INSTITUTIONAL FRAMEWORKS FOR REGIONAL DECISION MAKING IN THE USSR

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FOREWORD

This paper is a revised version of a presentation given by A. Kochetkov in an IIASA workshop on Regional Consequences of Large-Scale Energy Projects in February 14-16, 1983. The results from the project with the above title are now being edited as a book. The present paper provides important background information to this planned book.

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1. BASIC PRINCIPLES OF POLICY FORMULATION

The fundamental aims of regional policy in the USSR are as follows:

- to improve the distribution of industries and jobs through the rational deployment of industrial development throughout the country;
- effective economic development of new territories;
- to create territorial production complexes (TPCs);
- to improve socioeconomic development, with due regard to environmental regulations and ecological conditions; and
- to remove regional disparities in living standards and to promote equal development of all republics and nationalities.

These objectives are established and implemented through the joint efforts of centralized national, sectoral, republic, and local planning and management bodies. Hence regional policy is reflected in the planning system at all levels along both vertical (sectoral) and horizontal (territorial) lines. They are reflected in the territorial section of the five-year national economic plans, as well as in sections of the sectoral and enterprise plans in the comprehensive socioeconomic development plans of each administrative or territorial unit (i.e., the Union and Autonomous republics, territorial regions, regions, autonomous regions, administrative districts, cities, towns, and villages. Similarly, management at all levels is carried out through a system of the above bodies with combined sectoral/territorial controls.

Key issues that arise in the development and allocation of large-scale industrial complexes are resolved under the guidance of the State Planning Committee of the USSR (Gosplan), the State Committee for Science and Technology (GKNT), as well as energy ministries and sections of the republic administrations. The main problems of regional development arise from the complexity of combining sectoral and territorial planning in situations where there is some divergence between economic interests of the various business units and where these units are subject to different jurisdictions or managements. The organizational structures, methods, and procedures of the territorial/sectoral combination are far from effective and need to be improved. This improvement must proceed in four directions: (1) formulating comprehensive socioeconomic regional planning techniques; (2) strengthening the regional aspects of sectoral plans; (3) increasing the budgetary independence of republic and local administrations; and (4) developing new forms of program-oriented and cooperative management for large-scale projects.[1)]

2. REGIONAL ASPECTS OF LARGE-SCALE PLANNING

In the 1970s the centralized system of national economic planning became increasingly program-oriented. The program approach was first used in planning science and technology, but later it was more widely used to handle major socioeconomic problems, including those at the regional level. There was a decisive push to develop, under Gosplan guidance, comprehensive programs closely interwoven with sectoral and territorial aspects

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1) See Comprehensive National Economic Planning, 1974 (Moscow: Ekonomika); Methodological Problems of Socioeconomic Development of USSR Regions, 1979 (Moscow:Nauka); Territorial Production Complexes, 1970 (Moscow); Development and Formation of Territorial Production Complexes in the USSR, 1978 (Moscow); Regional Problems and Territorial Planning in Socialist Countries, 1978 (Moscow: Progress); Modern Problems of Economic Geography in the USSR, 1978 (Moscow); Territorial Production Complexes in the USSR, 1981 (Moscow).

of national economic plans. Striking illustrations of existing regional programs include the development of the west Siberian oil and gas complex, the Baikal-Amur railway area, and the agro-industrial complex in the non-black-soil zone of Russia. The approach was also successfully applied to the development of territorial production complexes (TPCs). Since the majority of TPCs are energy-oriented, (west Siberia, Kansk-Achinsk, Pavlodar-Ekibastuz, etc.), the experience gained in TPC planning and management has been extremely valuable in assessing and validating plans for other large-scale projects.[2)]

The theoretical basis of TPC development was laid down in the 1930s by Alexandrov (1931), Malyshev (1935), and later by Kolosovsky (1958, 1971), and involves the optimal deployment of resources through effective sharing of individual (enterprise) and common infrastructure (e.g., construction, energy supply, transport, housing, cultural and community centers, etc.) in an area.

The first large-scale project to use the systems approach was the Angara-Enisei complex. The new TPC approach was fully translated into practice in the Goelro Plan, the first large-scale development program of the state commission on the electrification of Russia. This involved the construction of 30 regional power stations and several large enterprises (Krzshishanovsky 1955). The Goelro plan, completed in the early 1930s, incorporated the basic concepts of the TPC, such as supplementing specialized activities with support industries and infrastructure, strict development priorities, the rational distribution of jobs, proportional development of production and nonproduction activities, efficient utilization of resources, and the establishment of rational (from a national economic point of view) intra- and inter-regional relationships. Later on, as the most advanced form of spatial organization of production areas, the TPC was viewed as

2) Long-term Investment Programs: Economic Problems and Models, 1974 (Moscow:Ekonomika); Methodological Problems of Allocation of Material Production Branches, 1979 (Moscow:Nauka); Basic Methodological Principles of Optimizing Production Development and Allocation, 1978 (Moscow:Nauka); Development of the National Economy of Siberia, 1978 (Novosibirsk:Nauka); Effectiveness of Productive Force Allocation, 1978 (Moscow:Nauka).

the basis for regional development (see Baransky 1949, Bandman 1981).

An especially significant contribution to TPC theory was made by Kolosovsky (1958), who first formulated the basic principles of the concept in a systems form:

- o interrelationships between TPC construction and rational spatial organization of productive forces (resources);
- o integration of multidimensional TPC objectives;
- o organization of internal TPC structure with regard to scale, sectoral composition, and other characteristics;
- o wide typological range of TPCs; and
- o mechanisms of TPC performance as integral systems (Kolosovsky 1947, 1971).

These basic TPC concepts were further developed by Baransky (1949), Nekrasov (1975), Saushkin (1973), Chetyrkin (1967, and in particular by Kolosovsky (1958, 1971). To date, more than 1500 publications have been devoted to TPCs.

The experience of TPC design gained during the 1930s in the course of the development of energy projects at Dneprovskaya GES, Pribaikalsky, etc., was further developed in the 1950-60s through the design of large power stations and industrial nodes in the Ukraine and Siberia, as well as in Kazakhstan, Middle Asia, and the Far East. In fact, the TPC concept provided the basis for the development of the general scheme for the allocation of productive forces.

Soviet experience in TPC development was reviewed at IIASA in 1976 through the Bratsk-Ilminsk case study. The principles of the allocation of economic, social, and environmental projects formulated on the basis of this experience considerably affected the validation and implementation techniques for subsequent schemes. In fact, each such project is now treated as a TPC with a particular specialization, in order that the negative consequences of development can be reduced, and otherwise irreversible mistakes avoided. The TPC approach to the development of large-scale energy projects has also helped to ensure optimal energy exploitation. All such projects supply some power to energy-consuming regions, while the remainder is consumed in situ by large energy-intensive industries. In addition, the energy-producing TPCs contribute to the creation of a centralized infrastructure, stimulate attention to social and environmental problems, and provide a structural basis for the development of settlements.

In order to define the place of large-scale energy projects such as TPCs within the national economy, it is convenient to use structural classification diagrams. Even with an integrated approach, the national economy has to be disaggregated in several dimensions. This involves the identification of: (1) sectoral subsystems (sectors, sub-branches, amalgamations, and enterprises, including energy complexes); (2) territorial subsystems (republics, provinces, areas, administrative regions, urban areas, and new settlements); (3) TPCs, as special instruments of national planning; and (4) zones with specific functions (e.g., tourism, forestry, agriculture, etc.).

These structural subsystems are identified on the basis of localization criteria of economic relationships and linkages. A more specific approach to determining the place of large-scale energy projects such as TPCs requires consideration of a special classification of territorial production combinations shown in Figure 1. This was compiled on the basis of an analysis of production-territory relationships, and their nature, intensity, and effectiveness. Accordingly, the west Siberian energy complex can be referred to as a second-rank, Kansk-Achinsk, Pavlodar-Ekibastuz, and Timana-Pechersky complexes as third rank, and large-scale power plants (industrial nodes) as fifth rank. It should be noted that the boundaries of large energy complexes (or TPCs) do not always coincide with those of administrative areas; for example, the west Siberian complex is located within Tjumen and Tomsk areas, and the Kansk-Achinsk complex is within Kranoyarsky province and Kemerovo area, etc. At the same time, each complex contains several industries: west Siberia - oil, gas, power generation, petrochemicals, timber, etc.; and Kansk-Achinsk and Pavlodar-Ekibastuz - coal, power engineering, etc.

This supports the thesis that large-scale energy projects require specific planning and management using a combination of

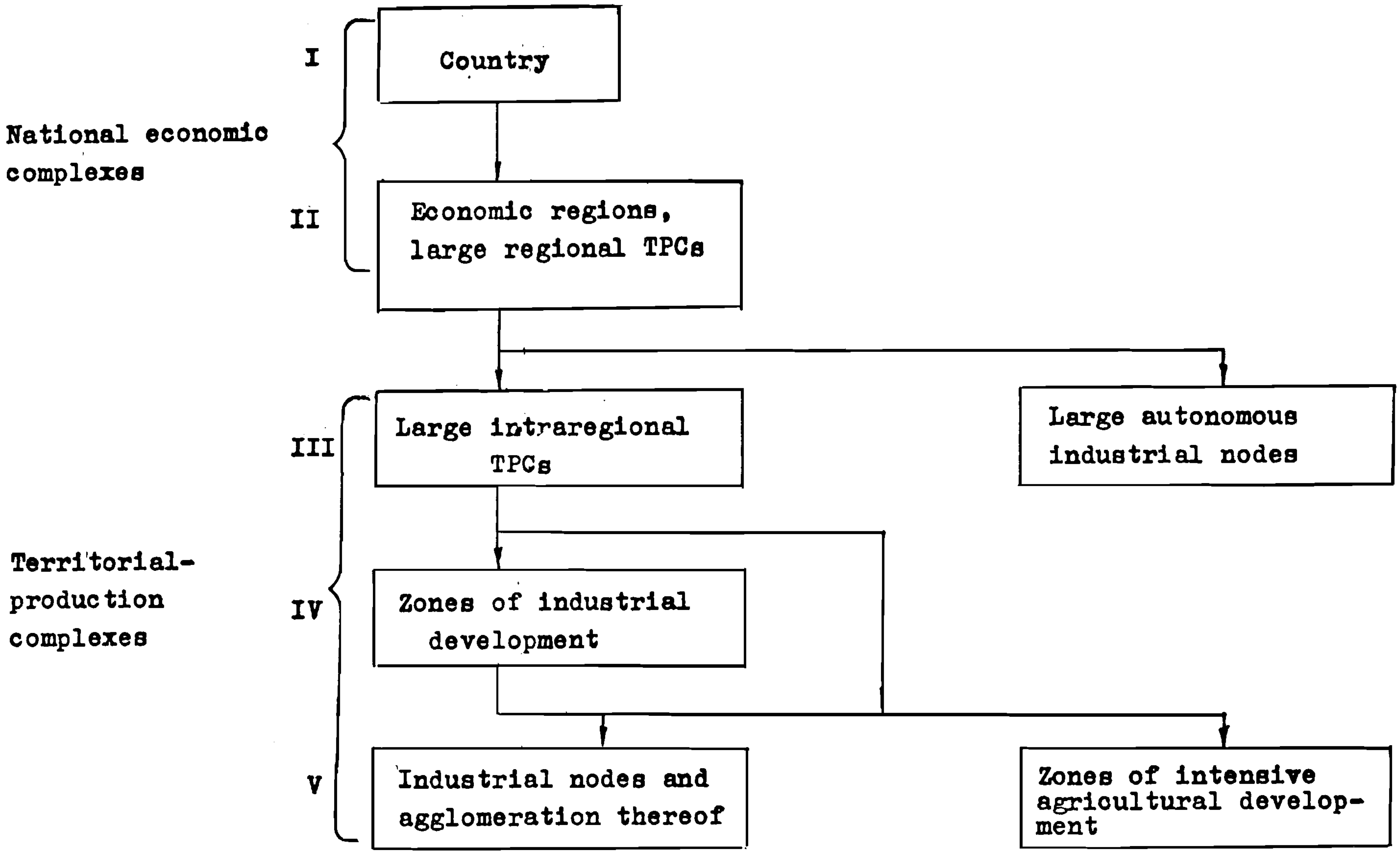

Figure 1. Main territorial-production combinations.

sectoral and territorial planning as well as a program-oriented approach (Bychek and Chistyakov 1977, Komkov 1981).

Experience suggests that the most effective management of such projects is achieved through a combination of the TPC and program approach concepts. An energy project is treated as a task-oriented investment and construction program, and requires: (1) formulation of objectives; (2) factor analysis and concept choice; (3) program-structured analysis (functional, spatial, and temporal); (4) optimal choice of projects, deployment, investment structure; and (5) decisions on program implementation.

Because a high degree of uncertainty is inherent in both decisions and their effects, most R & D activity during the 1970s was aimed at improving the methodology of multiple-option design. The various options - partial or complete, deterministic or stochastic - determine to some extent the methodological techniques, models, and procedures employed. Figure 2 shows a set of models developed at the Institute of Economics and Production Engineering of the Siberian Branch of the USSR Academy of Sciences (Bandman 1980). Those in most widespread use in the USSR are network models in which the dynamics of project implementation are presented in the form of a generalized activity network. The network reflects alternative modes of program realization as complex, logical relationships between interrelated activity packages. The models are helpful for decision making in multiple-option situations and for assessing the impacts of each partial option on the further implementation of the investment program as a whole.

Network models must also take into account ancillary requirements such as housing, cultural and community facilities, environmental protection, etc., as well as all direct and indirect activities and resources (including those that will help reduce the negative impacts of development).

3. COMPREHENSIVE REGIONAL PLANNING TECHNIQUES

The planning of a large-scale energy project in the USSR involves:

- Preplan long-term R&D on scientific and technological questions, which are carried out by research and design

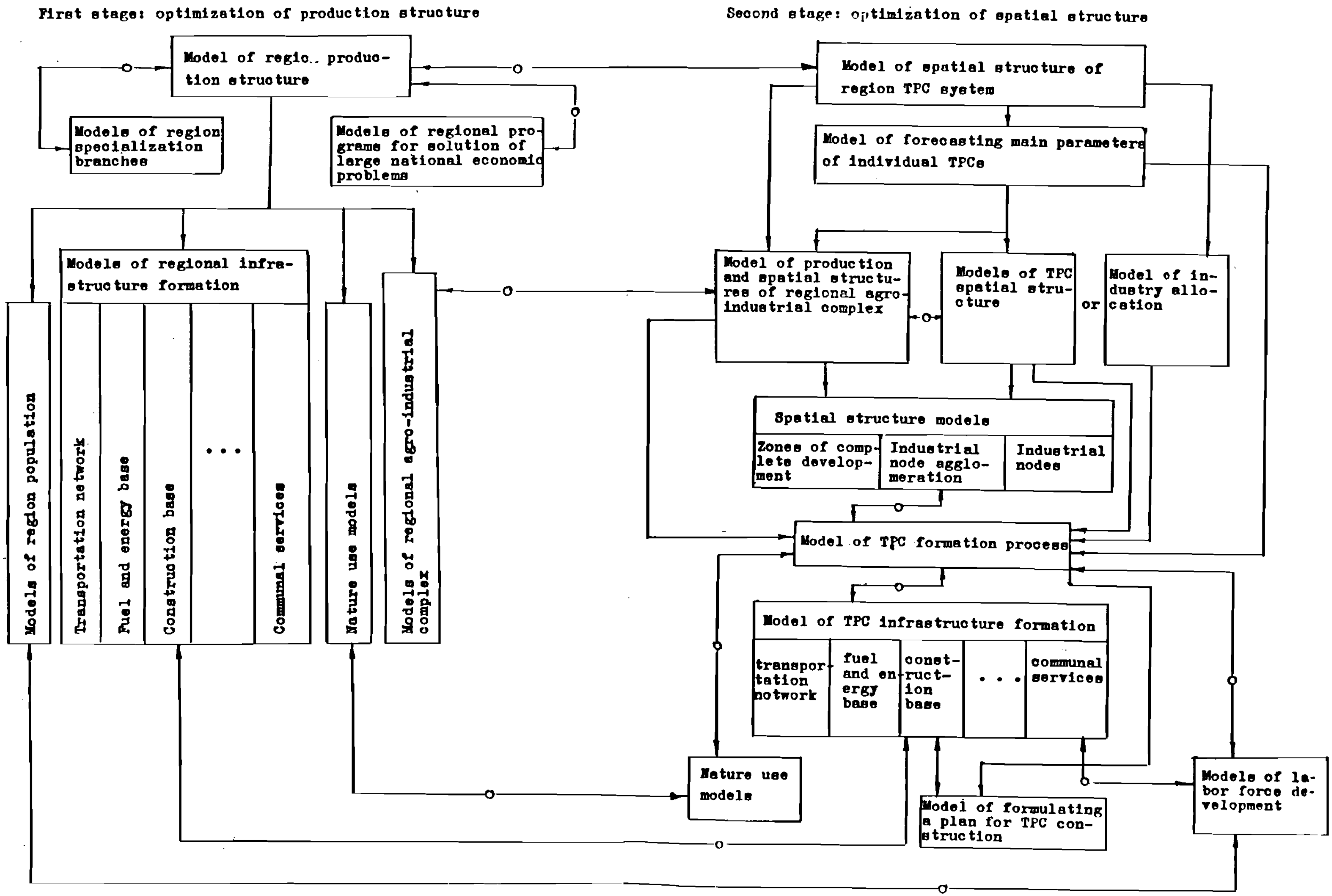

Figure 2. Region economy structure optimization models - directions of main information flows and decision coordination; -0- decision coordination.

organizations under the guidance of state committees.

- Predesign feasibility studies by design organizations within the energy ministries and by subcontractors.
- Special government directives on implementation, prepared by Gosplan with the active assistance of relevant ministries and organizations.
- Sections of the national five-year plans for socioeconomic development formulated by Gosplan, with annual assignments to other sectors of the economy, the Union republics, and key economic regions.
- Sections of sectoral plans of the ministries and related organizations.
- Sections of plans of the administrative and territorial units in which the project will be located.

The preplan and predesign approval procedures for energy projects are quite complex. First, a comprehensive program of scientific and technological development over a 20-year period is drawn up by the research institutes, under the guidance of GKNT and the USSR Academy of Sciences with sectoral and regional dimensions. This program takes into account long-term energy policy provides a basis for determining key parameters. As far as feasibility studies are concerned, energy projects are included in the general scheme for the development and allocation of productive forces. This scheme (developed under the guidance of the council for the study of productive forces, attached to Gosplan) is an important scientific forecasting document in which such projects are viewed from two perspectives: the development and deployment of the energy sector, and of productive forces as a whole. In other words, the scheme tries to match the territorial and sectoral location of projects with projected national needs.

The structure and details of such projects (as part of the sectoral schemes agreed upon with Gosplan) are approved by the energy ministries, and also (as parts of the schemes for each republic) by the Council of Ministers of the Union republics. In 1982 a general scheme of productive forces in the USSR until

1990 was completed, and another is being prepared that will extend it to the year 2000.

The choice of specific locations for large-scale energy projects is generally made in the development and allocation schemes of the energy industries concerned, and is then specified further in the predesign feasibility studies based on engineering surveys and analyses of possible alternatives (Makarov and Melentyev 1974).

Ministries and other organizations draw up development and deployment schemes for the various economic sectors, and resources allocation schemes for each region and Union republic; these schemes cover periods of 15 years (broken down into five-year subperiods) and any necessary adjustments can be made every five years. The schemes provide an opportunity for the elaboration of design and survey activities for specific projects approved within the five-year plans.

Feasibility studies are carried out by the parent design organizations assisted, if necessary, by subcontractors. These involve the coordination of technical, socioeconomic, and environmental decisions, as well as analyses of potential negative impacts and possible ways of overcoming them. In practice, a feasibility study is a predesign and preplan document that confirms the economic expediency of and the need for a specific energy project; the study then provides a basis for future project design.

When carrying out feasibility studies for energy complexes, the design organizations have to ensure that technologically advanced and economically efficient methods are employed in construction and production, that financial, material, natural, labor, and land resources are used rationally, and that effective environmental control measures are applied. Furthermore, they must endeavor to use designs that incorporate water, recycling systems, minimize solid and liquid wastes and air pollution, provide modern working conditions, and check the operational safety and reliability of buildings and other structures. All these requirements encourage designers to apply a systems approach and this tendency is strengthened by the need to coordinate the feasibility studies with regional schemes and designs, as well as general national industrial plans. These latter documents are drawn up by the Gosstroi R & D organizations. There is a marked tendency for development and allocation schemes to be considered in close conjunction with feasibility studies; therefore, the latter are not considered independently, but rather as elements of sectoral and regional schemes.

The preplan and predesign documents provide the basis for special government directives on large-scale energy projects. Prepared by Gosplan, ministries and related organizations, and research and design institutes, these directives constitute an organizational and legal basis for the development and implementation of such projects.

They fall into three main categories: (1) indicators of the relationships between industries, regions, and a particular project; (2) specific assignments for ministries and organizations (including administrative and management bodies of the Union republics) on intersectoral and interregional goals; (3) aggregate measures of resources required, including total investments, machinery and equipment, and construction and maintenance personnel levels (including skilled specialists), etc. Contingency funds or resources are allocated to specific energy programs, if required, through the national economic plans.

The range of activities specified by government directives results in a highly complex planning process involving R & D finance, capital formation, production and purchase of equipment, personnel training, and material and technical supplies. Government decrees normally also contain directives on wages, pricing, fringe benefits, and grants, and the setting up of new management bodies.

In the R & D field, the decrees stipulate the required activities of the institutes involved. In some cases GKNT is instructed to draw up coordination plans on the problem, but in more routine cases involving the construction of a number of similar projects, R & D activities are generally assigned to the Ministry of Power Engineering and to a number of other ministries and contributors.

In the area of construction and machinery investment, the decrees specify for each facility a commissioning schedule for resources to be used, etc. In addition, they specify construction schedules, the composition of teams of contractors, and any special requirements for construction techniques (e.g., concurrent design, the use of large modules, block-and-sections, etc.). This is particularly important because a shorter construction period will reduce the time the workforce (and its associated infrastructure) must be maintained, and generally contributes to more rational project management. Government decrees on large-scale energy projects also contain specific assignments relating to social amenity requirements, which are later incorporated into the five-year and annual national, sectoral, and territorial plans.

It is worth noting that the entire system of activities connected with a project covered by such decrees is an open one; extensions, adjustments, and modifications can be introduced during the planning and design process. Thus decrees always contain specific assignments for Gosplan, ministries, and other organizations; in due course these bodies make any necessary additional decisions.

Large-scale project investment programs are headed by one or more ministries that are fully responsible for developing unified technological and economic policies, for supervising other ministries and organizations involved, and for coordinating R & D activities. Due to the complex nature of energy projects, the decrees request the help of numerous business, industry, sectoral, and territorial agencies and organizations. But the coordination of all these activities is correspondingly complex, and this is by no means always successful. Improvements require progress in two directions: (1) the development of closer coordination between long-term directives and medium- and short-term plans; and (2) the search for more appropriate organizational forms and economic regulators for the management of the entire range of investment and construction activities.

Thus, the implementation of large-scale energy projects (within the framework of comprehensive scientific and technological programs) is guided by interindustrial and sectoral schemes and feasibility studies (in which they are scientifically validated), by government decrees, and by the national five-year socioeconomic development plans. Other significant questions are answered in schemes and plans of the Union republics and economic regions, and detailed validation is contained in sectoral and territorial design documents.

4. IMPROVING SECTORAL AND TERRITORIAL MANAGEMENT

A comprehensive approach to validation and implementation of large-scale energy projects is achieved by combining sectoral and territorial planning. This involves: (1) the development and generalization of key sectoral plan targets with respect to each territory; (2) the integration of territorial plan targets for overall socioeconomic development; (3) the direct synthesis of sectoral and territorial plans; (4) the development of basic options for the territorial section in national economic plans (in future, this will be done with a set of models); and (5) the analysis and generalization of regional preplan documents (Christyakov, 1982). These devices are now being used, to some extent, in practice in the USSR.

4.1. Procedures for Plan Coordination

General block diagrams of combined sectoral/territorial planning are presented in Figures 3, 4, and in Appendix I. Figure 3 illustrates the established practice of coordinating five-year sectoral/regional plans as well as the place of TPCs within the system. Figure 4 describes a normative approach to combined sectoral/regional planning, which at the same time retains major aspects of the established pattern of the process. The most poorly developed elements of the comprehensive approach include: the development of basic options of the territorial plan sections (at present they are too aggregated due to inadequate development of territorial aspects), the application of formal models to compute optimal plans (at present, the range of models is too small and generally includes input-output models, models of optimal allocation of production, etc.). It should be noted that there is a growing need for more detailed basic options, since this approach promotes a more rational deployment

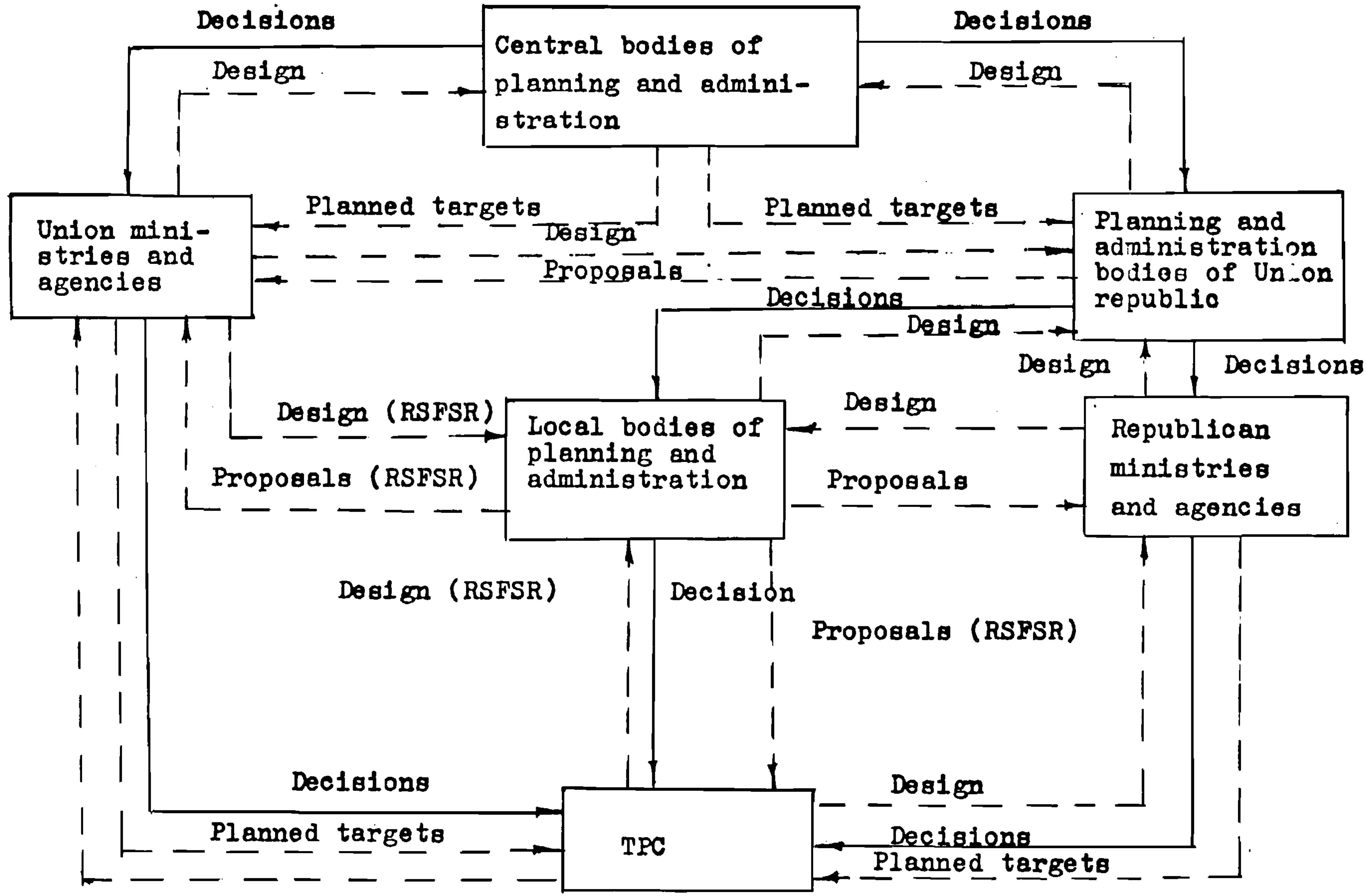

Figure 3. Established management patterns of TPC planning procedure.

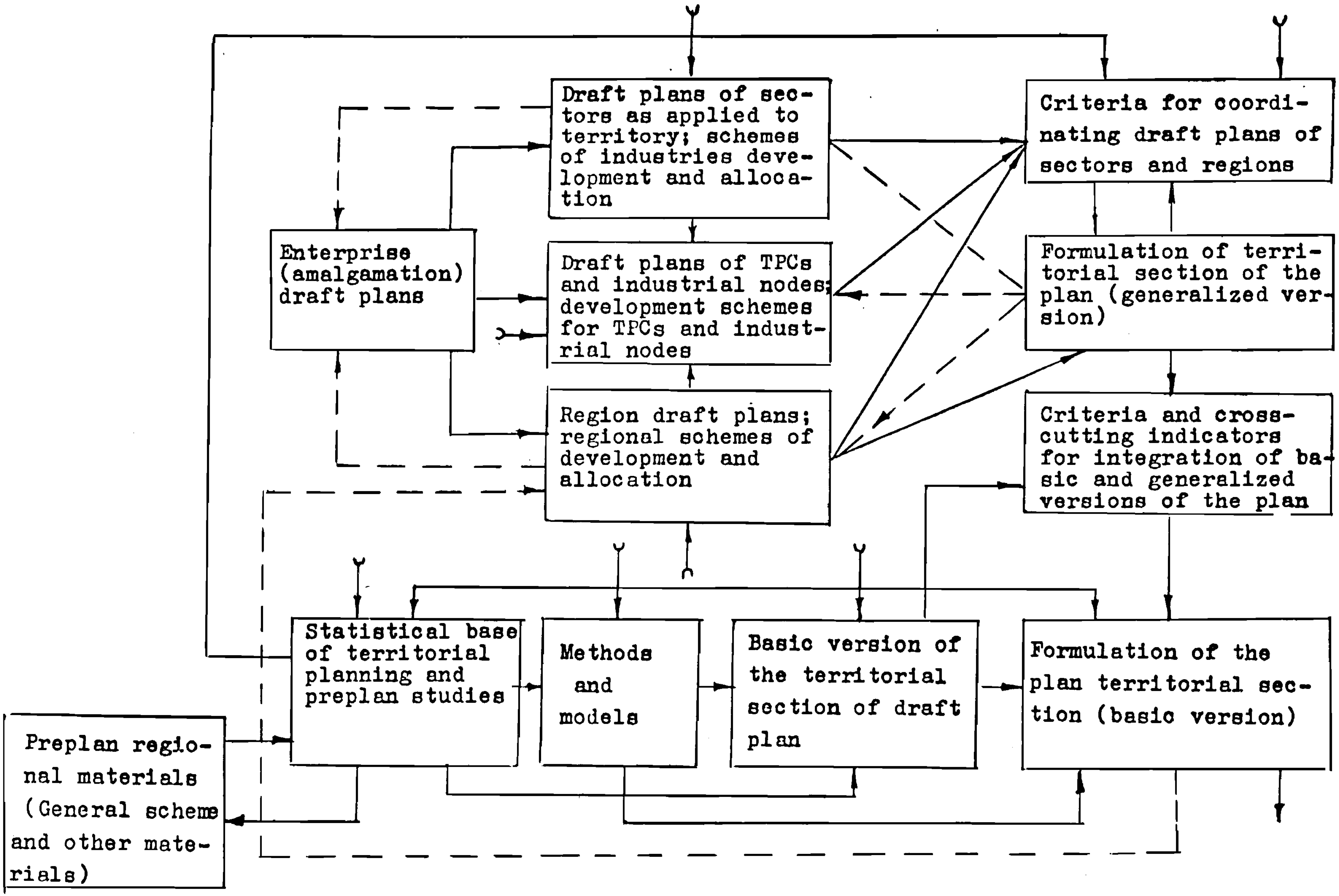

Figure 4. Aggregate scheme of regional planning.

of large-scale projects, the simultaneous solution of socioeconomic and environmental problems, and the removal of disparities in regional development and living standards in urban and rural areas (Ryabtsev, 1977).

At the same time, the development of optimal sectoral/ territorial plans requires concepts and tools that will allow the integration of macro (national economy), meso (sector or region), and micro (energy project) levels of decision making and implementation.

One approach to improving the coordination of sectoral/ regional planning of energy projects is illustrated in Figure A.1 (Appendix I; Christyakov 1982). In this figure, planning begins with a comprehensive sociodemographic analysis of the potential project site; national and regional economic trends; the directions and pace of scientific, technological, and social progress; and an analysis of environmental factors (block 0). On the basis of computations, the various regional impacts of a project are forecast, and long-term objectives are defined. Calculations and validation are performed using forecasting, expert judgement, simulation and optimization modeling, program-oriented planning, etc.

Demographic analyses (block 1) are generally undertaken by administrative units using available statistics, and these provide the basis for assessing labor availability, as well as the social infrastructure required (blocks, 2,3,4). The computations enable plan options for basic industrial development to be drawn up, i.e., power engineering, as well as associated support (blocks 5,6). Computation of interindustrial proportions of manufacturing branches is performed in block 7 (using dynamic input-output models). On the whole, computations and validations performed in blocks 1-7 provide the means for formulating a comprehensive draft regional plan with regard to project feasibility, taking into account socioeconomic and environmental factors. This provides the basis for assessing long-term consumption and capital accumulation targets (blocks 8,9) and later, indicators of efficiency (block 12).

The program aspects of regional socioeconomic development plans (block 10) are formulated using analyses of changes in the normative base (blocks 0.6), as well as preplan studies and design. Proceeding from computations in blocks 5,7, and 10 (block 11) alternative targets are formulated to maintain a regional economic balance. The evaluation and choice of alternatives (block 13) is done on the basis of economic efficiency indicators (block 12) in order to coordinate national economic, sectoral, and regional interests. Then, basic and support branch development targets are corrected (block 14), sectoral targets are disaggregated, and the plan is assigned to specific business organizations (blocks 15 and 16). It is worth mentioning that the evaluation of the impacts of an energy project, as well as other aspects of sectoral development (by branch ministries) is done in block 7, and the final plan options are drawn up in blocks 12-14).

There is another version of the comprehensive approach to national economic planning, which resembles a normative model, as shown in Figure A.2 (see Appendix II). This diagram contains four levels: upper decision-making centers, central planning bodies, sectoral/territorial management centers, and enterprises and organizations. Three types of plans are integrated: (a) long-term plans (over five years), which focus on the integration of technological, socioeconomic, and environmental processes; (b) medium-term plans (1-3 years), which are key components of the system and are specific and direct; and (c) short-term plans, which can be viewed as implementation and adjustment tools. There is a fixed procedure for plan formulation. According to Figure 10.6 energy projects are developed within sectoral, inter-industry, and resource programs on the basis of long-term plans and sectoral forecasts. The entire planning cycle involves coalescing plan horizons, forecasting, and so-called rolling time horizons (Figure 5).

Overall energy project validation at all levels and phases of planning and design involves the evaluation of several key factors: (1) sectoral indicators of project efficiency (technological level and economy of scale); (2) rational deployment of large-scale projects; (3) agglomeration effects connected with joint infrastructure enterprises and projects within the TPCs.

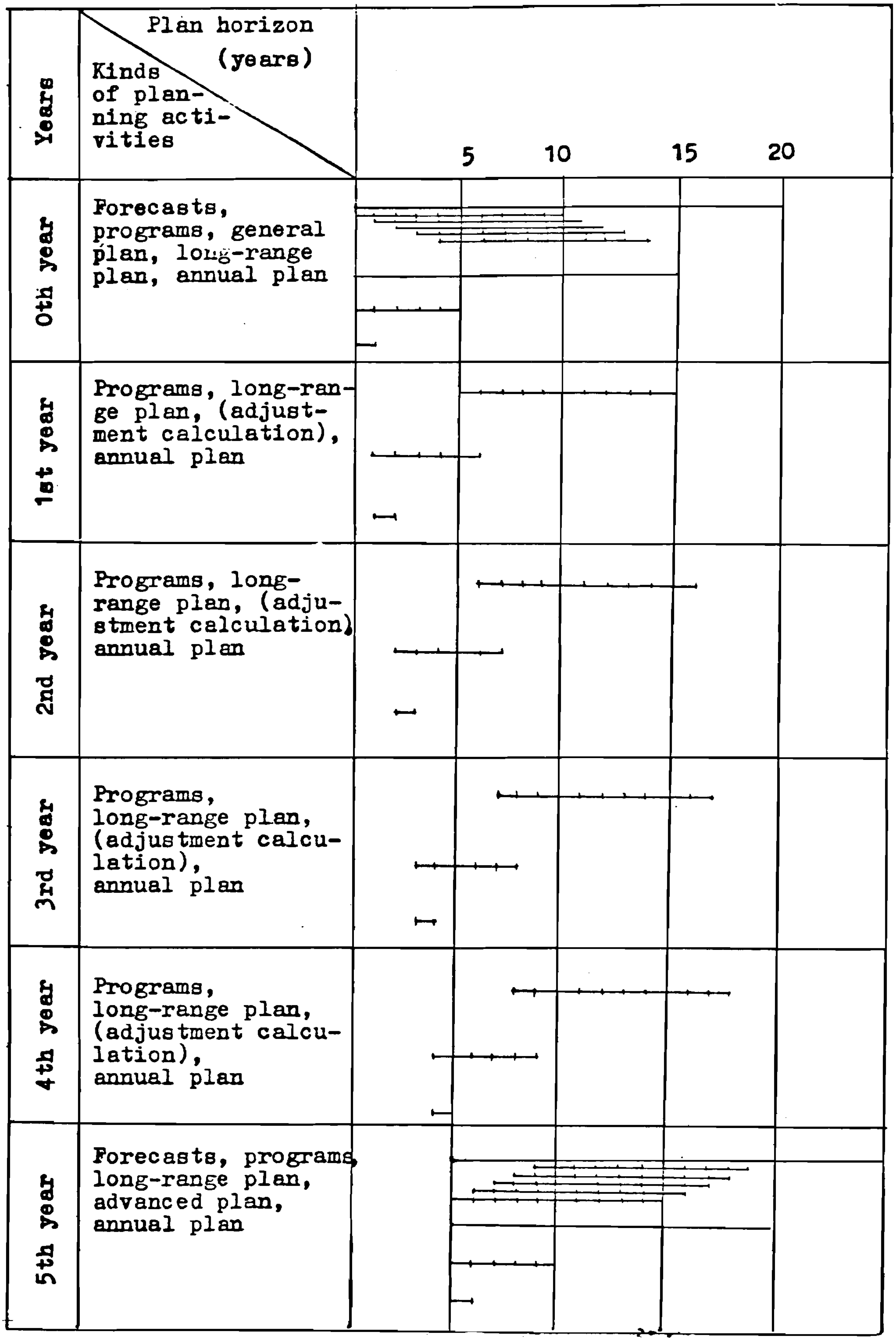

Figure 5. Scheme for rolling plans.

4.2. Research and Evaluation Criteria

The regional aspect of research includes the last two factors, which are directly linked to the evaluation of the implications of an energy project. Research methodology emphasizes the analysis and evaluation of basic technical and economic indicators such as capital and labor requirements, use of resources, transportability of final products, etc. At the aggregate research level, extensive use is made of statistical analyses, such as factor analysis. Less frequently, inter- and intraregional relations are evaluated separately.

The system of economic indicators used to evaluate the deployment of energy projects was developed in the 1960s, based on standard procedures for assessing the efficiency of investments. A national economic approach is taken, i.e., one that takes account of the impact of decisions on a given sector or region, as well as on the economy as a whole. Thus there is a mandatory evaluation of the impacts of a project on contiguous sectors and regions, and on consumers. The techniques seek the most effective investment alternatives, with due regard to socioeconomic factors. Projects are also evaluated with respect to prospective technological changes, the availability of various raw materials, geographical patterns of producing and consuming regions, and changes in prices and efficiencies.

In planning and design, general (or absolute) economic efficiency is defined as the ratio between benefits (effects) and investment costs, and comparative efficiency as the ratio of current cost savings to differences in investments required for each option. The following factors are also taken into account: The interrelated costs of construction, energy, and raw materials; compensation for construction-induced losses (e.g., due to flooding); environmental protection; settlement construction; displacement of workers and their families; training of personnel; construction of transport systems, and current costs associated with the delivery of raw materials and the transport of final products to users. The total cost is calculated on the basis of existing sectoral rates of specific capital investments and current assets; where no such rates are available, other aggregate indicators are used.

A number of other important aspects are also examined during the planning and design stage:

- o the time lag between capital investment and the resulting effect;
- o the commensurability of the resources required and the effect;
- o the distribution of costs between bodies participating in the investment program according to the results obtained;
- o any other sectoral or regional peculiarities of the project (e.g., territorial, energy, etc.).

During the validation process, full use is made of econometric techniques, which make it possible subsequently to improve (by minimizing total discounted costs) the initial models of consumer dependence on particular suppliers (using interregional, interindustry, and sectoral models). Validation techniques employ a national economic approach, one of the more significant features of which is to improve the state examination of energy projects. The existing technical and economic examination is an effective form of design verification, relying on close cooperation with an interdisciplinary commission of scientists and planners (an expert subgroup of Gosplan), which has its own operating staff. On the basis of such examinations, the commission makes recommendations to ministries and other organizations. In order to ensure the national economic evaluation of each project, the commission keeps in close touch with Gosplan departments, ministries and other organizations, and the President of the USSR Academy of Sciences.

To carry out an examination, the commission sets up an interdisciplinary group of experts from research, educational, planning, and design organizations, ministries, and industrial enterprises. The group considers and reviews each project and decides on its efficiency. If necessary, members visit the site of future projects. The task of the commission is essentially to evaluate each project, paying careful attention to its composition, as well as methods of data collection, analysis, and evaluation, and by using national economic criteria and models of effective design-option choice.

Such state examinations of large-scale projects could be improved, however, by introducing sectoral/regional resource development and deployment schemes, as well as some adjustments; and by improving the examination methodology, i.e., the system of design evaluation models, techniques, and procedures. The latter are already being improved through the increased participation of project decision makers and scientists (power engineers, economists, sociologists, ecologists, systems analysts, etc.) in the building of and experimentation with models. On the other hand, the participation of representatives of Gosplan, ministries, and other organizations in model building requires some simplification of computer language and improvements in the aggregation and presentation of data in forms that are more useful for decision makers. It is equally important that it should be possible for models to be corrected or option analysis extended.

Apart from the improvement of the general systems methodology of energy project validation, in the 1970-80s strong emphasis has been placed on specific and comprehensive consideration of some other aspects, primarily social and environmental factors because they had been neglected in the past. The consideration of social factors in the course of energy project development and implementation is required in order to ensure the adequate provision of housing, cultural, community, recreational, and other facilities. Many of the social problems that arise are caused by the inadequate provision of social infrastructure. To a great extent, some of these inadequacies are due to the difficulties in accounting for specific conditions in the regions in which projects are sited. They also prompt differentiation of the system of standards, which are now being consistently updated through regional management.

Another way of solving social problems is to integrate more closely sectoral (primarily industrial) and regional (social) planning. In real life this combination manifests itself primarily in the cooperation of industry in providing resources for the development of social infrastructure. The share of combined resources in newly developed regions often amounts to

30-50% of the total social expenditure. In the late 1970s and early 1980s the government issued a number of directives aiming to resolve social problems by extending the powers of regional and local authorities in organizing and controlling social plan targets. The social factor is generally taken into account through the system of standards and resources required for implementation.

The environmental impacts of energy developments require careful assessment, but there are substantial difficulties in measuring the economics of nature conservation measures (e.g., through damage to the environment and human health), although a methodology has recently been developed. The evaluation of conservation measures to mitigate the impacts of energy projects is achieved through the distribution of expenditures of various sectors of industry and other groups. The refinement of such assessment methods has resulted in the improved development and commissioning of less wasteful production systems, including recycled water supply systems, the use of power station discharges for district heating, etc.

The major areas of environmental protection are as follows:[3)]

- environmental conservation at the base level (reduction or elimination of polluting discharges);
- environmental restoration (improvement of water and air quality, soil, and forests);
- environmental protection against negative effects of harmful wastes (through the creation of protected zones around energy project sites, construction of heat dissipation pipes, etc.);
- minimization of harmful waste products (e.g., by reducing the amount of sulphur in boiler fuel).

Regional management practice indicates that the most effective environmental protection measure is to manufacture pollutant-free products (e.g., fuel for power stations), but at present the main problem of project development is to minimize the costs of meeting

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3) See On Further Improving Economic Mechanisms and the Planning System. Decision of the CC of the CPSU and Council of Ministers of the USSR, 12 July 1979 (Moscow: Politizdat); Forecasting Socioeconomic Development of a Region: Questions of Theory and Methods, 1981 (Moscow: Nauka); Regional Socioeconomic Research in CMEA Countries, 1979 (Moscow: Mysl).

environmental quality standards. The most complicated environmental evaluation issues are: (1) setting the priority of measures in order to increase their effectiveness; and (2) ranking measures according to their effects. The solution of these problems has been facilitated by the introduction of discharge standards (along with harmful pollutant concentration standards).

5. ORGANIZATIONAL, ECONOMIC, LEGAL, AND INFORMATION ASPECTS

The system of management of large-scale energy projects reflects the multilevel and multifaceted planning system described above. Decisions on R & D, investment, and construction activities, in line with the sequence of planning and management processes, are made by the government (through directives), central agencies such as Gosplan, GKNT, and Gosstroi (programs, master schemes, plans, designs), branch ministries (sectoral schemes, plans, designs), and territorial authorities (territorial schemes, plans, designs).

Despite the predominantly sectoral nature of management, the powers of the Union republics and local bodies have been extended in recent years. For example, the Union republic Gosplans and local planning committees formulate short- and long-term plans for socioeconomic aspects of large-scale projects; these are concerned primarily with social and enviromental problems and infrastructure development, which add considerably to the activities of the power engineering and construction ministries. The complexity of combined sectoral/territorial management is manifested in the significant problem of managing interdepartmental interactions during project development. The effective solution of this problem implies coordinating the activities of hundreds of enterprises and organizations from different ministries; the extent of their cooperation in the investment process can have a considerable effect on the timing, quality, and efficiency of an entire project. Accordingly, the setting up of a large-scale energy complex presupposes the introduction of new management techniques through the program-oriented approach, including matrix structures and improved coordination and cooperation.

The cooperation of the organizations involved in a project enables them to pool their resources to create centralized production and infrastructure, scientific/technological complexes and training centers, as well as the rational allocation of resources. Under a centralized planning system, the cooperative management of a project can have two levels: an upper level represented by an interdepartmental council (at ministerial level); and a lower level represented by the board of directors of the enterprise or some other management body. The board sets up special groups for the operational management of the venture, including a shared computer center. The extensive participation of Gosplan, GKNT, Gosstroi, territorial planning committees, and operational management bodies in the activities of the interdepartmental councils and boards of directors, provides the organizational basis for the formulation and implementation of comprehensive decisions.

The planned management of energy projects generally involves the application of the entire system of economic instruments and incentives--self-accounting, prices, rates, profit, credit, etc. Greater emphasis is now being placed on the economic evaluation of natural resources and the introduction of the reimbursement principle of land use (rents), which enables the area of land allocated for construction to be reduced, to ensure a more efficient use of energy resources, and to reduce environmental impacts. Equally important are the economic measures used to control interregional migration encouraged by the project. Economic incentives for more extensive cooperation within the complex are now becoming more widely used. A number of specific economic instruments are available to encourage rational management: compensation by the energy ministry for losses of agricultural land (these costs, of course, are part of a project's budget); differential wage rates depending on regional conditions; a greater degree of sharing of the costs of shared infrastructure facilities; the search for new sources of credit, etc.[4)]

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4) See On Further Improving Economic Mechanism and the Planning System. Decision of the CC of CPSU and Council of Ministers of the USSR, 12 July 1979 (Moscow: Politizdat); Forecasting Socio-economic Development of a Region: Questions of Theory and Methods, 1981 (Moscow: Nauka); Regional Socioeconomic Research in CMEA Countries, 1979 (Moscow: Mysl); Economic Problems of Siberian Development, 1974 (Novosibirsk: Nauka).

Other useful economic instruments that aim to rationalise large-scale projects include (i) the rent evaluation of land, water, forest, and mineral resources (on the basis of public registers), and (ii) credit and financial mechanisms, and more extensive use of incentives for cooperation within projects.

The implementation of energy projects is subject to civil law and economic regulations: general and annual capital construction contracts, supply agreements, and agreements on creative cooperation between research and production organizations. The cooperative management of energy complexes has been extended through new regulations and interterritorial cooperation; through special collective agreements, project participants take part in a number of joint activities. Collective agreements regulate all such activites, including the pooling of resources for common facilities and the establishment of participative management structures.

Large-scale energy project management also requires information support on an interdepartmental basis. Various types of integrated information systems are in use at present. The simplest method of information exchange and interaction involves preserving the autonomous information systems available to each participating group, thus creating a database for management (or board of directors), and arranging direct data exchange between computers. A somewhat more complex alternative is to create an information system on the basis of a shared-access computer center, and to concentrate in this central system all data on the energy project as a whole and the activities of all participating groups, although it is still advisable for each user to solve his own problems separately, whenever possible.

APPENDIX I

Figure A.1 describes a procedure for improving the coordination of sectoral/regional planning. The components of Figure A.1 are:

0 analysis of preplan materials and evaluation of the level of socioeconomic development of the area, estimates of the regional resource potential;

1 population and demographic structure forecasts

2 monetary income and expenditure indicators;

3 real income indicators

4 & 4') indicators of intermediate and final demand;

5 communal service development indicators;

6 validation and computation of resource constraints;

7 development indicators of regional branches of industry and TPCs;

8 & 9) consumption and accumulation fund indicators;

10 program-oriented plan formulation;

10' TPC plan formulation;

11 formulation of socioeconomic development plan targets with respect to the area;

12 economic effectiveness indicators and criteria;

13 evaluation and choice of alternative indicators of socioeconomic development;

13' consideration and coordination of alternatives suggested by ministries, agencies, and local planning bodies;

14 adjustment of plan targets in response to suggestions of ministries, agencies, and local bodies;

15 statistical and normative base, algorithms of aggregation, and disaggregation of plan targets;

16 formulation of sectoral, departmental, regional, and program sections of the plan;

17 & 17') suggestions of ministries and agencies, and regional planning bodies;

17.1, 17.2, ..., 17n) enterprises (amalgamations);

I preplan materials (comprehensive scientific and technological development program; general scheme for development and allocation of productive forces; regional layout of TPCs and industrial nodes; general schemes of urban development, etc.)

II socioeconomic plan objectives.

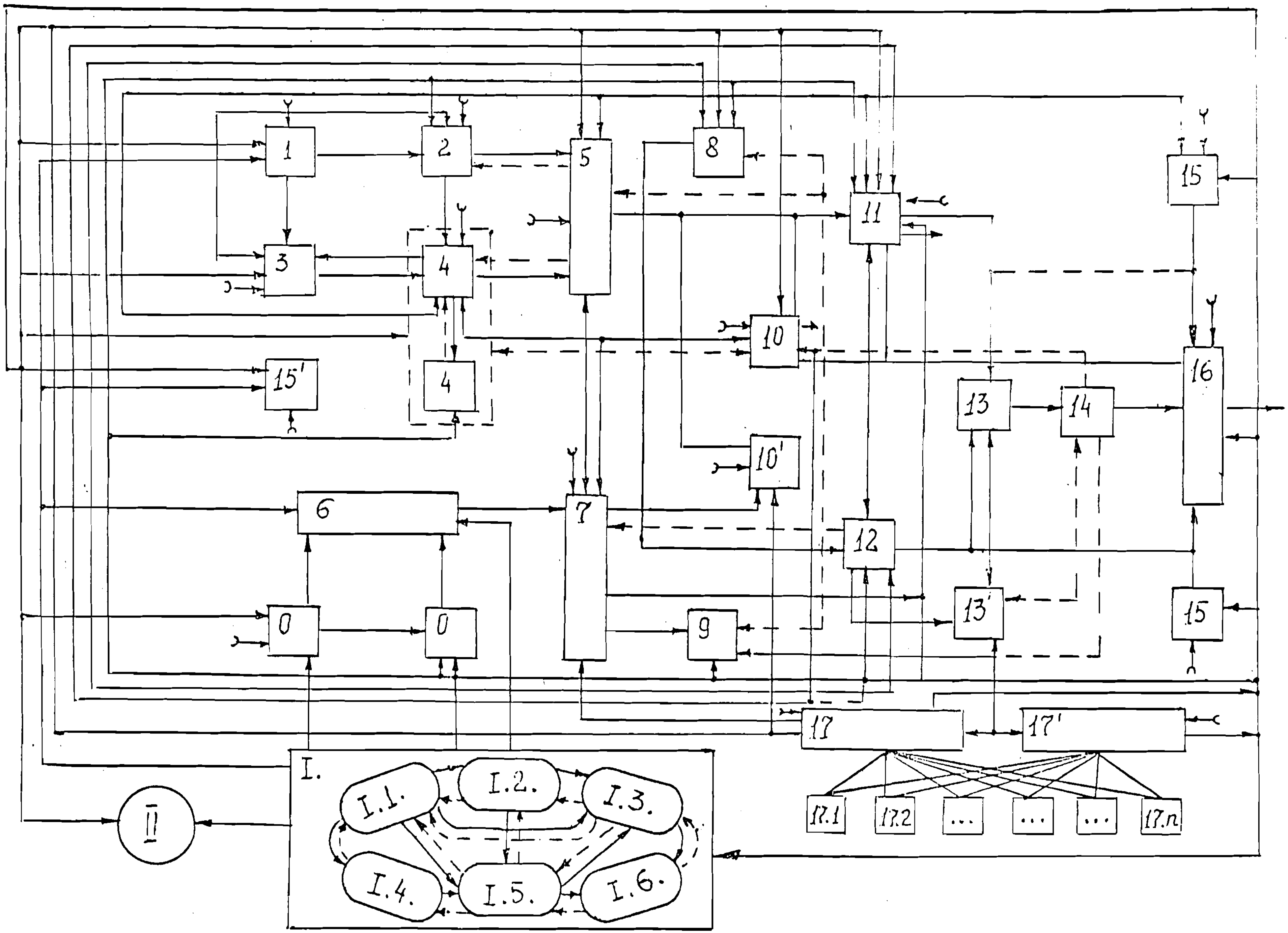

Fig. A.1 Structural and functional block-diagram of territorial plan formulation

APPENDIX II

This appendix describes an alternative way of improving plan coordination. The components of Figure A.2 are as follows:

A long-term plan formulation;
B advanced (medium-term) plan formulation;
C formulation of current (short-term) plans; planning stage: (a) task-oriented; (b) preliminary; (c) final.

I top management bodies;
II central planning bodies;
III Union sectoral, intersectoral, and functional ministries and agencies, top planning bodies of republics;
IV enterprises, business amalgamations and complexes.

1 general national goals;
2 long-term plan objectives;
3 long-term forecasts of business complex development;
4 partial (sectoral, functional, and republic) forecasts;
5 comprehensive forecasts;
6 integrated forecasts;
7 draft long-term plan concept;
8 long-term plan concept;
9 draft programs of business complex development;
10 sectoral, functional, regional draft programs;
11 general task-oriented and resource draft programs;
12 draft directions of long-term plan;
13 directions of long-term plan;
14 general task-oriented and resource programs;
15 sectoral and regional subprograms of general programs;
16 programs of business complex development;
17 draft long-term plan broken down by five-year periods, and
18 main directions of the next five-year plan broken down by years;
19 long-term plan, and
20 main directions of five-year plan;
21 main directions of sectoral and regional five-year plans;
22 draft five-year plans of business amalgamations;
23 sectoral and regional draft five-year plans;
24 draft five-year plan including plans of task-oriented and resource programs of complexes;
25 five-year plan;
26 supervision of implementation and adjustment of general programs;
27 supervision and adjustment of other general programs;
28 current (annual) plans of business amalgamations;
29 annual plans of sectoral and regional development;
30 plan of interindustry and interregional supply;
31 financial and credit plans;
32 adjustment of five-year plan targets (formulation of annual plan);
33 draft state budget;
34 state budget.

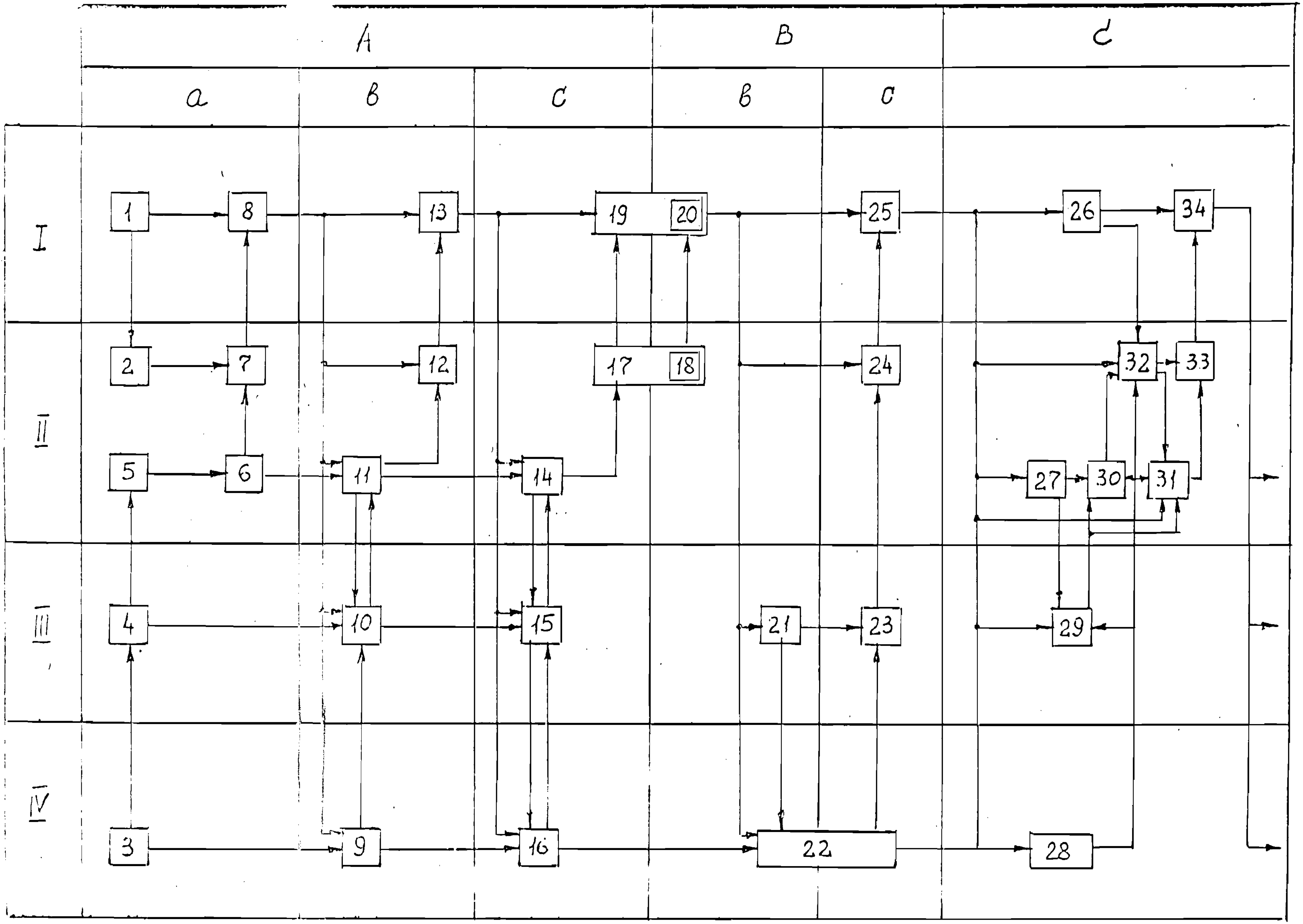

Fig. A.2 Diagram of comprehensive national economic planning

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