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The Place and Role of Cybernetics as a Science and Practice in the Socio—Economic Development of Socialist Romania

Within the policy according to which "the Party constantly starts from the consideration that science represents a primordial element of contemporary progress, that the multilaterally developed socialist society and communism can be built only on the basis of the most advanced gains of science and technology" [1] studies in the field of social and economic cybernetics, both theoretical and applied have been developed in Romania, during the past decades.

The merit of our Party, of its leadership of stimulating with an unprecedented intensity the development of science and culture including cybernetics in Romania was once again recognized, internationally, when in December 1978, the President of the Socialist Republic of Romania was awarded, following the decision of the Fourth International Congress of Cybernetics and Systems held in Amsterdam, in the autumn of 1978, the "Norbert Wiener" Gold Medal of the World Organization for General Systems and Cybernetics. On that occasion, President Nicolae Ceaușescu said: "I only want to mention that we, in Romania, are doing everything for the society we are building through the entire people's work — and, in which science is playing an essential part-to provide to the people ever better, equal working and living conditions (....). Along with many brilliant gains of mankind, cybernetics is holding an important place. It is affirmed in the concern for building a better and more righteous world, in which each nation can develop freely, in which people can turn their knowledge to good account, in which both the peoples' and individual personality should be affirmed ..." [7].

Already before the appearance of cybernetics as science, recognized on a planed-scale, scientists in Romania had worked in the elaboration of fundamental concepts and theories which belong to this science, today. Thus, the first Romanian scientist who was the initiator of the systemic interpretation of the social, economic and technical phenomena and of their interre-

lations, of the role played by science and technics in the development process was Spiru Haret, mainly through his paper "Mécanique sociale" published in Paris, in 1910. A large systemic outlook also characterized the activity of Prof. Gheorghe Marinescu (1863—1938), the founder of the Romanian school of neurology while all the works of prof. Daniel Danielopolu regarding the neuroendocrine and immunological systems were based on their systemic interpretation. The Romanian scientist had worked out already in 1938 the general diagram of the adjustment mechanisms of the functions of the body, a diagram bearing all the characteristics of a cybernetic system. C. I. Parhon (1874—1969), a world famous Romanian scientist tackled the problems of human physiology and pathology in the light of the close interdependence between the human somatic and psychosomatic subsystems. Paul Postelnicu, a professor, today, has come to the conclusion of the existence of analogies between the electronic and the biological systems, outlining the importance of positive reaction circuits and elaborating the circuit or the vicious complex theory published in the scientific review "V. Adamachi" of Iaşi, at the beginning of 1945.

Similarly, dr. Ştefan Odobleja wrote the paper "Psyhologie consonantiste" published in two volumes, in Paris, in 1938, at the Maloine bookshop, in which he used many notions now belonging to cybernetics.

General preoccupations in connection with the cybernetic science in Romania started being manifested soon after the publication of Norbert Wiener's book *"Cybernetics or the science of communication and control with animals and machines"* (1948). A number of Romanian scientists started working out studies and research on the line of cybernetics.

The small philosophical dictionary published in 1954 explained the notion of "cybernetics", however from wrong, not-scientific and not-dialectical positions. It was presented as a "reactionary pseudoscience" [10]. However, cybernetics started being taught in various forms and started being developed in Romanian higher education. The first preocupations in the development and teaching of the science of economic cybernetics have appeared at the beginning of the 50's, within the Faculty of Statistics and afterwards within the Department of Statistics (II) of the Academy of Economic Studies and, they were initiated by the founder of the Romanian school of socio-economic cybernetics, Academician, Professor Manea Mănescu.

In 1967, within the Academy of Economic Studies in Bucharest, the Faculty of Cybernetics was set up, which is now functioning as the Faculty of Planning and Cybernetics. In the same year 1967, in the same higher education institution, the Economic Cybernetics Departament was set up and previously, its laboratories (1963).

Courses of theoretical, technical, economic cybernetics, etc. started then being delivered in many higher educational institutions of our country.

The book of counter-admiral, eng. Grigore Marteş "Cybernetics in the Army" was published in 1964.

A number of works started appearing in the field of socio-economic cybernetics, an outcome of scientific studies made by the Romanian scientists with preoccupations in this field.

On this line, the review Economic Computation and Economic Cybernetics Studies and Research was brought out in 1966, by the Economic Cybernetics Department of the Bucharest Academy of Economic Studies, a quarterly which publishes valuable works in the field of theoretical and applicative cybernetics, in the socio-economic fields (cybernetic-statistical analysis, mathematical-cybernetic modelling, economic computation, economic informatics, etc.).

The work of Academician, Professor Manea Mănescu entitled "Considerations on the aplication of the principles of cybernetics in economy" was published in 1969. This work is quoted in the Dictionary of Political Economy, Bucharest, the Publishing House for Political Literature, 1974, underlining that it has made "important contributions" to the development of economic cybernetics in Romania. Quoted on the same line is also another book "Cybernetics and its applications in the technique and economy of industry" brough out in 1973 by the Publishing House of the Academy of the Socialist Republic of Romania. Also published in 1973 is the book "Applications of economic cybernetics in the chemical industry " written by Valeriu Pescaru, Gheorghe Boldur, Vasile Ionescu , Moise Altăr and others. In 1973, Constantin Ionescu published "Man, Society, Socialism". The book "Dynamics of Social Structure in Romania" brought out by the Publishing House of the Academy of the Socialist Republic of Romania was awarded in 1974 one of the Academy prizes and in 1974, together with Oscar Hoffman, he published the book: "The Working Class in the Socialist Republic of Romania". "Dynamics and Structure" (the Publishing House for Political Literature) analyses the transformations in the social and class structure system of our country, the process of social homogenization as a social cybernetic system. Also in 1974, the Publishing House for Political Literature brought out Mircea Bulgaru's book "Population and Economic Development", a work of demographic-economic statistics with a marked cybernetic character.

Professor Emilian Dobrescu's work "The Optimum of Socialist Economy" appeared in 1976, elaborating economic growth models of theoretical and practical importance for the Romanian economy.

Appearing in 1976 and 1979 were the works "A Multisectorial Economic Analysis" (the Scientific Publishing House) written by Ludovic Tövissi and Eugen Tigănescu and "Methods and Models of Structural Economic Analysis" — written by Ludovic Tövissi, Emil Scarlat, Alexandru Taşnadi, this book being awarded, in 1981, the "Petre S. Aurelian" prize of the Academy of the Socialist Republic of Romania. In 1979, the Publishing House of the Academy of the Socialist Republic of Romania brought out the book "Economic Cybernetics" by Academician Manea Mănescu, a reference work of Romanian science and cybernetics. Also published in 1979 was the work "The function of the quantity of information in the stability of a social system" which was awarded the "Petre S. Aurelian" prize of the Academy of the Socialist Republic of Romania, in 1981.

A series of other valuable works in the field of the living systems cybernetics, of technical and industrial cybernetics, etc. have also contributed to the development of the self-adjustment systems theory in our contry. Thus, the paper "Fuzzy Sets and Their Applications" was published in 1974,

written by Constantin V. Negoiță, and translated afterwards into Japanese and English as well as the paper "The Informatic Systems, Models of Control and of Controlled Systems," in 1975, by Paul Constantinescu and Constantin V. Negoiță.

A remarkable activity in the field of cybernetics in Socialist Romania is carried out by professor Edmond Nicolau from among whose works in this field, we mention "Elements of Neurocybernetics" written together with doctor in medicine Constantin Bălăceanu, brought out by the Scientific Publishing House already in 1967, "Cybernetic Analogy, Modelling, Simulation" (the Scientific Publishing House, in 1977) and "Man-Machine-Cybernetics" brought out by the Publishing House for Political Literature, in 1978. The prodigious works on the application of cybernetics in the field of medical sciences and practice have made of Academician Ştefan Milcu a pioneer, in this direction. Also on this line, we can mention the works of Academician Eugen Macovschi and of Prof. dr. Victor Săhleanu on cybernetics applied in biology. In 1975, the Technical Publishing House brought out Prof. Ştefan Bîrlea's book "Initiation into the Cybernetics of Industrial Systems". Among the books of Prof. Mihai Drăgănescu linked with cybernetics, we mention "System and Civilization" brought out by the Publishing House for Political Literature, in 1976 and "The second industrial, microelectronic, automatic, informatic revolution — decisive elements", published by the Technical Publishing House, in 1980. In his works, Prof. Walter Roman is also showing preoccupations in the field of cybernetics. We mention "The 20th Century — the Century of the Great Revolutions" brought out by the Publishing House of the Academy of the Socialist Republic of Romania, in 1976 and "Balance and Inbalance" published in 1978, by the Scientific and Encyclopaedic Publishing House. We also mention the book "Applications of the information theory — dynamic systems — cybernetic systems", published in 1968, the paper "Consonantal Psychology and Cybernetics", by Ştefan Odobleja, published in 1978, "Systems Engineering" by Adrian Gheorghe, published in 1979, now printed in the U.S.A, in English, "Cybernetics, Automatics, Informatics in the Chemical Industry" written by Mihail Florescu, corresponding member of the Academy of the Socialist Republic of Romania and others, published also in 1979, as well as other works, among which "Trends in the Development of the Chemical Industry", (1977) and "Scientific Methods in the Development of the Chemical Industry", (1979) written by Mihail Florescu, all these being an example of the cybernetic approach of this industry, of its technical, technological and social processes, of its growth.

The volume "Cybernetics" as the crowning of the fruitful activity carried out in our country, on this line was brought out in 1981, by the Publishing House of the Academy of the Socialist Republic of Romania, in the series "History of Sciences in Romania".

At the same time, many Romanian scientists have published valuable studies of cybernetics in a series of volumes, of collections of studies, such as "Dialectical Materialism and the Contemporary Sciences of Nature", (Bucharest, 1964), "Materialism and the Sciences of Nature", volume 9, (Bucharest, 1964) and "Dialectical Materialism and Natural Sciences".

In the Socialist Republic of Romania, on the line of developing cybernetics, a number of works of foreign authors with an essential contribution in this field have been translated, such as the book of Norbert Wiener, who laid the foundations of cybernetics as a science, "Cybernetics or the science of control and communication with beings and machines", the Scientific Publishing House, Bucharest, 1966 as well as his books "God" and Golem Ltd.", (the Scientific Publishing House, Bucharest, 1969) and "I am a Mathematician" (the Publishing House for Political Literature, Bucharest, 1972), L.B. Italson's book published in Moscow in 1964 and in 1967 in Bucharest, by the Didactic and Pedagogical Publishing House, entitled „Mathematical and Cybernetic Methods in Pedagogy", the book of the East German Professor Georg Klaus "Cybernetics and Society" published in translation by the Publishing House for Political Literature, Bucharest, in 1966, the book of the French scientist Jacques Guillaumaud "Cybernetics and Dialectical Materialism", the Scientific Publishing House, Bucharest, 1967, the book of the Polish professor Oscar Lange "Introduction to Economic Cybernetics" translated by the Scientific Publishing House, Bucharest, also in 1967, the book of the British scientist W. Ross Ashby "Introduction to Cybernetics" translated by the Technical Publishing House, Bucharest, in 1972, etc.

A number of Romanian editorial selections after foreign authors have also been published. In the first place, the Publishing House for Political Literature and the Scientific Publishing House have the merit to have printed a series of such selections of studies of prestigious authors, Soviet, American, British, German, Czechoslovak and other cyberneticians. Thus, the volumes "Marxist Dialectics and the Modern Sciences — Cybernetics", "Theoretical Problems of Cybernetics", etc. were printed in 1963. In 1979, the Bucharest Scientific and Encyclopaedic Publishing House translated from Russian and published "The Dictionary of Mathematics and Cybernetics in Economy".

On the line of developing cybernetics in Romania, a real school has been created and the scientific knowledge in the fields of general systems and cybernetics has widely been disseminated.

Defining the system, the Romanian Encyclopaedic Dictionary points out that it is a set of interdependent elements representing an organized whole. The particular sciences make evident the existence of systems in all fields, in nature (for instance, the solar system, the living organism, etc.), in society (for instance, the socio-economic formation), in knowledge.

As is known, cybernetics is studying one of the most important categories of systems, the selfadjustment ones. It has discovered and demonstrated the analogy between the functioning mechanisms in different systems (the living, organisms, technical, automatic, social and other systems) and the fact that the systems are made up of subsystems in interconditioning relations, determined by the inputs, flows, processings and outputs of data which, in their turn, cause a complicated and intimate network of reactions and feed-back which bring about the homeostasis processes, respectively, selfadjustment through which the functioning and finality of these systems are ensured.

Indeed, contemporary science regards the whole universe, the whole nature as a hierarchization of systems which are interdependent, intercondi-

tioning and surpassing each other: atoms, molecules, macromolecules, cells, tissues, organs, organisms, populations. The theory of cybernetic systems has nowadays many applications in the particular sciences: in mathematics, physics, chemistry, biology, medicine, linguistics, psychology, sociology, economics, polytology, etc.

In the outlook of the Romanian school of social and economic cybernetics, society is considered an extremely complex system.

Any social system viewed in the light of the general systems theory can be considered to be cybernetic as well. This rigour is deriving from the fact that certain cybernetic laws and mechanisms are characterizing human society within which various social systems form its component parts.

Viewed globally and in the light of the cybernetic theory, society meets all the basic conditions required from a selfadjustment system. Thus, certain objective laws are operating in society, in keeping with the essence of each social formation, through which adjustment and selfadjustment are achieved or tend to be achieved; the elements composing society are connected by interdependence and interaction relations through which the cybernetic principle of connexion and feedback connexion is achieved. In the system called society, big quantities of information of different nature are circulated, quantities illustrating the level of organization of society. Similarly, in society, entropy is manifested with its effects towards the disorganization of systems and which, conditioned by information, creates the probabilistic features of society. Society is dynamic and it is highly complex and diverse. Finaly, operating in a multiple direction in society is the cybernetic principle of "rule", of the control and command of the system. It is also here that the cybernetic category of model has a boundless field of application.

From these points of view, all the existent social organizations have witnessed a corresponding cybernetic mechanism.

Admitting the cybernetic capacity of the social systems, Norbert Wiener specified that one of the working directions was based on the recognition of the importance of the notions and methods of the communications theory in the social systems. Undoubtedly, the social system is an organized whole just like the individual, it is joint together by a communication system, it has a dynamics in which the feed-back circulating processes are playing an important part. This is valid for all general fields of anthropology and sociology and for the more particular field of economy [11].

Because of the essential differences existing among different social systems, they cannot be considered "global" but individual, according to their essence, to the specific character of the laws operating in each system taken separately, to the operating modalities of these laws. Consequently, no cybernetic analysis of the social systems can be made globally; it must take into account the particularities of each of them, particularities which cause the cybernetic categories to operate in point of quantity and quality differently from a type of social system to another.

The cybernetic complexes in economy cannot be conceived outside the total connexions with the economic, social and political environment in which they are integrated. In economy, the set of activities and of the exist-

ing direct and feedback connexions is leading to the idea that any economic body (enterprise, branch, sector or the whole of economy) can be considered a cybernetic complex. Due to this set of connexions and to the dynamic character of a permanent change in parameters, the general cybernetic system of the economy may be considered as the most complex social cybernetic system.

The economic systems of any type are cybernetic because they are characterized by features like; the existence of the system with its links (subsystems): national economy, branches, subbranches, productive units, circulation, financial-banking, etc; the control function both at the level of the system and of each subsystem; the circulation of information (data on investments, production, profitableness, the circulation of products, finance, etc.); connexion and feedback connexion (interdependence and interaction with the mutual influence among all the links of the respective economic system); adjustment and selfadjustment (the operation of the laws specific to the respective economy, its functioning mechanisms); modelling; probability, complexity.

The dynamic behaviour, the interconditioning and complexity of the economic systems are characteristics of the cybernetic systems.

The cybernetic applications in the development of society and economy have a great practical importance nowadays, considerably speeding up the process of this development, a step by step cybernetization of the socio-economic life being thus achieved.

This cybernetization resides in the fact that, considering the complexity of the specific processs taking place in various socio-economic sectors, it is still more difficult to solve problems without applying to cybernetic methods and techniques supplied mainly by the systems theory, the information theory, the modelling theory, the decision-making theory, as well as to computers and informatics.

In Romania, for many years now, the applications of cybernetics in the management of society and economy, in the analysis and control over the socio-economic phenomena are current practice.

Pointing to the need of using a powerful infrastructure in the application of the contemporary technical and scientific gains, in building a modern economy based on advanced methods and means, President Nicolae Ceaușescu underlined at the Plenum of the Communist Party Central Committee of December 21—23, 1966: "Among the new fields which have appeared in contemporary scientific research, an important place is held by the science of the management of economic processes, of organizing production and work. The science of management has arrested general attention in many countries of the world. Better results are obtained in production on the basis of the means of modern computation technique and automation of analysis instruments provided by the latest fields of mathematics, cybernetics and economic informatics" [4].

The unitary socio-economic development of the Socialist Republic of Romania is taking place, on the basis of the national plan (a plan which is, at the same time, a powerful instrument of cybernetic adjustment in society), in a systemic outlook, cybernetics alongside other new scientific gains repre-

senting a powerful instrument of organization and management, of permanent modernization of production, of the economy and of society ..." "The role of science will grow — the Party General Secretary said at the working meeting with the party active in the ideological field and of political, cultural and educative activity of July 9, 1971 — as an ever more important element in the entire activity of organizing the socialist society. Speaking about the building of the multilaterally developed socialist society, we also bear in mind the changes to take place in the productive activity, on the basis of mechanization, automation and cybernetization" [5].

The importance, from the economic and social points of view, attached to cybernetics in Romania as a science and as a complex of practices is attested, as can be seen, by the numerous positive estimations made by the President of Socialist Romania who, at the International Congress of Cybernetics and Systems (Bucharest, August 25—29, 1975) said: "Cybernetics is playing nowadays an ever more important part in the scientific management of production processes, of economic life, in facilitating man's work and in raising its social productivity, in the general progress of human society" [6].

One of the main trends in guiding the efforts of specialists in production, education and research in our country, in the field of using methods and techniques of economic cybernetics and informatics was the elaboration of cybernetic-economic models for substantiating the national plans of socio-economic development both at a branch and territorial level as well as the plans of developing the branches, subbranches and economic units and the working out of informatic systems of socio-economic management at different levels.

The Economic Cybernetics Department of the Academy of Economic Studies has elaborated and substantiated an important number of concepts, methods and techniques of economic process optimization, such as the concept of economic space and time, the general cybernetic system of the national economy, economic logistics and quantic economy, cybernetic-economic models of economic growth at a territorial level too, models, algorithms and programs for investment optimization, forecast and planning problems at a branch and territorial level, of forecasting the development of scientific research, of managing educational activities, of efficient production scheduling, of optimizing the type of production, of organizing repair and overhaul work, of drawing up complex administration systems, etc.

The beneficiaries of these cybernetic models, techniques and applications were many central bodies and units of the Romanian society and economy, such as: the State Planning Committee, the Ministry of Chemical Industry, the Ministry of Light Industry, the Ministry of Education, the Central Institute of Economic Research, the Central Institute of Research and Design for Automation, the Institute of Technological Engineering and Design for the Chemical Industry, ICEMENERG, the Institute of Research and Design for Thermo-power Equipment, the Galaţi Institute for Naval Research and Design, the Institute of Nuclear Technology, the Institute of Research and Design for Chemical Equipment, the Institute of Research and Design for Crude Oil Extraction, the Institute of Applied Geophysics, the Bucharest Observatory, the Brazi Industrial Group for Refineries and Petrochemistry,

the Bucharest Enterprise for Plastics Processing, the Danubiana Enterprise for Tyres, Chimpex Constanţa, PECO, the Borzeşti-chemical Plant, the Industrial Group for Medicines, the Bucharest Gas Diatributing Enterprise, the Călăraşi Iron and Steel Plant, the Tîrgovişte Plant for Special Steels, the Cîmpia Turzii Metallurgical Works, the Buzău Wire Enterprise, the Electromagnetic Enterprise, the "Dîmboviţa" Enterprise, the wood working plants of Arad, Pipera and Oradea, the Romchim, Romtrans foreign trade enterprises and many other institutions or socio-economic enterprises.

The State Planning Committee has worked out the macroeconomic models for substantiating the Five-Year Plans, statical and dynamic models of the branch interrelation balance, the model of the formation and use of the population incomes, etc.

The Central Institute of Management and Informatics is intensely concerned with elaborating models and systems for the management of the socio-economic units and for implementing the national informatic system.

At the "Ştefan Gheorghiu" Academy, remarkable results have been obtained in using cybernetic methods of economic growth, as well as modern methods and techniques of the science of management.

The Central Board of Statistics has elaborated population forecasting models, models for correlating the economic branches and the components of the general cybernetic system of the national economy, the respective institution being a constant promoter in the cybernetization of the national statistical system.

Studies are made at the Bucharest University in connection with the application of the systems theory in the field of modelling social phenomena, the working out of forecasting models as well as of algorithms and programmes for the respective fields.

There are preoccupations and valuable results at the Bucharest and Timişoara Polytechnic Institutes, at the Centre for organization and cybernetics in constructions, at the Computation Centre of the Chemical Industry, etc., in connection with the modelling of phenomena at a macroeconomic level and the working out of information systems with interesting applications in the industrial and constructions activity.

The Finance Ministry has elaborated the model of financial flows in the national economy. Likewise, at the Ministry of Technical-Material Supply and Administration of Fixed Assets, the model of material stocks has been elaborated and the model of prices at the State Committee for Prices.

The concrete results obtained by applying cybernetics in society and economy have substantially and effectively contributed to improving the organization and management of society, of the economy, of the branches and subbranches, of enterprises, to obtaining substantial supplementary productions and profits, to raising the quality or work and production, of productivity, to developing science and technology, to raising living standards, and culture, and to improving working conditions.

Moreover, the development of cybernetics in Romania has, in its turn, stimulated the development of automation, electronics, the production of computation technique and informatics, as powerful elements of the technical-material basis of society and of the socialist economy.

The steady growth and diversification of the electronic and automation industry faithfully reflect the outlook and creative ideas of President Nicolae Ceauşescu who, in July 1965, in the Report to the Ninth Congress of the Romanian Communist Party pointed out: "... To cope with the need of measuring, control and automation machines and devices, the production of the electro-technical industry will attain the highest rate in the machine-building sector, marking an annual average increase of over 17% and further on, the basis of the electronic industry will have to be extended, being extremely important for the long-range development of the economy, on which depends the extension of automation of the production processes, by keeping pace with the requirements of the technical and scientific revolution" [3].

In the following, we shall try to present rather distinctly the evolution of automation, of electronics and of the computing technique in our country.

1. Whereas at the beginning of the creation of the automation means industry (1961—1965), in our country, patents were necessary for ensuring, in the first place, the modern fabrication technologies, in the past 15 years, the share of our own conception in the production of automation means has still more increased. It has impelled the steady growth of the automation means production (in the 1971—1980 decade, the annual average growth rate was of over 25%).

Thus, having started from a single small enterprise "Automatica" (with a small production in 1961, the foundation year and, whose production in 1975 made the needs of the national economy in the field of automatics to be covered from import in a proportion of 52%), new modern units have been raised along the five-year plan periods, units like the Enterprise for Automation Equipment (IFA), the Electro-technical Enterprise, the Enterprise for Pneumatic Elements and Measuring Apparata (IEPAM), the Electronic Computer Enterprise, the Peripheral Equipment Enterprise (IEPER), etc. the production of which was, in 1980, over 90 times bigger than that of 1965, covering the internal needs in a proportion of over 92%.

In 1980, the "Automatica" and "Electrotehnica" enterprises preponderently produced electronic equipment thus providing the automation means for technological installations of continous and sequential, slow and fast processes which are applied in the productive units, in all branches of the national economy (chemistry, metallurgy, energetics, machine-building, construction materials, light industry, etc.). We point out that the new, modernized products in the field of automation, turned out in the 1976—1980 Five-Year Plan period represented, in 1980, 55% of the production value in comparison with about 40% of the share of the whole industry, as envisaged in the Guide-Programme of scientific research, technological development and the introduction of technical progress in the 1981—1990 period and the main guide-lines for the period until the year 2 000. The assimilation of new and modernized products was achieved in a proportion of 90% based on our own conception, unified systems and subsystems having been obtained, compatible with similar products of foreign firms.

Among the automation equipment produced in this country, we mention those of the Slobozia, Tîrgu-Mureş, Arad, Craiova and other chemical fertilizer plants, the petro-chemical plants of Piteşti, Rîmnicu Vîlcea, Borzeşti,

Brazi, etc., the iron and steel works of Galați, Tîrgoviște and Călărași as well as those of the cement mills at Fieni, Tîrgu Jiu, Medgidia, Cîmpulung, Hoghiz, of the factories of the wood-working and light industries, agriculture, etc. The achievement of a domestic automation industry has allowed for the generalization of automatics in all branches of the socialist industry.

As it is pointed out in the Directives of the Twelfth Congress of the Romanian Communist Party, the electronic industry will mark a 2·3 — 2·4 fold increase in 1985 as against 1980, being mainly directed towards the development of automation means and computing technique, of microsystems, of industrial electronics equipment and of electronic components. In the 1981—1985 period, the machine-building industry will mark a 152·5% increase in comparison with 1980, the plan providing for "a higher growth of electronics and microelectronics, of automation means and production process control" [9].

Thus, the electronic and electro-technical industries will register an annual average increase of about 13% as against the average general growth of 8—9%. The increase of production in the field of automation means and of computing technique is higher to the growth rates envisaged for other groups of products in the machine-building or other industries.

The general trends resulting from the Party and State directives and guide-lines pursue the priority implementation of an increased electronization of the automation means by elaborating new generations of products, by keeping pace with the new generations of components which are low energy consummers, allowing for the miniaturization and reduction of material consumption. At the same time, the automation level will be raised with a view to increasing the efficiency of the technological equipment and installations, to raising labour productivity, to reducing material consumption and to improving working and living conditions in all branches of the national economy.

2. In the past, we could not speak in Romania about an electronic industry. The only production unit before August 23, 1944 was the "Standard" Factory (later on turned into the "Electromagnetica" Plant) for the production of telephone apparata with imported parts.

The "Standard Electrica Română" was set up in 1930, a small enterprise through which the Romanian government granted the telephone exploitation to the International Telephone and Telegraph Corporation.

In 1939, the Dutch Philips corporation commissioned a workshop in which radio sets were assembled. After the nationalization of the main means of production (1948) the "Radio Popular" Factory was set up by merging the Philips assembly workshop with several small enterprises. The "Radio Popular" Plant which later on became the "Electronica" Plant together with the Băneasa Enterprise for radio spare parts and semiconductors (IPRS) set up in 1962 succeeded in covering, in 1969, over 95% of the necessary parts for the radio sets production.

A certain development of electronics started in 1961 and intensified after the Ninth Congress of the Romanian Communist Party of 1965, at which President Nicolae Ceaușescu said: "The infrastructure of the electronic industry will have to be extended, being of utmost importance for the future deve-

lopment of the economy, depending on which is the extension of the automation of production processes, in keeping with the requirements of the technical-scientific revolution" [3].

The share of the electronic industry in the country's economy has constantly increased, in the conditions of a high industrial growth rate. The first units and research institutes were created in this field, and they passed to the implementation of a professional electronic industry, an extremely important part in its development being played by the "Programme for the endowment of the national economy with modern computing and data processing automation equipment" approved by the Executive Committee of the Romanian Communist Party Central Committee, in 1967.

Besides the development of informatics, the programme also provided for the organization of the home production of electronic computers, including the manufacturing of professional electronic components.

The implementation of the programme which provided the country with a professional electronic industry (the production of third generation electronic computers, the production of integrated circuits, etc.) has laid the technical foundations of cybernetics in our country.

At the same time, for the automation of big technological installations in all industrial branches, plants have been erected for the production of miniaturized measuring and control apparata connected with the electronic and pneumatic technique.

In 1967, the Institute of Computing Technique was set up contributing to the achievement of numerical computation equipment, of peripheral equipment and of computation system programmes.

In April 1972, based on the analysis of the results obtained, the Decision of the Central Committee of the Romanian Communist Party was issued in connection with the improvement of the socio-economic information system, the introduction of management systems by automatic data processing means and the endowment of the national economy with computation technique in the 1972—1980 period.

The orientations given through this Party document have underlied and continue to underlie the development of the computation technique production and of informatics in our country.

In the Programme of the Romanian Communist Party, approved by the Eleventh Congress of the Romanian Communist Party of 1975, stress was laid on the need of developing this top branch in a modern economy: "In this period, electrotechnics mainly electronics will register a great development. The home production of computation, automation and control means necessary for the economic and production activity, of the apparata and control system will have to be ensured" [1]. The 1976—1980 Five-Year Plan has reflected this policy.

The leap in the electronic components production will be made in the 1981—1985 Five-Year Plan period not only quantitatively but also qualitatively.

Reffering to the need of obtaining a new, higher quality in the entire economic activity, in the new Five-Year Plan, for a powerful increase of labour productivity and administrating with maximum efficiency the material and

financial resources, the Report to the Twelfth Congress of the Romanian Communist Party presented by President Nicolae Ceaușescu points out: "An important part, to this purpose, will be played by the extension of mechanization and automation, the building of entirely automated lines, especially in foundries, forge shops, in thermal treatment sections and in other sectors using hard labour, the use of multifunctional aggregate-machines, of industrial robots and microprosessors. Action will have to be taken for a cybernetized control of technological processes, for the generalization of work on several machines, the rational use of the work time, the use of electronic technique in production programming, in computation and registration work and, on this basis, the reduction of the office workers to the strictly necessary number" [8].

Through all these provisions and moreover through the fulfilment of the targets envisaged in the field of electronics, they tend towards what is determining the essence of the contemporary scientific and technical revolution, namely the production process and information automation.

At present, the electronic industry of our country is turning out a wide range of products: passive components, imprinted cables, digital and linear integrated circuits, Kinescopes, MOS memories, portable receivers, casette recorders, television sets with integrated circuits, closed circuit television equipment, radio-communication installations for ships, desk electronic computers, pocket electronic computers, invoicing and book-keeping electronic machines, electronic microcomputers and minicomputers, medium-capacity electronic computers, equipment for the automatic control and supervision of production processes, terminal equipment, modems, numerical control equipment for machine tools, telecontrol equipment for adjustable electric operations, various automation systems, etc.

3. The appearance of computers based on electronic technique has revolutionized the operating system in economic administration, in the first stage and afterwards was extended through process computers, especially through microprocessors, in the constant control and functioning, with high precision, of technological processes whose technical complexity and capacity could no longer be mastered with means characteristic of human natural potential.

Following the existence of a school of mathematics which has produced world famous scientists like Pompei, Țițeica, Lalescu, Moisil, Nicolescu, Mihoc, Onicescu, Popovici, Teodorescu and others as well as a result of the progress obtained in electronics, the first Romanian computers were achieved beginning with the year 1957, Romania being thus among the first countries of the world with such achievements at that time. Such computers were achieved within prestigious institutions, like: the Institute of Atomic Physics (CIFA and CET) the collective led by eng. Victor Toma, the Timișoara Polytechnic Institute (MECIPT), the Computation Institute of the Cluj branch of the Academy of the Socialist Republic of Romania (DACIC) and others (MARICA, CAU, MECAN). The success of the equipment builders was completed by the pioneering in the programming field made by engineers Dragoș Vaida and Ion Zamfirescu who, at that time, were working at the Institute of Atomic Physics.

In the field of computing technique, 1970 is marked by an industrial-scale production of universal medium capacity electronic computers of the third generation, of the FELIX C-256 type, followed by the FELIX C-512, FELIX C-32 U, FELIX C-32 P computers for industrial process control, by the FELIX M-8 and M-18, INDEPENDENT 100 (M100) microcomputers to be followed by M-200, M-40 (CORAL 4011 and 4001), and others.

The production of "artificial intelligence" is also in full swing in Romania, at present. Robots designed in Romania have been manufactured at the Bucharest Polytechnic Institute, at the "Electromotor" Enterprise in cooperation with the Timişoara Polytechnic Institute and in other machine-building units, robots which started working at the DACIA Car Enterprise, at the Reşiţa machine-building enterprise and in other industrial units. The names of professors, like Dolphi Drimer, Traian Demian, Mihai Nicu, Ioan Micşa, of engineers Ion Crişan, Constantin Ionescu, Vlad Negulescu, Vasile Tanvuia, Emil Petriu, Dorina Petriu, Vladimir Creţu, most of the active participants in our conference debates and others represent today the pleiad of Romanian pioneers in the field of robotics.

The Peripheral Equipment Enterprise (IEPER) was put into operation in 1975 aimed at developing the peripheral equipment production and the "ROMCONTROL DATA" Joint Venture (RDC) was set up in the same year, taking over from the production of IEPER new types of products also aimed at speeding up the introduction in our country of improved equipment for serial production.

The prospects of the development of Romanian cybernetics are sure. With a view to developing it and its component branches and to constantly intensifying their application, studies in these fields are being coordinated and are taking place, at present, within the Cybernetics Commission of the Academy of the Socialist Republic of Romania, within the Central Institute for Management and Informatics as well as within the Scientists' Association of the Socialist Republic of Romania, within the Academy of Economic Studies and other higher education institutes as part of university, post-university, doctor's degree forms, etc.

To the extent to which the programmes of socio-economic, scientific, technical and technological development of Romania give due importance to cybernetics and its component branches, they will constantly develop. The programme-documents of the Twelfth Congress of the Romanian Communist Party ensure this, underlining that: "... studies will intensify for the optimal functioning of the unitary system of the socio-economic processes control, based on a wide-scale use of cybernetic methods ..." [2].

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