Professor MANEA MĂNESCU
Member of the Romanian Academy

The Goods Production and Services System

The goods production and services system consists of the national economy system components that execute productive activities, i.e. all the units that belong to industry, agriculture, buildings, transportation, circulation of goods and to other branches of production. In this way, the goods production and services system is built up as a *unitary whole*, the *structure*, *behaviour* and *functionality* of which are formed by the tasks it receives within the economic growth process.

1. THE SYSTEM TOPOLOGY AND CONNECTIONS

The goods production and services system gathers the main flows of raw materials, materials, labour force, technologies, fixed assets etc... from all systems in the national economy space; these components are the *system inputs*. Meanwhile, it generates goods and services flows that are aimed, as the *system outputs*, at all the national economy system components, as well as at the world economy space.

From the point of view of economic cybernetics, the goods production and services system can be looked at as a macro-process, wherein the input flows are processed into the social product macroflow. This system is mainly fed by two "power pools" of the general cybernetic system, namely by labour force flows coming from the national wealth system, viz. raw materials, materials, fixed assets etc. (Fig. 1).

The flows coming from the research and development system, as well as those coming from the international economic relations system, also converge towards the goods production and services system (Fig. 2).

The most efficient operation of this system is the decisive element that causes the development speed and rhythm of the whole general cybernetic system on the progress trajectory. This is caused by the commands coming from the management system, as well as by the many interactions with the labour productivity and the efficiency-profitability systems.

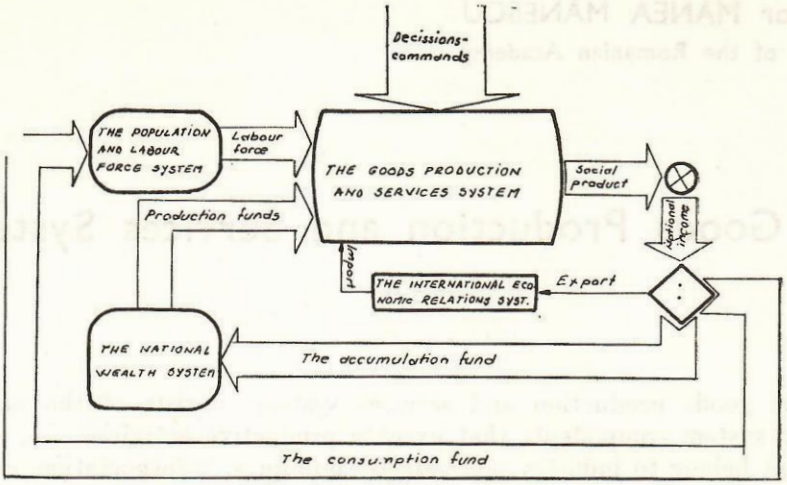

Fig. 1

As regards the developing countries, the reduction of the distance between the evolution trajectories of the general cybernetic system of their national economy and those of the developed countries depends upon the working mode of the goods production and services system.

In the framework of a modern economy, the topology of the goods production and services system is of a high complexity, being so structured as to fulfil in an optimal manner the tasks it has in order to ensure the proper operation of the whole economic body, i.e. the minimisation of the economic time within each of its cells. After a rapid analysis, the following large entities of the goods production and services system that are its main subsystems are identified (Fig. 3) as follows: industry, agriculture, buildings, transportation, goods circulation, "other branches of goods production".

In the general cybernetic system of the national economy, the industry and agriculture subsystems play an outstanding part in the optimal balanced and proportional economic growth process and in the increase of the nation's wealth and welfare, generating the direction of development and the dynamics of all the other systems that evolve in the national economy space.

2. THE INDUSTRY SUBSYSTEM

In the framework of the industry subsystem the main new materials flows generated by this subsystem, as well as by the agriculture subsystem and those coming from the world economy space are concentrated. The inputs coming from the national wealth, i.e. the fixed assets, the raw materials etc... are the decisive factors ensuring dynamic growth, both of the industry subsystem and of the goods production and services system as a whole (Fig. 4).

Very strong direct and feedback connections exist between the industry subsystem and the labour productivity and efficiency-profitability systems. The rise of the quality level of the activities within the industry subsystem,

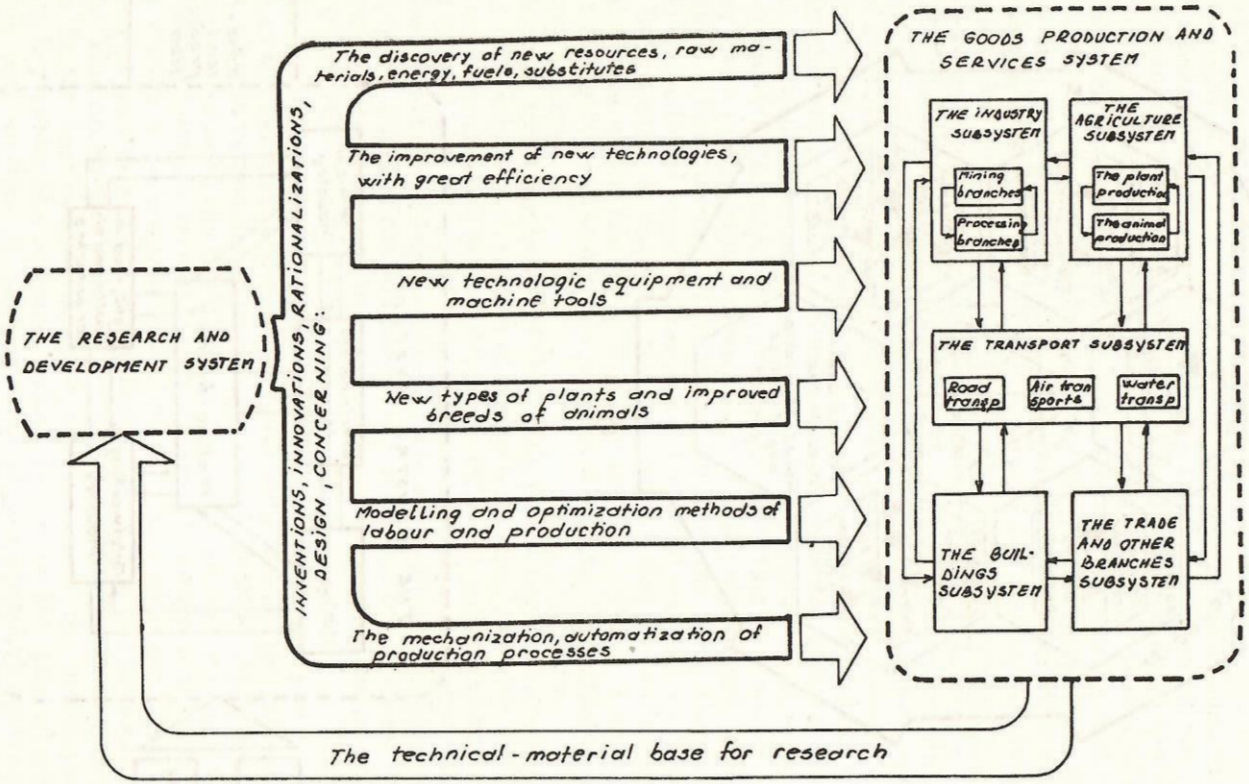
THE RESEARCH AND DEVELOPMENT SYSTEM
INVENTIONS, INNOVATIONS, RATIONALIZATIONS, DESIGN, CONCERNING:
The discovery of new resources, raw materials, energy, fuels, substitutes
The improvement of new technologies, with great efficiency
New technologic equipment and machine tools
New types of plants and improved breeds of animals
Modelling and optimization methods of labour and production
The mechanization, automatization of production processes
THE GOODS PRODUCTION AND SERVICES SYSTEM
THE INDUSTRY SUBSYSTEM
Mining branches
Processing branches
THE AGRICULTURE SUBSYSTEM
The plant production
The animal production
THE TRANSPORT SUBSYSTEM
Road transp.
Air transports
Water transp.
THE BUILDINGS SUBSYSTEM
THE TRADE AND OTHER BRANCHES SUBSYSTEM
The technical-material base for research

Fig. 2

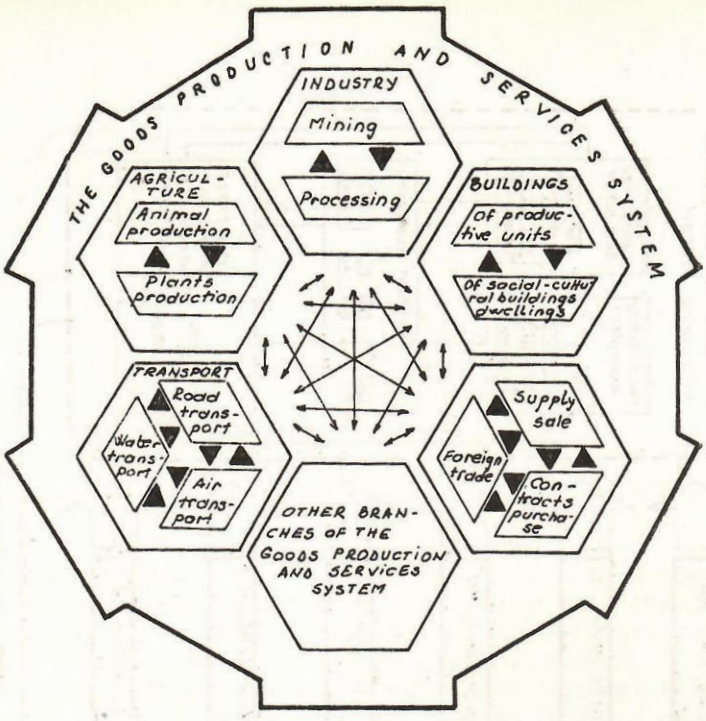
THE GOODS PRODUCTION AND SERVICES SYSTEM
INDUSTRY
Mining
Processing
AGRICUL-TURE
Animal production
Plants production
BUILDINGS
Of productive units
Of social-cultural buildings dwellings
TRANSPORT
Road transport
Water transport
Air transport
Supply sale
Foreign trade
Contracts purchase
OTHER BRANCHES OF THE GOODS PRODUCTION AND SERVICES SYSTEM

Fig. 3

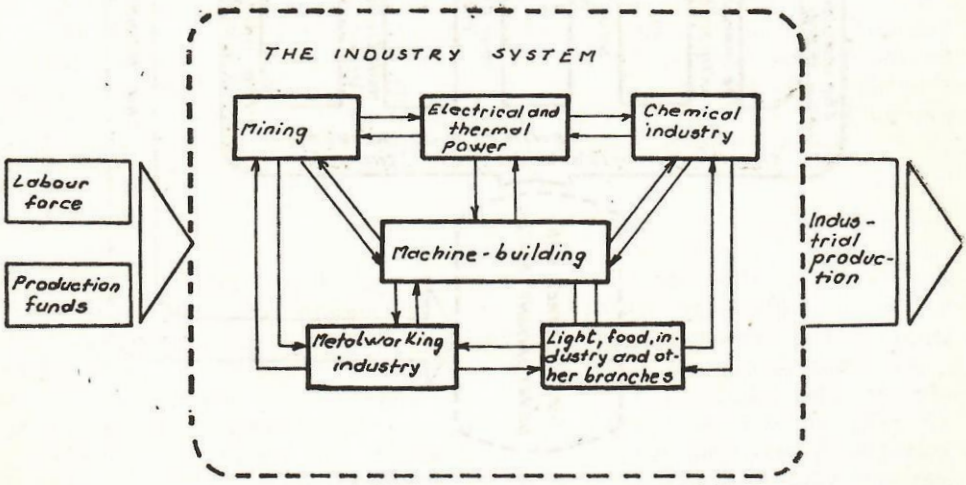
THE INDUSTRY SYSTEM
Mining
Electrical and thermal power
Chemical industry
Machine-building
Metalworking industry
Light, food, industry and other branches
Labour force
Production funds
Industrial production

Fig. 4

the reduction of the raw materials, fuel and power consumption, the increase of the fixed assets efficiency and the permanent improvement of labour and production organisation — are decisive factors for the continuous increase of labour productivity and of economic efficiency.

By means of the changes it induces in its socio-professional structure, industry strongly influences the *population* and *labour force system.* Indeed, the development of the industry subsystem causes the appearance of new crafts and professions and of new types of activities; thus structural changes are induced in the topology of the population and labour force system.

Between the industry subsystem and the *national wealth system* there are also many direct and feedback connections. Industrial development contributes in a decisive way to the increase of the standard of living, both by means of the diversification of the goods flows it generates and by the influence it has upon the development of the towns and the creation of new urban centres. Industrial development also creates new possibilities for a better supply of equipment for socio-cultural institutions (public education, national health etc.). By means of the population and labour force system, this positively influences the whole goods production system, industry included.

Another main feedback connection is between the industry subsystem and the *international economic relations system.* Because it provides export goods, industry is the main generator of the flows that go from the national economy space to the world economy space. On the other hand, their magnitude causes a large increase of flows coming from the world economy space towards the national economy space, i.e. import flows that are mostly absorbed by industry. At the same time, industrial development modifies the flows structure within the world economy space by means of an increasing amount of highly-processed goods for export and by the reduction of compensatory imports.

Each of the components of the goods production and services system consists of a *hierarchical network of subsystems.* Thus, industry is formed of many subsystems, such as coal mining, extraction and processing of crude oil and natural gas, mining of iron and non-ferrous ores, electrical and thermal power, metal-working, machine-building, chemical, building material, timber, pulp, paper, light industry, food industry, etc... These consist of industrial corporations, sections, workshops and places of work, all of them being cybernetic-economic systems.

The mining industry, that produces raw materials and power resources, as well as the electrical and thermal power industry, i.e. the national energy system, play an outstanding part in the national economy. At present, energy is a decisive factor in the whole economic growth process, a basic component of the techno-scientific revolution. The continued development of the national energy system is an essential condition for the achievement of high rates of economic growth and for the technical progress in the national economy system. This necessarily follows from the fact that energy has deep implications in the development of other components of the goods production system; it provides the necessary motive power for the production process of goods and services, it takes part in physico-chemical conversions (for instance, electrolysis, catalytic cracking), it supplies the cold and heat that condition many technological processes etc... Energy also takes a direct

part in the development of data-processing in the national economy space, i.e. measurement and control and in operating telecommunication, remote control and teleprocessing circuits.

The need for a permanent energy supply for all systems and subsystems evolving in the national economy space is a basic feature of the national energy system. Any interruption in the energy supply may have very serious effects upon the operation of many components of the general cybernetic system of the national economy. The national energy system has to develop on the basis of new sources, according to the permanent growth in size and complexity of the national economy system, in order to satisfy power consumption of a modern economy. It consists of an integrated ensemble of components that ensures the production, transport and distribution of electrical and thermal power. The high integration level is a specific feature of the national energy system; in fact, all the electrical power transmission lines and stations are coupled and affect one another. The advantages of a high level of integration lead to a reasonable utilisation, as well as to a uniform distribution of all the energy throughout the whole national economy system.

Between the national energy system and that of research and development many and complex connections are formed. The energy system provides research with the necessary energy for the research processes, receiving in turn technical solutions for its optimal development and for its optimal rates of work at the system level, as well as at the process and equipment level. At the same time, the research and development system clarifies the phenomena induced by energy production, identifies the ways and methods that ensure a safe supply to the consumers, reduces power consumption, increases environmental protection and provides solutions for prospecting for new resources and energy technologies.

The energy system also benefits, in an indirect way by means of the other branches, from science and technology, viz. mining, machine-building industry, chemical transportation and other industries; technical progress of these leads to new resources and goods, and materials and services of high technical-economic performance.

Between the national energy system and that of national wealth there are many connections. On one side, the national wealth system, by means of its components (human resources, natural resources, e.g. bituminous coal, lignite, shales, oil, natural gas, water sources, nuclear fuels), as well as by means of its fixed assets, ensure the proper operation of the energy system. In turn, the energy system directly contributes to the creation of goods that increase national wealth are problems of outstanding importance. This is very cogent, because superior fuels with high specific calorific power, especially hydrocarbons, are also basic raw materials for the chemical industry, which enables their economic and efficient use.

The fact is that the control performed by the management system upon the connections between the national energy system and that of national wealth for efficient use of energy resources and for the reduction of fuel and power consumption, has a direct influence upon the majority of the systems evolving in the national economy space. This causes an improvement and utilisation of new types of processes and installations, often based upon new

principles that enable maximum energy saving in all the other cells of the economic body.

Between the national energy system and the world economy space there are also direct and feedback connections by means of the international economic relations system. These mainly consist of the import and export of primary power resources (oil, coal, etc.). Many connections also exist between the national energy system and that of the national welfare. The former directly contributes to the increase of the nation's welfare by means of increased home comforts determined by the electrical and thermal power it provides. At present, energy is a basic component of the degree of a people's civilisation because it directly contributes to the operation of many home implements.

The *machine-building industry* plays an important part within the industry subsystem architecture. There is a *cybernetic isomorphism* between this component and the whole goods production and services system. In practice, for any subsystem of the goods production and for any industrial branch, it is the machine-building branch that produces the necessary equipment, machines and installations. The important part of the machine-building branch in the development of the whole goods production and services system and, eventually, in the growth process of the whole general cybernetic system of the national economy, is revealed by this isomorphic relationship. To any important technological process in a cell of the economic body there corresponds, by means of the isomorphic relationship, a development of the corresponding element in the frame of the machine-building industry.

The use of a higher degree of mechanisation, automation and cybernetics in production leads to an increasing importance of the machine-building branch in the industry subsystem structure. One has to stress that the dynamics of the goods production and services system and finally, that of the whole general cybernetic system of the national economy, depends upon the weight some branches have within the machine-building industry: electronics, electrical engineering, precision mechanics, optics etc. . ., that generate around them a *gravitational* area which attracts the other branches too.

Cybernetic analysis of the two basic components of industry, namely the national energy system and machine-building industry, can be similarly carried out for the other components, i.e. chemical, building materials, light, food, and other industries. Thus, the great complexity of the structure and functions of the industrial components in the whole economic growth process is made evident; likewise the part played by the various direct and feedback connections that exist between them, with the aim to ensure an upward, proportional and balanced evolution of the general cybernetic system of the whole national economy.

3. THE AGRICULTURAL SUBSYSTEM

The agricultural subsystem is the second main component of the goods production and services system.

The location of the general cybernetic system of the national economy on the progress path leads to the building of a powerful, modern and intensive agriculture. The achievement of this aim greatly depends upon the connec-

tions between agriculture and industry, between these and the population and labour force system and the research and development system, as well as on the investment flows coming from the social product and national income system.

The agriculture subsystem with its two basic components, *plants and animal production*, provides food flows for the increase of the people's material standard of living-a basic component of the national welfare system-as well as flows of goods towards the world economy space. Thus, the connections are emphasized between the agriculture subsystem and the other systems evolving in the national economy space.

Between the industry and the agriculture subsystems there are direct and feedback connections (Fig. 5). In effect agriculture receives from industry,

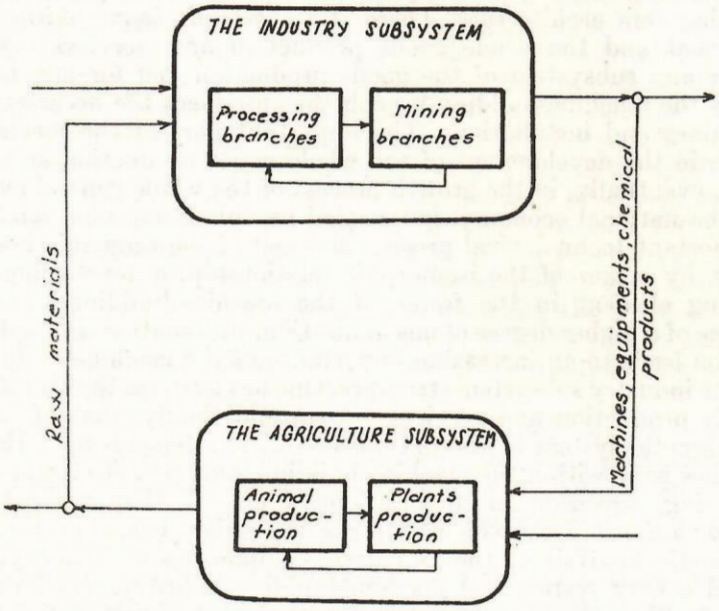

Fig. 5

especially from the machine-building and continuous development as necessary.

On the other hand, agriculture provides industry with the raw material flows for many of its subbranches. The development of the agriculture subsystem greatly depends upon the achievement of an adequate structure between its two subsystems, namely plants and animal production that are joined by many connections. Thus, intensive agriculture induces a more rapid development of animal farming which, in turn, requires the development of plant production in order to feed the former.

4. THE BUILDINGS SUBSYSTEM

The building subsystem has an important part in the complex process of the construction of a modern economy and in its development. Between

this subsystem and all other systems evolving in the national economy space, there are strong connections that enter into isomorphic relationships. The development of any activity in industry, agriculture, transportation, and trade subsystems, in the research and development system, in the training field of education, in the national health etc. entails building development. The buildings subsystem plays an important part in the national wealth growth, because it accelerates the materialisation process of the investment flows; it settles a reasonable proportion between the fixed assets involved in machines and equipment and those belonging to buildings and special projects.

An outstanding part in the most efficient operation with maximal efficiency of the buildings subsystem belongs to the connections with the industry subsystem. By means of prefabricated parts produced by industry, highly integrated and equipped, light, resistant and well finished buildings are produced.

5. THE TRANSPORTATION SUBSYSTEM

The transportation subsystem plays an important part in ensuring good circulation of the flows between the components of the goods production and services system, between all systems in the national economy space, as well as between this and the world economy space. This subsystem, by means of its components (rail and road water and air) is, in fact, the highway by which the material flows move within the economic body.

There are strong and many connections between this subsystem and the other components of the goods production and services system. The development and diversification of industry and the intense and multilateral development of agriculture induce modernisation and growth of the means of transportation, the "vascular system" of the economic body. This is achieved by the building of roads, highways, ports, modernising of the railroad system, use of containers etc. . .; these, in turn, induce a development of some industrial sectors, viz. shipbuilding and the building of the stock for railroads. Thus, the strong feedback connection between industry and transportation is evident. In addition, there also strong connections between the transportation subsystem and other components of the general cybernetic system of the national economy. Thus, the transportation subsystem exerts much influence upon the nation's welfare system, upon the structures formed in the population subsystem, upon the labour productivity growth, upon the participation mode in the world circuit etc.

The transportation subsystem has many tasks in the *optimisation of the economic time* and in the reduction of the necessary time for the operation of the production-sale relation. The inputs into the transportation subsystem consist of the flows of raw materials, fuels, finished products etc. . . An important type of inputs comes into the analysed subsystem from the data-processing system and deals with information concerning the needs for transporting all components of the general cybernetic system of the national economy. The outputs from this subsystem consist of goods carried throughout the economic space.

6. THE GOODS CIRCULATION SUBSYSTEM

This subsystem has the task of providing the connections between production and consumption (the sale-buy relation) within the mechanisms that evolve in the national economy space. This subsystem performs the activities of supply-sale, those regarding the whole sale and retail trades, the purchase and contracting of agricultural goods etc. By means of the goods circulation subsystem, processes are reflected that take place during the settlement of the connections between the goods production and services and their sale in the frame-work of various systems and subsystems in the national economy space.

By taking into account the specific functions of the goods circulation subsystem in the framework of the economic mechanism, it can be divided in the following components: *technical and material supplies; activities of purchase and contracting; trade activity concerning the feeding of the population.*

The operation of the activities in the national economy space requires a regular supply of raw materials, materials, fuels, power etc. in proper quantity and structure, as required by the character of the processes in each cybernetic-economic system or subsystem.

At the same time, the sale of the finished products, the results of the activities developed by the cybernetic-economic systems and subsystems, is a *sinequanon* condition for the resumption of the production process. The technical and material supply has to provide the proper circulation of the flows formed in the national economy space between the cybernetic-economic system that produces raw materials, materials etc. . . and the systems that consume them. In order to achieve in the best manner its tasks, this supply ensures, according to the commands coming from the management system, control and self-control of the flows between the producing and the consumer units so as to avoid overstocking. Thus, the technical and material supply is important for the formation of an optimal size and structure of material stocks in order to accelerate turnover.

Between the goods circulation subsystem, namely its component concerning the technical-material supply, and the industry and agriculture subsystems, there are many direct and feedback connections. Thus, the level of the activities taking place in the frame of industry and agriculture and their degree of diversification determine the structure and size of the technical-material supply. On the other hand, the availability of the necessary raw materials, fuels, power etc. is mainly due to the level of the activities and of the outputs in industry and agriculture.

The operation of the technical-material supply subsystem is strongly influenced by the degree of production specialisation and cooperation and by the structure of goods production and services system in the country. At the same time, this component also ensures a technical-material supply of all research and development units, so that these can achieve their tasks under good conditions. On the other hand, the research and development system directly contributes to the continuous improvement of the supply-sale activity by means of the methods and techniques elaborated in the field of material consumption optimisation, creating new types of materials with

high parameters and of new technological installations that enable a wide-scale utilisation of substitutes, secondary energy recirculation, recycling of wastes etc. . .

In the operation of the coupling flows between agriculture and industry, an important part is played by those units in goods circulation subsystem that have the task to contract and purchase agricultural goods. It can be stated that within the economic role they perform is an activity analogous to that of the technical-material supply in a specific field, viz. agricultural goods, with implications upon all the components of the general cybernetic system of the national economy.

The part of the *trade activity* devoted to the *supplying of goods to the nation* is important for the achievement of a continuous interaction between the goods production and services system and that of the nation's welfare. In this way, one may derive conclusions concerning the activities performed within the goods production system components, thus making the connection between production and consumption.

The inputs into the trade cybernetic-economic subsystem are goods and services flows coming from the components of the system. By means of the economic data-processing system the population and labour force system and the nation's welfare system send many information-type flows to the trade subsystem, concerning the dynamics of social needs, food-stuff and other materials, requests for services in accordance with the social environment, sex and age groups, income groups etc. All these are elements for the realisation of the control and self-control process in the framework of trade, in order to ensure harmony between the people's needs and the goods fund existing in the trade network.

The utilisation within the trade subsystem of the methods, techniques and models produced by economic cybernetics makes possible a more accurate knowledge of the dynamics of the people's needs. This makes possible the adoption of control and self-control decision in order to promptly adjust production to the demands of the population and to the improvement of the structure, quality and viability of goods and services. At the same time, conditions are created for an optimal build up of stocks in the trade network and a rational distribution of the goods over the country.

The analysis of the connections between the goods production and services system and that of the nation's welfare (main systems in the topology of the general cybernetic system of the national economy) renders evident the fact that these connections are mainly established by means of trade; this reveals once more the important part of that component.

The direct and feedback connections between the goods production subsystems, as well as between these and the components of the general cybernetic system of the national economy, are extremly complex and their analysis puts into relief the harmony of the economic body structure.

An outstanding role in the achievement of the optimal, balanced and proportional growth programmes of the general cybernetic system of the national economy is played by the connection between the goods production and services system and the national wealth system. It can be stated that this is one of the most important connections within the national economy space. The development of the goods production and services system directly

influences the increase of the national wealth size and this, in turn, is the decisive condition for the growth of goods production. The development of industry, agriculture and of the other goods production components leads to an efficient use of resources, to the growth of newly-created values and thus to conditions for a national income growth; consequently, there is an increase of the national wealth and of the people's welfare (Fig. 6); on the other hand, industry, agriculture and all other subsystems of the goods production and services system develop on the basis of the growth of national wealth.

7. THE CYBERNETIC-ECONOMIC GROWTH MODEL OF THE GOODS PRODUCTION AND SERVICES SYSTEM

In order to optimise the activities taking place within the goods production and services system and to determine its optimal growth trajectories, many types of cybernetic-economic models are used. They deal with the optimisation of the goods production and services system structure in branches, subbranches, products and groups of products, with the proposed optimal production programmes, transport flows, optimisation of the technical-material supply, of trade activity etc. . . It is worth noting that for the analysis and optimisation of the activities performed within the industry subsystem, a new chapter of cybernetics has been elaborated, i.e. industrial systems cybernetics.

The basis model of the goods production and services system deals with the growth process in branches, subbranches, products and groups of products, this system being connected with almost all other models of the general cybernetic system of the national economy.

The cybernetic analysis of the goods production and services system enables one to form a system of models essential for the realisation of the most efficient decisions for the continuous development and modernising of the production of goods, the motive element of the progress of the whole society.

8. THE INTERNATIONAL ECONOMIC RELATIONS SYSTEM

This system, by its structure and functions, plays a major part within the overall topology of the general cybernetic system of the national economy. It produces a coupling between the space of the national economy and its environment, i.e. the space of the world economy. Under these circumstances, this system has the task of ensuring an optimal propagation of the flows between the space of the national economy and that of the world economy, and a best use of the advantages produced by the international division of labour.

The role of the international economic relations system within the mechanism of optimal operation of the general cybernetic system of the national economy is continuously increasing at present because of the growing increase of the international division of labour and the expansion and the improvement of international cooperation.

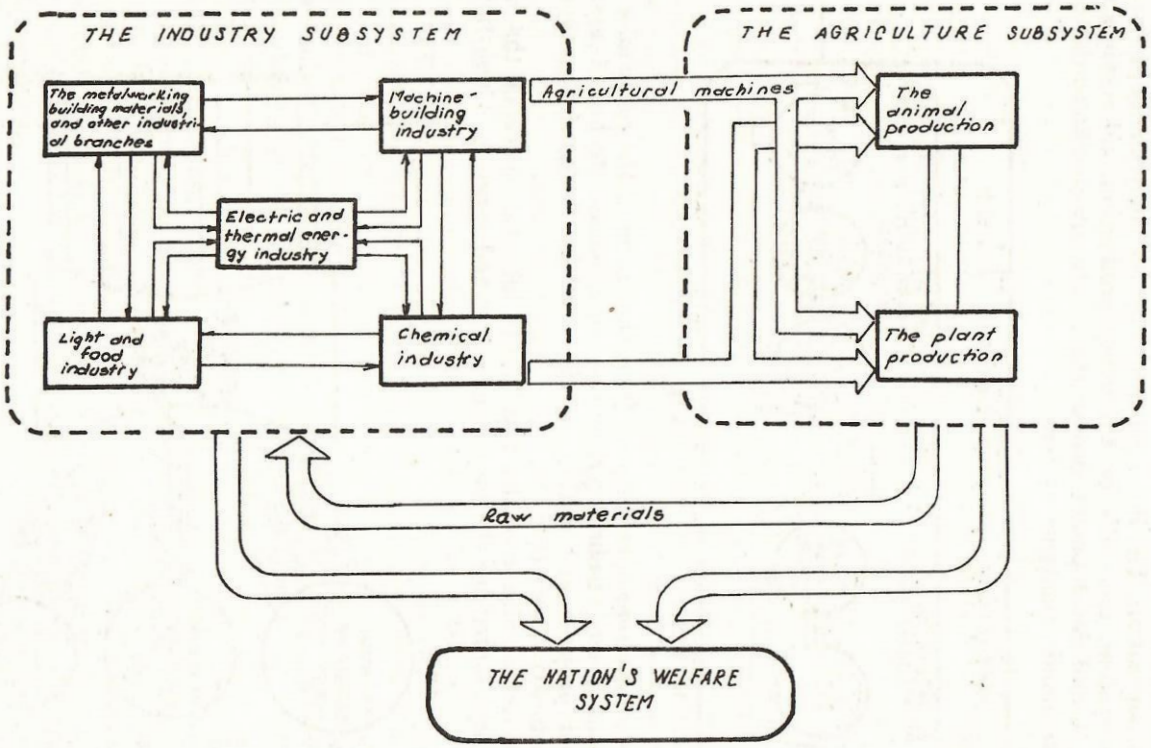
THE INDUSTRY SUBSYSTEM
THE AGRICULTURE SUBSYSTEM
The metalworking building materials, and other industrial branches
Machine-building industry
Agricultural machines
The animal production
Electric and thermal energy industry
Light and food industry
Chemical industry
The plant production
Raw materials
THE NATION'S WELFARE SYSTEM

Fig. 6

9. SYSTEM TOPOLOGY AND CONNECTIONS

The following two subsystems (Fig. 7) of the system under analysis can be used to emphasise the diversity of behaviour of the international economic relations: foreign trade, scientific-tehnological and production economic cooperation. The flows generated by the components of the general cybernetic system, especially by the goods production and services system, the research and development system etc. . . are directed towards the international economic relations system.

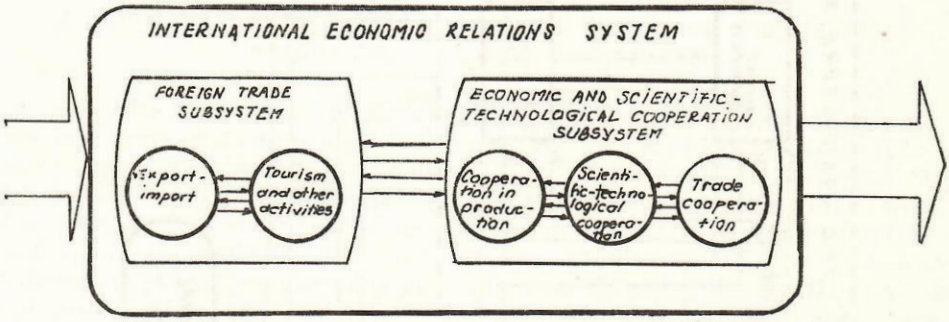

Fig. 7

These flows represent outputs from the space of the national economy consisting of goods, technology, export of licences, technical assistance, studies and projects elaboration, services in the fields of transportation, tourism, education etc. (Fig. 8).

This system also provides the inputs into the space of the national economy represented by the import of goods and services. These flows (im-

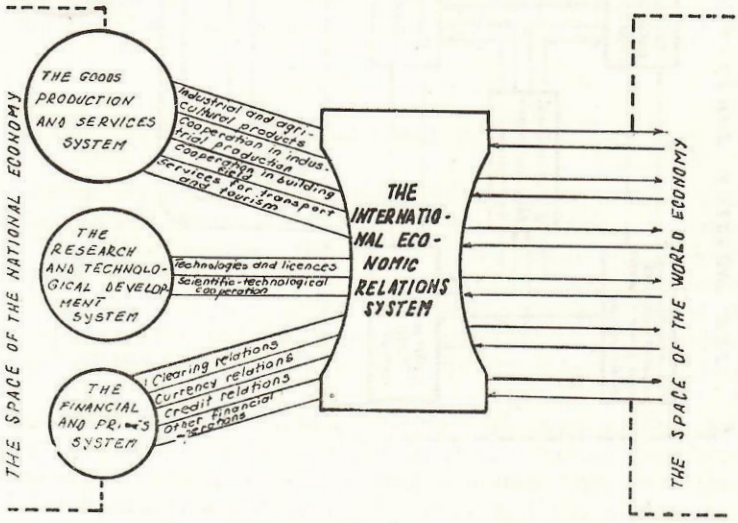

Fig. 8

ported raw materials, technologies, licences) are directed by specific mechanisms towards all systems and subsystems inside the space of the national economy, especially towards the components of the production and services systems. At the same time, the flows of imported machines, equipment and instruments, which contribute to the technical endowment of various sectors and, eventually, induce changes of the structure of the national wealth and which take the form of goods accumulated as fixed funds, are directed towards the national wealth system. Simultaneously, flows of imported consumer goods pass through the international economic relations system in order to complete the resources produced internally and destined for the nation's welfare system.

Exports produce input flows from the components of the space of the national economy for the *foreign trade subsystem* and, at the same time, outputs towards the various systems within the space of the world economy. Imports represents the inputs from the space of the world economy and, at the same time, the outputs towards the systems of the national economy space. Thus, it is characteristic for the foreign trade subsystem that each of its inputs is, at the same time, an output; the flows are thus uni-directional.

The *subsystem of international cooperation* — through which multiple forms of economic cooperation, in the production and scientific-technological fields, including international companies, can take place — plays an increasing part in achieving an optimal coupling between the spaces of the national and the world economies. It must be pointed out that, as opposed to the foreign trade subsystem, the flows in the international cooperation subsystem are bi-directional. The cooperation subsystem reflects the new modern ways of developing foreign economic relations. Within this framework, one can see the particular importance of cooperation in production for the achievement of economic objectives and the specialisation in producing particular goods. These activities ensure a higher stability of the economic relations taking place between the components of the space of the national economy and those of the space of the world economy. There are multiple forward and feedback connections between the international economic relations system and other systems within the space of the national economy. All these are directed, coordinated and controlled by the management system which establishes, within the general strategy concerning optimal balanced and proportional economic growth, the directions of development of foreign economic exchanges (Fig. 9).

A large number of extremely complex connections are formed during the process of economic growth between the international economic relations system on one hand, and the work productivity and efficiency-profitability system on the other. Indeed, one of the main functions within the economic mechanism of the international economic relations system concerns the generation of circumstances favouring the reduction of social work and the achievement, on this basis, of an *optimal economic time* inside the space of the national economy.

The system under analysis, through the more intense participation in the international division of labour based on the precise understanding of the mechanisms in the space of the world economy makes a contribution towards the efficient use of the national potential, of the material and human

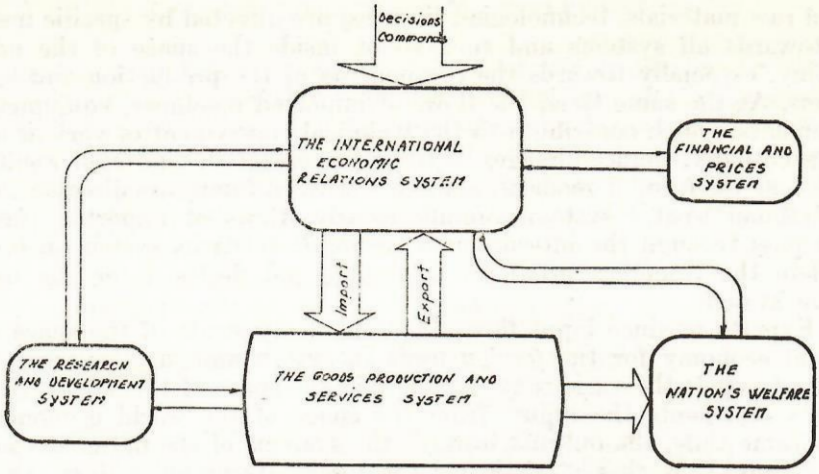

Fig. 9

resources and of the nation's creative capacity. At the same time, the international economic relations system has the task of directing the export flows towards the most favourable zones of the space of the world economy, which also ensures an efficient use of the work done inside the space of the national economy and of the material resources available.

Particularly important tasks are set for the international economic relations system in ensuring a complex process of optimal, balanced and proportional growth of the general cybernetic system of the national economy. The achievement of high rates of economic growth implies a priority assignment concerning the development of the functional branches of the goods and services system (steel industry, machine building, chemical etc. . .). This requires the import of some raw materials which can not be found in sufficient quantity in the space of the national economy and, at the same time, an efficient use of the surplus products realised by these branches.

There is a considerable interaction between the international economic relations system and the social product and national income system, especially through the trade balance, which can exert a certain influence on the size of the national income shared between consumption and accumulation as compared with that created in the country. Strong and multiple connections, forward and feedback, are formed between the national wealth system and that of the international economic relations. The latter ensures, by the direction of the export flows towards the various zones of the world economy and by the way in which cooperation in production and technology is achieved, an efficient use of all the components of the national wealth system, of human resources and of the nation's creative potential, of natural resources, of fixed funds and of other elements of the accumulated goods subsystem. At the same time, through the import flows of raw materials, the international economic relations system ensures a proper preservation of the components of the national wealth system i.e. the subsystem of natural resources.

The positiòn of the international economic relations system in the topology of the general cybernetic system gives it the task of filtering and attenuating disturbances which could form in the space of the world economy, thus contributing to the development of the process of optimal, balanced and proportional growth.

This system through its processes and by its functions within the economic mechanism establishes the character of complex system of the general cybernetic system of the national economy and the existence of multiple interactions between the space of the national economy and that of the world economy. Within this framework set by the need for a new economic order in the space of the world economy the role of the international economic relations system is increasing even more; it has multiple tasks in identifying the optimal ways of participation of each country in the world economic circuit.

10. ECONOMIC-MATHEMATICAL MODELS

In order to fulfil the task designated to it, the international economic relations system makes use of many types of cybernetic — economic models concerning the forecast of the evolution of the main mechanisms within the space of the national economy, the design of the ways and means necessary for a favourable balance of payments, the achievement of a maximum efficiency for the system's activity on the basis of optimising the volume and the structure by products, countries and geographical zones of the foreign trade, the choice of optimal directions of cooperation in the production and of scientific-technological fields, the modelling of the entropic states in the space of the world economy etc. . . The modells allow, at the same time, the simulation on a computer of a large number of alternatives in directing the import-export flows as a function of the predicted reaction of foreign parteners, of the evolution of the prices on the international market, of the presence of disturbance elements in the space of the world economy following crises, etc. An important group of models of the international economic relations system is that concerning the choice of the optimal directions of cooperation in production and scientific-tehnological field. These models are based upon the *modern theory of strategic games*, *especially upon that of dynamic games*.

The first cybernetic-economic model of the international economic relations system is that concerning the *optimisation of the balance of external payments*. This is strongly connected with the models of other systems inside the space of the national economy through the permanent flows of information received from them and transmitted to them. We pay particular attention to the powerful connections to models of the logistic management, production and services, social product, national income, efficiency-profitability etc. . . The solutions obtained, based on the optimisation model of the balance of payments, are transmitted to the management, command, checking and control system, which correlates them with the solutions obtained by using the models of other systems in the space of the national economy and takes appropriate decisions.

Another important class of cybernetic-economic models of the international economic relations system concerns the optimisation of the volume and the structure by products and geographical zones of foreign trade, thus allowing the achievement of a proper balance for each geographical zone. Such a model could be an optimal mathematical programming model. A group of equations describing the model concerns the possibilities of maximum exports by groups of products as a function of the development level reached and of international needs. Another group of equations characterises the absorption capacity shown by various markets for the products to be exported. The data are produced by the forecast models constructed by the international economic relations system.

An important group of model constraints deals with ensuring supplies of quantities of imported raw materials and equipment necessary for the development of the national economy and also with the possibility of obtaining them advantageously from various markets in the world economy. Finally, a third group of constraints concerning the maintaining of a favourable payment balance with each and all partners is given.