A C T A U N I V E R S I T A T I S L O D Z I E N S I S
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SOME REMARKS ON SYSTEM CONCEPTIONS IN SCIENCE

In the last fifty years growing interest in systems conceptions may be observed in many fields of science. W. N. Sadowski writes about it in the following way[1]: "The terms »system«; "structure", "comprehensive analysis", "structural analysis" and their derivatives are now being widely adopted by specialistic sientific and philosophical-methodological research. To regard this phenomenon as accidental and of little significance would be an error. Seemingly insignificant changes of terminology cause in reality essential theoretical-gnosiological and practical consequences which in fact cannot be overrated. Today one can say in earnest that the shift towards the analysis utilizing systems in the modern science signifies, as a matter of fact, a substantial transformation of scientific knowledge, of our comprehension of the world". In the recapitulation the author concludes that analysis in terms of systems belongs to basical curiosities of the XXth century. T. Kuhn defines this situation simply as the birth of a new paradigm in science[2].

Systems approach, however, is not quite new in science. L. von Bertalanffy, the creator of the general systems theory, stresses the fact that the conception of system is as old as

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[1] W. N. S a d o v s k y, Metodologisheskie problemy issledovania obektov predstavlayushchykh soboi sistemy [in:] Sotsiologia v SSSR, Moskva 1965.

[2] T. S. K u h n, Struktura rewolucji naukowych, Warszawa 1968

the European philosophy. He refers to Aristotle, Dionysius the Aeropagite, Leibniz, Hegel, Marx and others[3]. However, wider interest in systems aroused as late as at the beginning of the XXth century and, what is interesting, independently in various fields, in opposition to the dominant mechanistic methodology. In biology those were holistic and organismal conceptions[4], in psychology - Gestalt theory[5], in sociology and antropology - functionalism and structuralism[6], in linguistics - among others the works of F. de Saussure, N. Chomsky[7]; cybernetics was created - the works of N. Wiener, W. R. Ashby, C. Shannon, G. Walter and others. This is in no way a complete list; in the domain which L. von Bertalanffy called system technique and which comprises the methods of solving concrete technical and social problems, among others the following disciplines originated: system engineering (the designing of large systems), system analysis (the way to solve complex decision problems of incomplete structure), operational research[8].

It is the reality analysis in terms of systems which connects these, disciplines otherwise different one from another. Most generally a system was defined as a certain unit whose properties, functions and attributes are non-reducable to the properties and functions of its components. Closer definitions of a system are various but two main approaches may be mentioned:

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[3] L. von Bertalanffy, Historia rozwoju i status ogólnej teorii systemów [in:] Ogólna teoria systemów. Tendencje rozwojowe, Warszawa 1976; tenże, General System Theory. Foundations, Development, Applications, New York 1968.

[4] L. von Bertalanffy, Problems of Live. An Evaluation of Modern Biological Thought, New York 1952; Filozoficzne zagadnienia biologii [in:]. Główne zagadnienia filozofii, Warszawa 1966.

[5] E. R. Hilgard, Wprowadzenie do psychologii, Warszawa 1972; von Bertalanffy, General System...

[6] C. Levi-Strauss, Antropologia strukturalna, Warszawa 1970; P. Sztompka, Metoda funkcjonalna w socjologii i antropologii, Warszawa-Wrocław-Kraków-Gdańsk 1971.

[7] J. Piaget, Strukturalizm, Warszawa 1972.

[8] W. Gasparski, A. Lewicka, Problematyka badań systemowych; "Prakseologia" 1973, nr 2.

1. By way of analogy with a living organism (particularly often met in social sciences - here one assumes that the considered system is so similar to a living organism that its features and regularirties - otherwise better known - may be transformed to the system under investigation, broadening indirectly the knowledge about the analysed subject). For instance, K. Detsch in his work "Mechanism, Teleology and Mind"[9], defines organism as a non-reducable entity, at least when it comes to its essential elements. It cannot be taken to pieces and then assembled again. Particular parts of a classical organism, even if they can be separated, have in their structure special functions they were designed for. They cannot fulfil any other functions without the destruction of the organism. The behaviour of the organism is irreversible and one-way. It possesses a substantial past and history. A. R. Radcliffe-Brown[10] also writes that an organism is an integrated whole and this makes it different from an ordinary aggregate (set) of elements. System of bonds forms an organic structure. Preservation of the structural continuity and at the same time changeability of the concrete elements are the characteristic features of a living organism.

2. The second and most often met way to describe a system is the method of description per abstracto. This is an approach typical of the modern versions of functionalism, structuralism or a general system theory. Here the features and properties which are specific for a given system or a class of systems are ommitted and the properties mutual for completely different systems are investigated, at least from a point of view of traditional classification of sciences. They are expressed in terms of mutual homologies and isomorphisms which in turn make the basis for scientific application of models and model concentions and for the transformation of principles from one domain to another. Then a system is defined as a certain whole, a set of mutually connected and conditioned elements. And so L. von Bertalanffy determines the objects of the general system theory in a narrower sense[11] separating it from the so-called systems attitude, sys-

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[9] S z t o m p k a, op. cit.

[10] Ibidem.

[11] v o n B e r t a l a n f f y, Historia rozwoju...

tems vision of the world. Its main tendencies are characterized by G. J. Klir[12]. An essential virtue of the method of per abstracto description of the system is that it makes it possible to broaden the scope of objects for whose characterization the notion of the system is useful.

Apart from mutual starting assumptions, particular currents of systems research differ one from another in a substantial way, both when the generality degree is concerned (the general system theory is regarded as metatheory by some authors, e.g. W. N. Sadowski)[13], and the uderstanding of such notions as "structure"; at last they have different detailed assumptions. In structural antropology the investigator passes from the recording and observation of the phenomena to the deep analysis uncovering their hidden character, to the analysis of hidden structures which result from unconscious properties and actions of human mind. Moreover, they are identical in essence both for the ancients and the people living now, both for the primitive and civilized men. What people are conscious of is of concrete, individual, incidental and changeable nature. Structures are virtually invariable; if they change or perish it happens because of external forces and not internal discrepancies[14]. It is otherwise in the general system theory where systems, structures, models are of abstract, logical-mathematical character. In functionalism basical assumptions (i.e. the assumptions of entirety, functional integration and environment) are enlarged by additional assumptions, as for instance the assumption of the directional system organization (among all the possible states of a system a state or a class of states is separated, necessary for the "survival" of the system, and which the system tries to maintain by means of elimination of deviations and disturbances). The assumption about the relations between the elements of the system is also often met. This may be the principle of

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[12] G. J. K l i r, Przegląd wstępny. Polifoniczna ogólna teoria systemów [in:] Ogólna teoria systemów. Tendencje rozwojowe, Warszawa 1976.

[13] W. N. S a d o w s k i, Ogólna teoria systemów jako metateoria, "Prakseologia" 1973, nr 2.

[14] L e v i S t r a u s s, op. cit.

consensus (non-conflicting mutual relations) on which among others T. Parsons[15] bases, or the principle of conflict e.g R. Dahrendorf's models[16]. P. Sztompka presents the models of functional analysis basing on definite, specific for functionalism, basical and detailed assumptions[17]. K. Marx's analysis in "The Capital" is different, although also a systems one. He also considered structures but they were not invariable, on the contrary - they underwent permanent transformations caused by internal, dialectic discrepancies. Thus, in spite of common bases, system theories and conceptions are different and even often opposite. However, through their common assumptions, notional schemes and methodology they are a new way of regarding reality which manifests itself as an arrangement of systems in hierarchical order. Such an approach gives a chance to interdisciplinar investigations of reality (as below) and maybe will make integration of different fields of science possible in the future[18].

Of course, it does not mean that the advocates of mechanistic theories have been disposed of totally, the more so as the word "mechanicism" has a lot of meanings. For example, some biologists regard themselves as mechanists in wide sense of this word; they claim that the phenomena of animated nature appear in a definite order and that space-time structures of bodies condition this occurrence. So understood mechanicism in not contradictory to theses of organismal biology. It is doubtful whether today such biologists exist who would profess Cartesian mechanicism, who would identify living organisms with machines, etc. Mechanicism has undergone definite evolution and now main controversies are raised by the question: is the reduction of biology to physics and chemistry possible? The achievements of molecular biology seem to confirm the theses of modified mechanicism. E. Nagel discussed it in the following way[19].

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[15] T. P a r s o n s, Structure and Process in Modern Societies, Glencoe 1960.

[16] J. M u c h a, Niemarksistowskie konfliktowe modele społeczeństwa "Studia Filozoficzne" 1976, nr 2.

[17] S z t o m p k a, op. cit.

[18] v o n B e r t a l a n f f y, General System...

[19] E. N a g e l, Struktura nauki, Warszawa 1970.

Two formal conditions necessary and sufficient for the reduction of one science to another must be met. These are the compactness condition and the condition of logical issuing. The former means that all biological terms must be "tied" with the notions of physical and chemical theories, the latter assumes that every biological law should be a logical consequence of a certain class of sentences belonging to physics or chemistry. Modern biology does not fulfil the two conditions and thus it cannot be reduced to physics and chemistry which does not contradict the statement that it will be possible in the future. Up till now nobody has indicated the inconsistency of the reduction of biology. The problem remains open and it cannot be solved in an a priori way. Also the statements of the followers of the organismal theory and hierarchically arranged "entireties" do not exclude, in the opinion of E. Nagel, the mechanistic explanation. Thus they have not proved an absolute autonomy of biology nor the substantial impossibility of physico-chemical and mechanistic explanations of the phenomena of life.

The application of the system notions and methods in a concrete domain may bring about a number of dangers and this because of the generality of system notions, variety of the possible approaches and specificity of a given domain. Non-identified terms in the research region which interests us (e.g. economy) may turn out to be empty and useless, the lack of an explicit method may introduce chaos. So it is necessary to separate the definite classes of systems and characterize them in a closer way. As an example we shall describe social systems in more detail.

Social systems differ from other systems in that there are people participating and acting in them who strive at the realization of their competing and not competing purposes widely understood. These are to be the following: economic interest, prestige, feeling of safety, achievement of power, appreciation in a group and so on. In their actions people depend one on another and an action of an individual always intrudes upon and interferes in other people's affairs. Mutual interactions, however, are not arbitrary, they take place according to definite "rules of the game" determined by institutions, that

is sets of principles (norms) managing people's behaviour. Institutions originate from the system of values common for the whole society and they make up a peculiar "skeleton" supporting social order. They make it possible to anticipate the actions and expectations of people and regulate their own actions according to them. The next feature of the social systems is that these actions and interactions of the members of the system mainly take place in organizations and social groups and through them. Organizations and groups are mutually connected and form a definite (most frequently hierarchical) structure which does not mean that their interests and aspirations harmoniously agree. Conflict is a constant characteristic of social relations. It may be of two kinds: 1) individual - organization, group, 2) organization-organization. The sources of conflicts first of all ought to be sought within the system, in its structure. Internal system discrepancies may lead to formation of spontaneous self-regulation mechanisms, sometimes of ergodic nature (e.g. systems of auctions, negative power, blocking of information systems, etc.)[20]. This system of complicated interdependencies, etc. of interactions between organizations and social groups often results in the stiffening, red-tapism and alienation of structures which begin to "live their own lives" and get out of human control. Organizations and social groups may be classified in various ways. However, the most general distinction is, after Kornai, into the organizations of real (material) sphere and regulation sphere[21]. It is an interesting thing that both features of social systems are omitted in economy. It is assumed that the participants of the economic process (individuals and organizations) behave rationally, according to the logic of economy and that the information system works efficiently[22].

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[20] J. S t a n i s z k i s, Patalogie struktur organizacyjnych, Wrocław-Warszawa-Kraków-Gdańsk 1972; t a ż, Odmiany władzy, "Studia Socjologiczne" 1973, nr 2; t a ż, Struktura jako rezultat procesów adaptacyjnych organizacji [in:] Organizacje. Socjologia struktur, procesów, ról, Warszawa 1976.

[21] I. K o r n a i, Anti-Equilibrium, Warszawa 1973.

[22] Ibidem; A. K. K o ź m i ń s k i, Zarządzanie. Analiza systemowa procesów i struktur, Warszawa 1974.

Apart from their own distinctive features social systems also fulfil all the basical systems assumptions which we discussed above. They may be described doubly: in a reistic way - as sets of people or organizations making up certain wholes, or in a nonreistic way - as sets of roles and social positions, notions; then the emphasis is put on the place of elements in the lattice of linkages composing the whole. In sociology the term "social system" is used for the determination of relations formed on the plane of official-professional dependencies, e.g. system: an official - a customer, or for the determination of the system of relations in definite spheres of life (e.g. economic system, education and so on)[23].

How to investigate social systems? J. Gościński states that systems analysis of social systems has two departures: 1) the acceptance of three-segmental analysis formula: structure - functioning - development, 2) the acceptance of management system as a sequentional, multi-stage process of decision making. After A. K. Koźmiński the author assumes the following typology of decision: 1) structural decisions (the division into subsystems, the division of tasks, competences, information flow), 2) controling decisions (elaboration and the choice of the ways of realization of the planned tasks), 3) planning decisions (the elaboration of program variants and the choice of the most advantageous one from the point of view of the accepted criterion). The types of decisions correspond to the segments of the analysis formula[24]. However, the acceptance of the rules of the systems analysis suggested by J. Gościński does not decide about the choice of a concrete variant of systems conceptions. A number of functionalism models, dialectical analysis as well as other methods may be accepted here. The author of this article is mainly interested in the acceptance of such systems methodology which would allow to reject the simplifying assumptions of particular social sciences, in, so to say, a fusion of economic, sociological and psychological analysis. The postulate of comprehensive investi-

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[23] H. B i a ł y s z e w s k i, Koncepcja systemu społecznego w socjologii, "Studia socjologiczne" 1968, nr 3-4.

[24] J. G o ś c i ń s k i, O analizie struktur i procesów, "Przegląd Organizacji" 1976, nr 4-5.

gation of the social processes is undoubtedly connected (among others) with Marxism (although the Classics stressed a special role of economics in social life). From Marxism one may derive a lot of inspiration, but here we are interested in Marxian analyses of capitalism. J. A. Schumpeter formulated it in the following way[25]: "Although Marx defines capitalism sociologically, that is through the institution of private control over the means of production, he considers the mechanism of functioning of capitalist society using his economic theory. This theory is to show sociological data incarnated in such notions as the class, class interest, class behaviour, class exchange, function by means of economic values, profits, wages, investments, etc. and how exactly they start the economic process which will burst its own institutional frame, at the same time forming conditions for the creation of a new social world". It seems that this short quotation renders the essence of Marxist sociology. The economic interest is its fundamental analytical category; on the one hand it makes the structure-making strength of social relations, and on the other - a "motor" of the economic activity. In this way the fusion of the areas of sociology and economy into one whole takes place[26]. Analogous reasoning may be performed at the analysis of the social systems - i.e. we connect the investigation of the systems of interests (widely understood) between individuals and groups, of mechanisms of human activities and their consequences with economic and sociological categories, and the whole analysis is of systems nature. Of course, with such a general methodological line various detailed solutions are possible.

In a short article it is impossible to exhaust the questions the systems conceptions deal with because of the vastness, the importance of the problems, the multitude of motives and the variety of currents. Hence the above presented considerations have sketchy character and require more profound analyses and research.

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[25] J. S c h u m p e t e r, Capitalism, Socialism and Democracy, New York 1947.

[26] W. N a r o j e k, Społeczeństwo planujące, Warszawa 1975.

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KILKA UWAG O KONCEPCJACH SYSTEMOWYCH W NAUCE

W drugiej połowie XX wieku uwidacznia się wzmożone zainteresowanie koncepcjami systemowymi w wielu odrębnych dziedzinach nauki (biologii, psychologii, socjologii itd.). Elementem łączącym rozważania dotyczące różnych zupełnie problemów jest analiza rzeczywistości w kategoriach systemów.

Prezentowany artykuł przedstawia różne koncepcje podejścia systemowego do badanych zjawisk oraz różne metody opisu systemów. Przedmiotem szczególnego zainteresowania są problemy dotyczące systemów społeczno-ekonomicznych, które tym różnią się od innych systemów, że uczestniczą i działają w nich ludzie dążący do realizacji swych konkurencyjnych i niekonkurencyjnych celów. Autor postuluje stworzenie takiej metody opisu tych systemów, która pozwoliłaby na odrzucenie założeń upraszczających i stopienie analizy ekonomicznej, socjologicznej i psychologicznej w jedną całość.