rural areas' development.

## 7. Some mechanisms of state control over rural development



## 8. Exchange of resources and values that link rural and urban areas



Until now I have considered rural areas as a whole and single unit. But as a matter of fact they have a very complex organization. At least three particular structures of rural areas are of greater importance for our study. These structures are shown in the following drawing (Fig.9). In the left column, the conditional names of the structures are given, while the right one tells us the purpose of each structure's identification and study.

Thus, the reproductive structure is a methodological means for studying development processes, that is the dynamics of rural areas. The functional structure serves as a means of explaining current activities of rural people, including those of formal organizations and of private individuals. The spatio-managerial structure is needed for studying spatial distribution and diversity of both current activities and development processes in rural areas.

As a matter of fact, three kinds of structures define the three directions of our investigation. The first was the research and modeling of socio-economic dynamic processes with the final target being the forecasting of the future of rural areas as dependent on available state policies. The second direction was the detailed study of mechanisms and quantitative trends of the rural areas' current function. The third direction was the multi-stage study of socio-spatial structure of rural areas, based on the methods of typological analysis.

In order to understand these structures more fully, let us turn to the reproductive structure of rural areas outlined in Fig.10. The inner solid circles represent the material elements of the rural reproductive structure consisting of population, natural resources and environment, and artificial environment (for example, buildings, machinery, equipment, clothes, furniture and the like). The fourth inner block represents social relations that determine the conditions of interaction between the first three elements.

9. Rural area structures that are important for our systemic study

## STRUCTURE

## QUESTIONS TO BE STUDIED

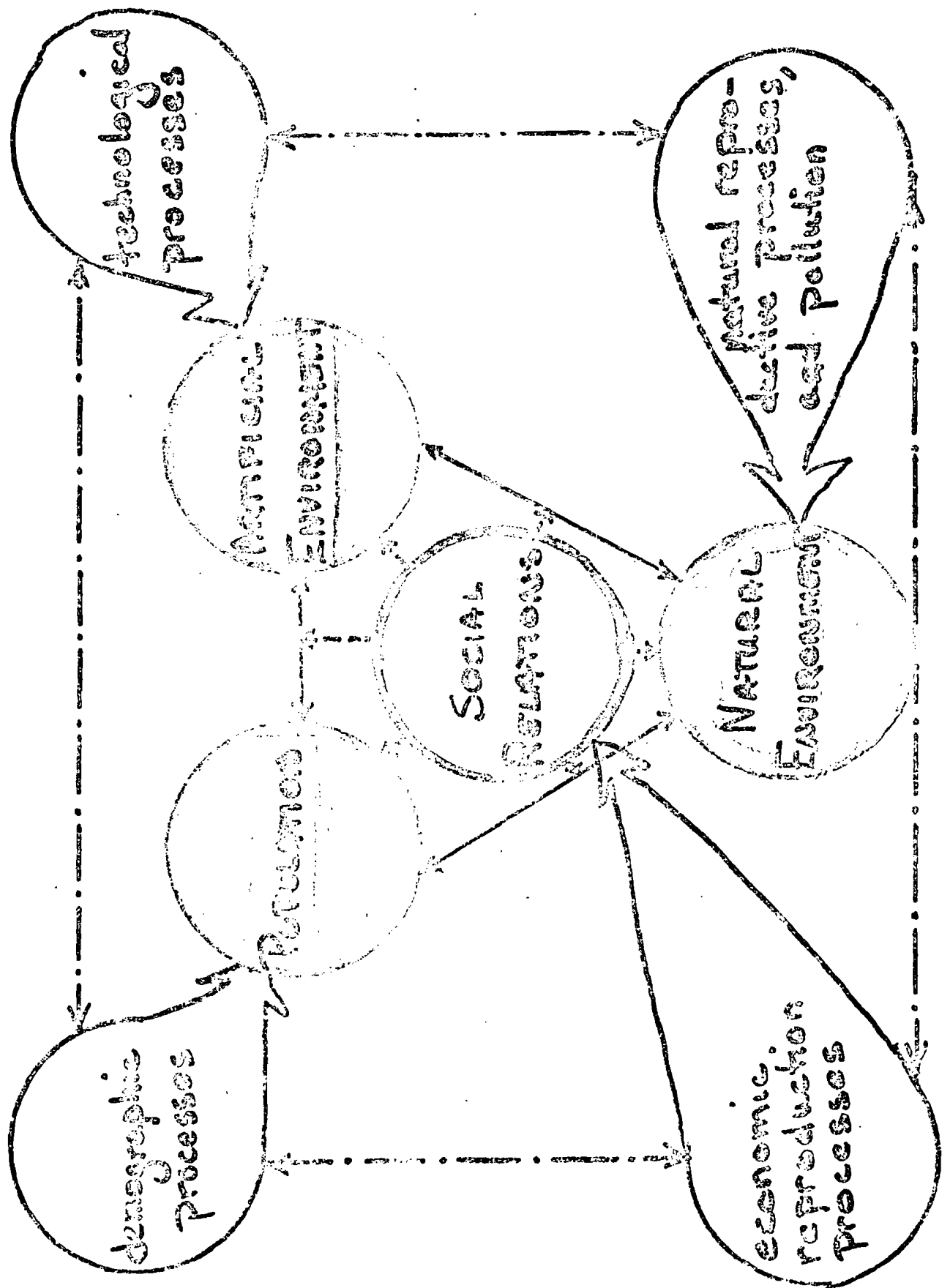
1. Reproductive —————> Reproduction and development  
Processes

2. Functional —————> Current activities and social  
function's fulfillment

3. Spatio-managerial —————> Spatial balances of current  
activities and development  
Processes



# 10. "Reproductive" structure of rural areas



The four outer blocks refer to the social processes which are responsible for the reproduction of each of the "static" elements. One can see that all of them have quite a different social nature. Thus, reproduction and development of the population is based on the demographic processes of fertility and mortality, reproduction of the artificial environment is based on technological processes, and reproduction of natural resources is based on natural processes as well as man made pollution. Finally, reproduction of social relations is based primarily on economic reproduction processes.

Efficiency of the system must depend on the quantitative proportionality between the three "material" blocks of the structure as well as on the accordance of the social relations to the state of all these elements. Since this assumption is correct for statics, it should also be correct for dynamics. In other words, processes having completely different natures and mechanisms must be ruled in such a way as to balance the structural elements of the rural areas. It means that it is necessary to study not only all kinds of reproductive processes, but also relationships between these processes.

Two groups of sociologists and mathematicians are trying to provide the relevant set of models simulating rural development. One of these groups is in Novosibirsk with Professor F. Borodkin as its leader. Drs. S. Soboleva, L. Trus and some other people are also in this group. The other group is at the Institute of the Control Sciences in Moscow, with Dr. J. Muchnic as its leader.

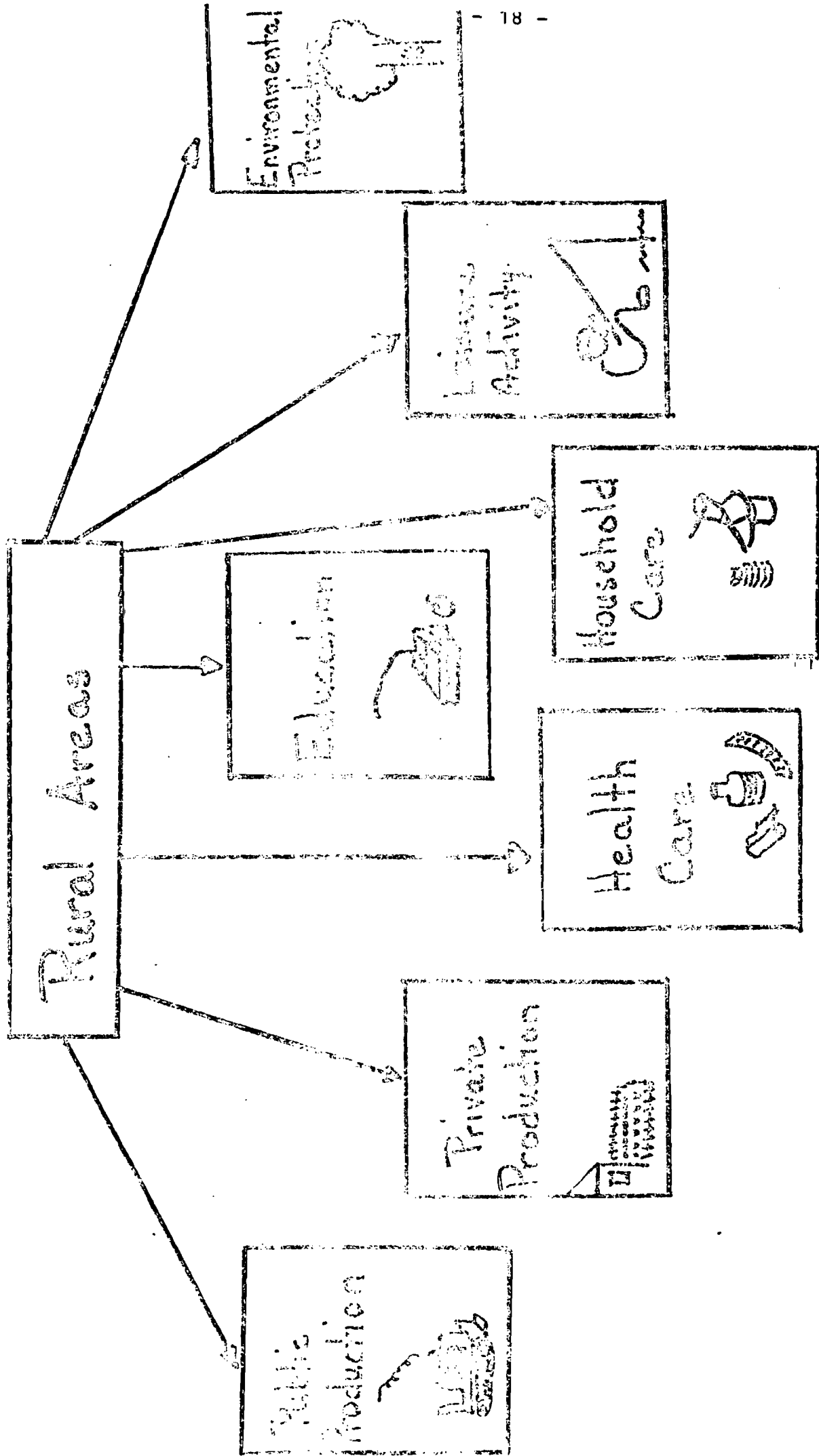
These two groups are experimenting with different approaches to the problem. The first is concentrating on the relevant simulation of every separate type of development processes, namely demographic reproduction processes, technological changes, and public production development. An adequate model that can incorporate all the results of this study has still to be written. Up to now, mainly socio-demographic models have been constructed and

used. They allow us to evaluate different variants of population development with respect to a population distribution by sex, age and level of education. Some scholars are trying to adopt well known models of optimal agricultural production development for our specific needs by integrating them with socio-demographic models. One very new and interesting study is being conducted by F. Borodkin and S. Soboleva on the interaction between migration intensity and the state's investment policy, particularly, the distribution of investments between urban and rural areas. The Moscow group is concentrating on macromodels simulating general trends of rural development mainly on the basis of econometric methods.

The second and really the most important direction of our study is based on the functional structure of rural areas. Seven spheres of rural population's activities are identified as elements of this structure, or "subsystems", that are responsible for a fulfillment of rural areas' function in the society. These spheres are shown in Fig.11 and include: public production, private plot's care and private production, health care, education, household care, leisure activity, and environmental protection.

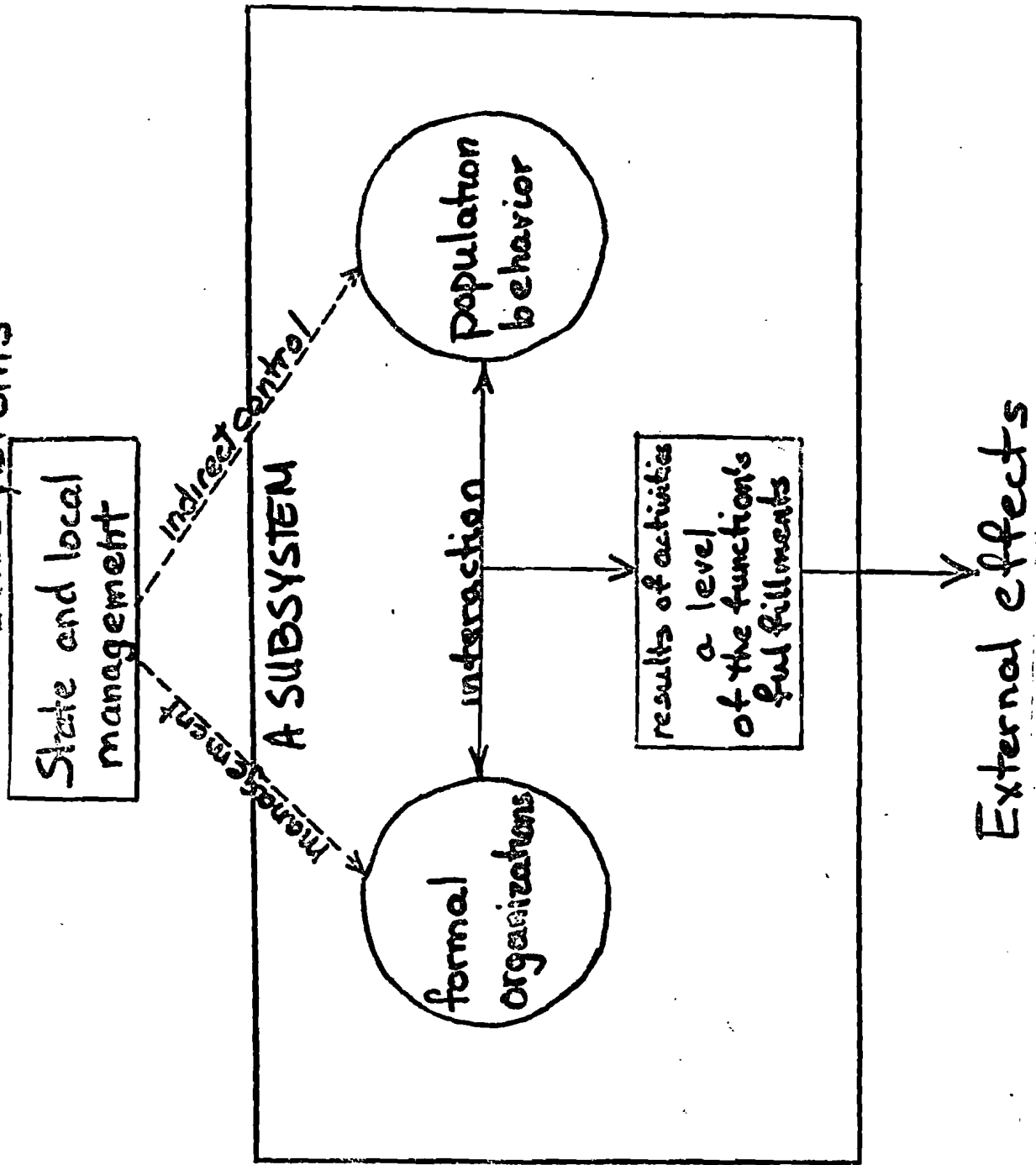
Time limits do not permit me to show how these subsystems correlate to the elements of the reproductive structure of rural areas, but it is true that they are correlated.

Many of our team members are engaged in studying the structure, function, and development of particular subsystems. As a rule, one or two scholars are studying each subsystem. The only exception is a subsystem of natural environmental protection. Up to now, we have failed to find a good specialist in this field. It is important to note that the point of departure of our investigation is a definite conception of the subsystem's general structure. This structure is shown in the following picture (Fig.12). The typical subsystem of rural areas includes two closely correlating and interacting blocks: a) formal organizations responsible for the appropriate aspect of a rural social



## 11. Functional subsystems of rural areas

## 12. General structure of subsystems



life and b) the behavior of the rural population. Whatever subsystem we choose, these two elements would exist. For the public production subsystem, for instance, these elements are cooperative farms, state farms and other enterprises on the one hand and human labor force on the other. For the health care subsystem they are state medical services and the population adopting these services.

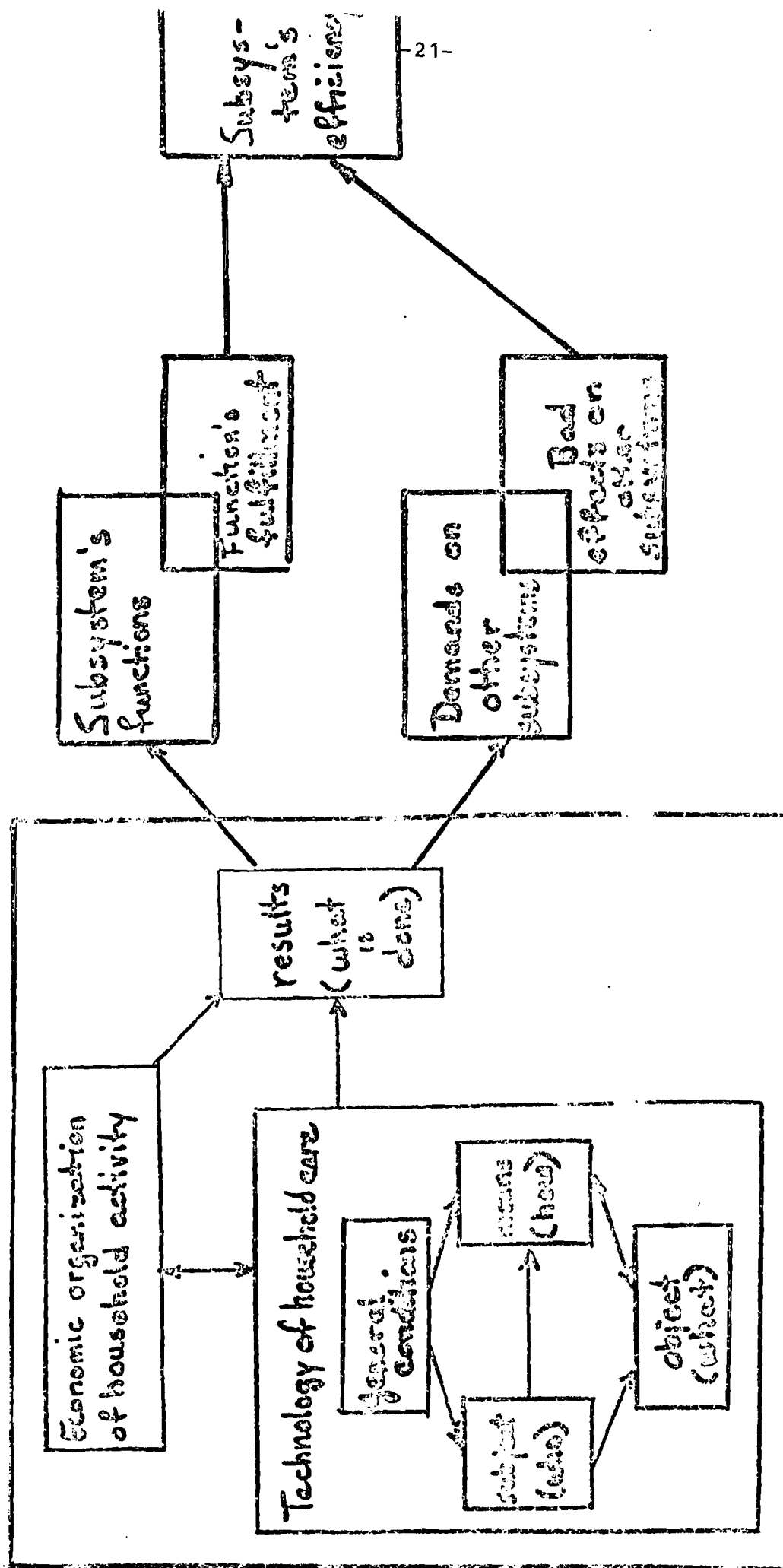
The final results of a subsystem activity depend on the interaction of formal organizations and the population where every side has its own values and purposes and uses its own means of fulfillment. Therefore, extreme importance is given not only to the separate study of organization and population activity, but also and primarily, to the study of their relationships and interactions. Because state and local management affect organizations and population, both directions of its control are to be studied.

A general subsystem structure is needed in order to integrate results that are provided by the study of the individual subsystem. But this structure is too general to serve as a methodological means for concrete socio-economic studies of subsystems. For the sake of such studies, a more detailed structure of subsystems was provided. This approach defines the main features that are common for all subsystems, while their more detailed features may be slightly different.

Fig.13, for example, illustrates the structure of the household-care subsystem. The elements of the subsystem are shown in the large frame. The smaller, inner frame shows the elements of household-care's technology, including characteristics of the activity's subject (who does it?), of its object (with what objects?), of its means (machinery or equipment), and of its general conditions (housing, climate, etc.)

The second block of the subsystem presents an economic organization of household activity (prices, services, facilities, etc.).

### 13. A detailed structure of the household core subsystem



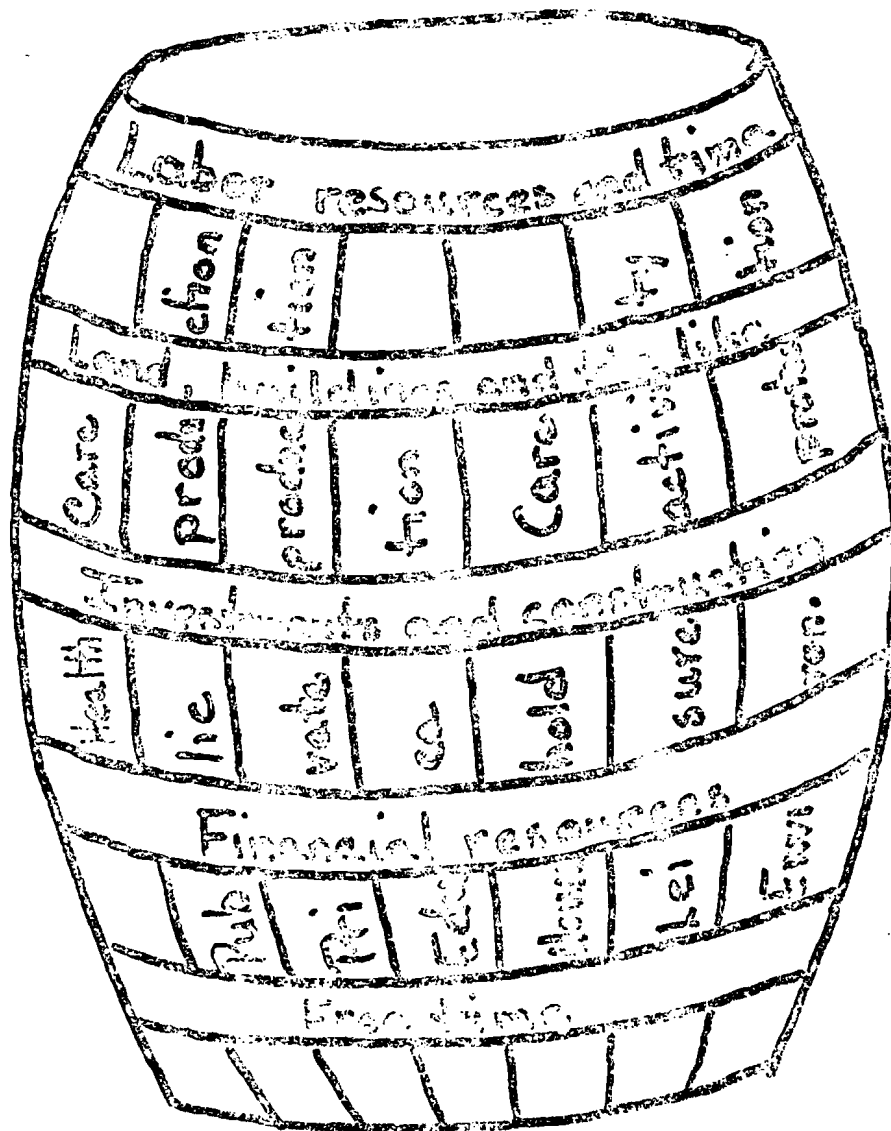
The third block shows the final results of activities - the level and character of material consumption and applied services. These results are confronted by the social expectations reflected by the subsystem's functions, and by the demands of the rest of the subsystems. The efficiency of the subsystem as a whole may be assessed by taking into account both of these aspects. Special attention is paid to links between functional subsystems. There are five types of them under study, presenting respectively proportions of distribution of labor resources and labor time, free time or rural population, public and private financial resources, investments and construction facilities, as well as the main material conditions of human activity, including land, buildings, and the like.

Figuratively speaking, the functional structure of rural areas may be presented by the image of a barrel (Fig.14): the slats being the subsystems and the rings being the particular linkages between subsystems that hold them together. The investigation of each link forms a subject of a task, being solved by one or two scholars.

We have discussed the organization of the major part of our study, dealing with the functional structure of rural areas. But what are the results of this study? Are there some empirical findings or is all that we have said only a theoretical framework designed when sitting at a desk? No, it is not. Many results are obtained with the help of this methodology. First of all, the adequate means for statistical data collecting and sociological survey conducting are worked out. This has allowed us to gather really unique information for the system description of rural areas. Furthermore, many concrete estimations and projections were completed and many particular but inter-linked socio-economic problems of rural development were analyzed. The results of this part of the study are published in ten books and summarized in the book Methodological Problems of A Systemic Study of Rural Areas. In its first part the theoretical frame-



# 14. Subsystems and linkages between them



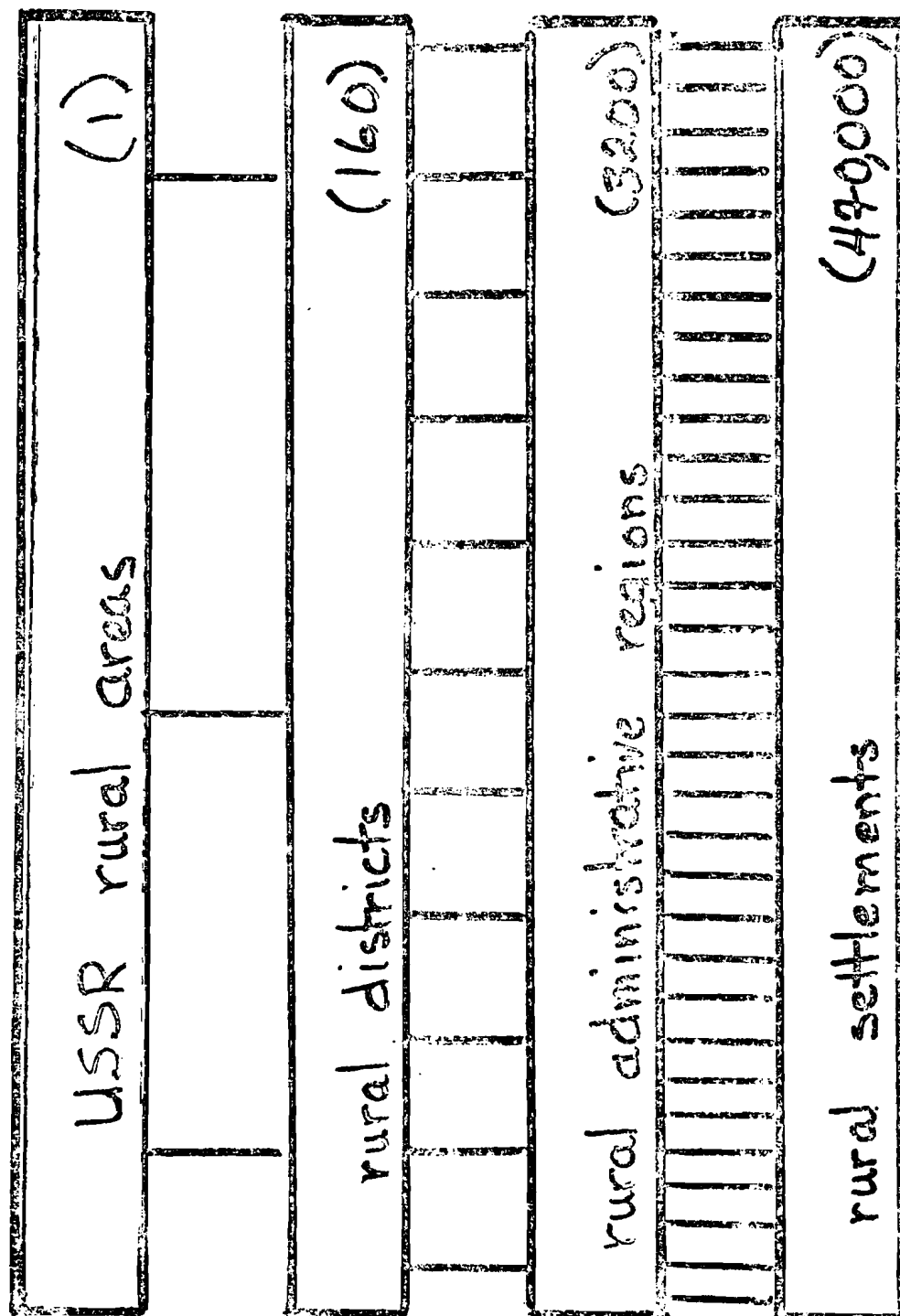
work of the whole study is presented. In the second part the descriptions of five subsystems, based on this framework, are given. And in the last part, selected links between subsystems are described and analyzed. Of course, the study was not completed when the book was being written, moreover, it is not completed even now. However, some important results of it are already published and known.

The last set of questions I am going to touch on concerns the spatio-managerial structure of a rural area, presented in Fig.15. The upper level of this structure is formed by 160 districts, that are the rural parts of 160 administrative districts of the USSR. The middle level of the structure consists of 3200 rural administrative regions, and the lower level includes 470,000 rural settlements.

The spatio-managerial structure of the rural areas is very important for a practically oriented study but, at the same time, it is too complex to be studied by itself. It is necessary to construct and to analyze a more generalized socio-spatial structure of rural areas, as shown in Fig.16. This new structure has similar levels to the former but its elements consist of generalized socio-economic types of districts, regions, and settlements, rather than of particular districts, regions or settlements. Three levels of this structure are consistently correlated. Thus the types of regions are to be constructed within the types of districts, and the types of settlements within the types of regions.

Though I am not able to go into details of this study, it is important to note that it is being conducted in all three levels. Three separate groups of scholars are dealing with each of the levels. The first constructs a socio-economic typology of all rural districts of the USSR, the second provides a typology of rural regions of West Siberia and the third builds a typology of rural settlements of the Novosibirsk district. All studies are based on the linguistic method of the construction of typology.

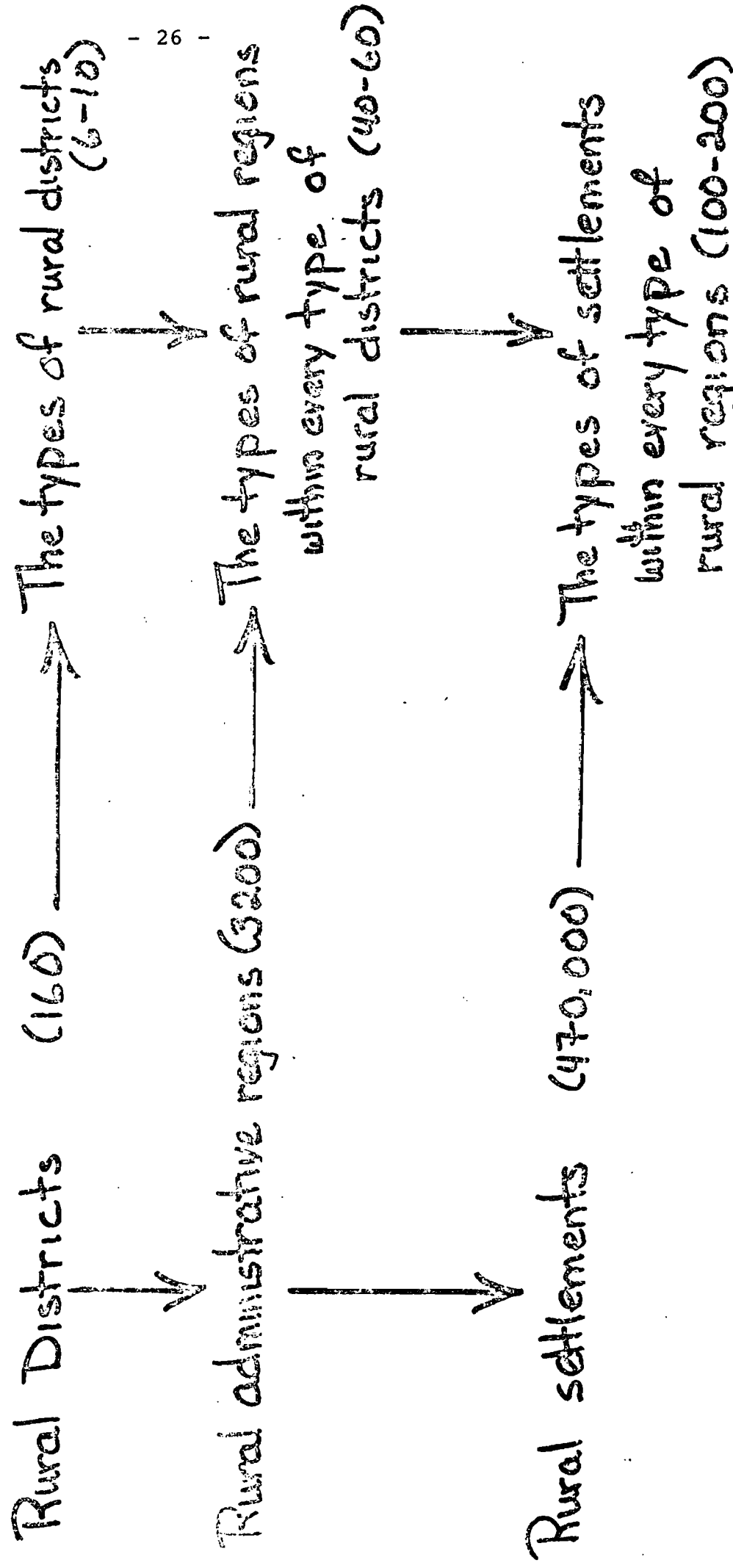
# 15. Spatio-managerial structure of the Soviet rural areas



## 16. Spatio-managerial and socio-spatial structures of rural areas

Spatio-managerial  
structure

Socio-spatial  
structure



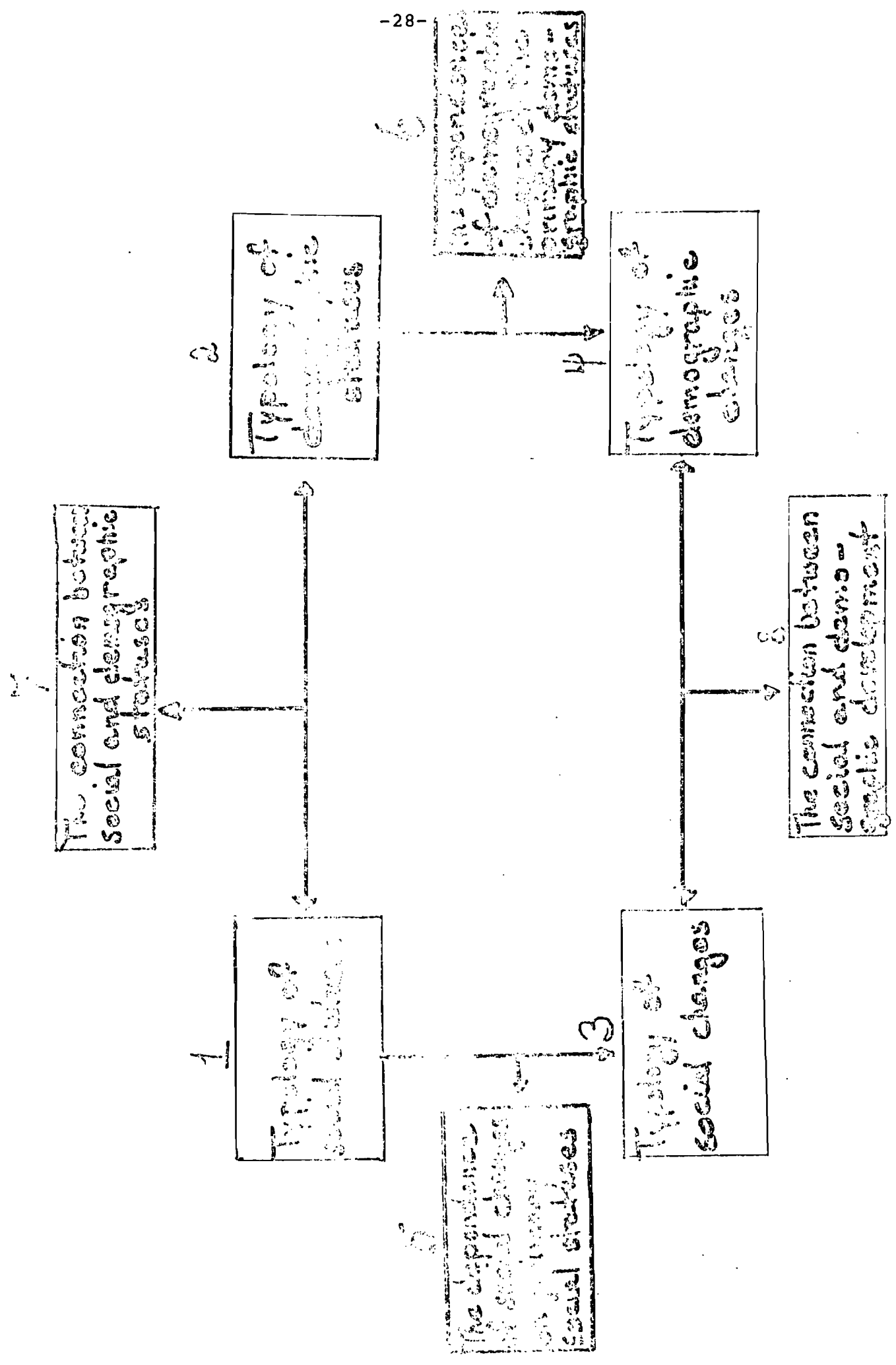
This methodology combines factor analysis and automatic classification, and appears to be very efficient. The authors of this methodology are scholars of the Institute of Control Sciences in Moscow who are working with us. Up to now, the most interesting findings are obtained for the levels of settlements and districts. The results of the first direction are presented in the book Rural Settlement's Development - The Linguistic Method of Social Object Classification, published in 1977.

What is the general structure and what are the main tasks discussed in this book? Four separate but connected sets of data on 157 rural settlements of Novosibirsk district were processed: two for 1967 and two for 1972. For both moments the data on 39 social and 20 demographic indicators, characterizing every settlement, were provided. Using these data, we decided on eight tasks, which are presented in Fig.17.

First of all, the static typologies of settlements by their social and demographic statuses were constructed. Then two dynamic typologies were created to generalize typical patterns of social and demographic changes of settlements' statuses in a 5-year period. Furthermore, dependence of social and demographic changes on the initial status of settlements were analyzed. And finally, the dependence of demographic characteristics on social characteristics were studied statically and dynamically.

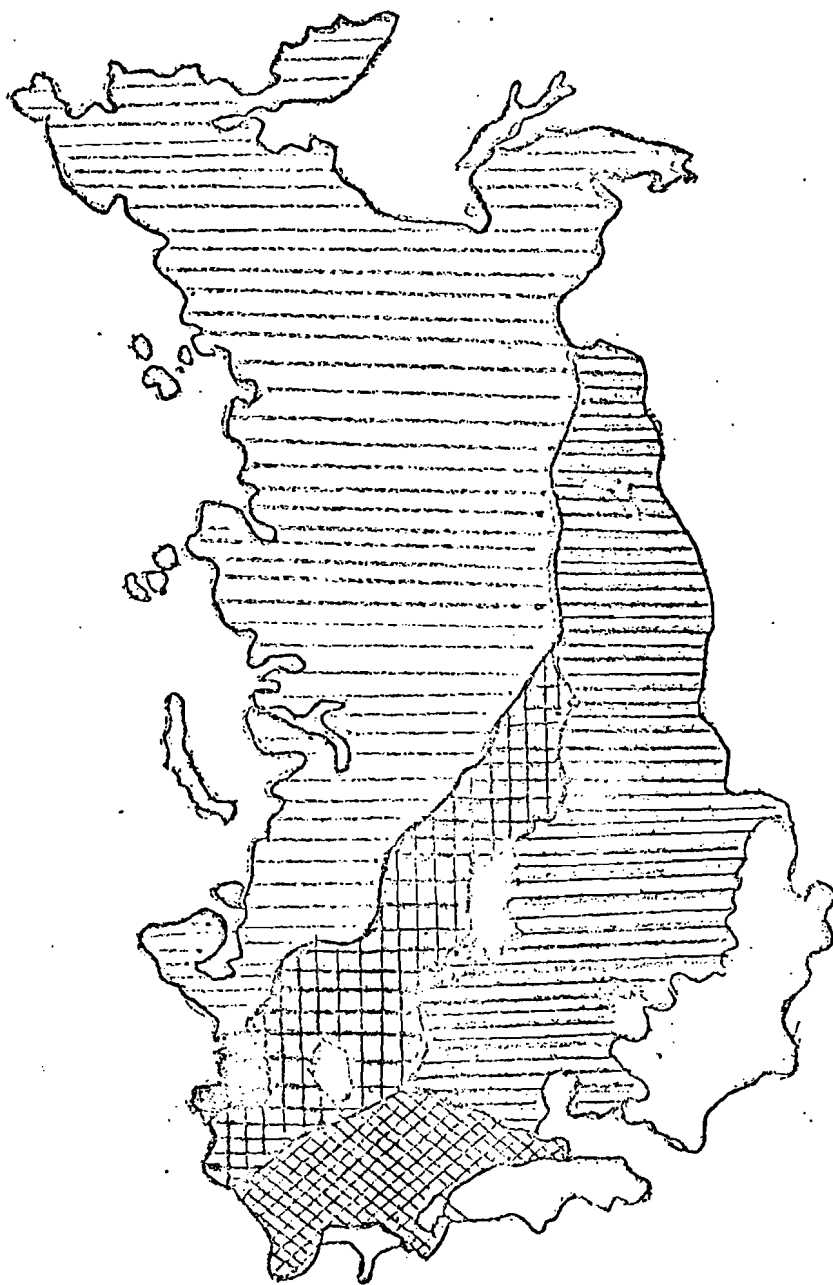
Fig.18 shows a rough scheme of six socio-economic types of rural districts in the USSR. This scheme is based on estimations, taking into account nearly a hundred socio-economic indicators. Among them are, for example, the average size of the rural settlement, the average distances between the settlements, the level of labor force education, the availability of modern agricultural techniques, and the labor force participation in public production.

I shall not describe in detail particular problems confronting each of the types of districts. But what should be stressed is the extreme diversity of these problems for each type of



# 14. Tasks of typological analyses of 157 rural settlements

18. Six types of rural districts confronting different sets of problems



region. Really, every type is confronting specific socio-economic problems. Therefore, more detailed analysis of the actual problems should be conducted for every type of region individually.

I would like to conclude with a general summary of the study. Fig.19 shows its three main directions based on the investigation of reproductive, functional and spatio-managerial structures. The scheme includes also the more concrete elements that make up each of these three branches of our study.



# 19. A general scheme of the systemic study of rural areas

