The Global Model of Sustainable Development for Protecting the Living Environment – Possibilities or Utopia

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Abstract—The author considers the problems of planning and realizing sustainable development aiming at protecting the living environment. In this research, the author recognizes that the stable and sustainable development together with the protection of the living environment is not possible without recognizing self-regulating mechanisms of the nature and their adequate application to the advancement and modernization of social and concentric circles of realization and feedback mechanisms. In researching, the author presents and analyzes the fundamental functioning and possibilities to construct the so-called global models and system-synthesis models. The author comes to the pessimistic conclusion that all the attempts to construct the global model of sustainable development, including the living environment protection have failed. To design and apply such a model in the world proportion, however, it is necessary to solve a row of different and difficult problems, and this elaboration the author plans to do in her next work.

Key words: sustainable development, living environment pollution, self-regulating mechanisms, general system theory, system-synthesis model

I. INTRODUCTION

Constant changes and harmonious functioning of the nature for billions of years have been provided by the mutual effects of regulation cycles, which function with an exceptional preciseness (they are, in fact, self-regulating feedback mechanisms). Changes inside the cycles of feedback can result in improvements, but also in regulation system damages. The complete system of regulation cycles of biological balance has not yet been explained. Therefore, in case of technical system intervention, harmful consequences are visible later. The knowledge of circular flows of interrelation systems and regulation cycles represents the conditions to understand biosphere and the possibility of professional influence on its functioning. The knowledge of mechanisms of the natural systems and their adequate application in order to advance social flows, regulation cycles, and self-regulating mechanisms represents the starting point. This system of self-regulating, unfortunately, is not always efficient in functioning the human society, therefore we can say that the crash of self-regulating systems has appeared [Moser and Palmai, 2006, p. 66].

One of self-regulating mechanisms is also the capability of regeneration of the nature. The nature has attained, during its constant experimenting, amazing wisdom, and all living creatures have, more or less, accepted capability of self-control and adaptation. This capability is called homeostasis, and this characteristic enables ecological system processing, reducing and eliminating external polluters, and own deformation. The capability of natural regeneration is limited, because the contemporary human has misused and restricted its capabilities in many ways. The new industrial civilization produces too many wastes, innumerable new chemicals; therefore, the nature is not capable any more to eliminate damages, which the people cause.

Up to recently, some more or less reliable self-regulating mechanisms functioned in social organizations, too. Today, they do not function reliably. As an example, we can take the way of functioning political institutions of contemporary democracies. Today’s political mechanisms are not capable to maintain healthy equilibrium, which, as necessary, has been often revised and changed, and it makes the basis of democracy. Even under the supposition of normal functioning, institutions of democratic mechanisms are not capable any more to meet the requirements of today’s complex and integrated society, regarding that some problems must be solved although not well understood by parties, voters or experts. Contemporary societies require adequate political and social procedures, which have not yet been established.

The cited problems need considerations of possibilities to plan and regulate sustainable development with simultaneous environmental protection in contemporary conditions.

II. GENERAL EXCHANGE EQUILIBRIUM

During the 19th and 20th centuries, the narrow connection was establishes between economic life, science and technology. In this regulation cycle, the human primarily gave basic signals his laws and political mechanisms. Signals of prevention originated from the
environment, often from the human and the organs of influence or integration, as the signal of regulation, were unknown. In this regulation cycles, science exerted influence on technology, technology on economy, and the economic life influenced on science. Besides, cited factors were in the interaction with the living environment and its biological and non-biological resources. See Figure 1 [Moser, 1998, p. 43].

Figure 1. [Moser and Palmai, 2006, p.68] illustrates that science and technology did not contribute enough to humanization of the living environment. Technological innovations forced the human to adapt development, based on own, existing or predetermined by some interest groups, most economically motivated aims. Electronics, as the result of technological progress, got too big importance. Many competent experts considered that in this, relatively new field, the consequences of wrong development was shown. Too early adaptation to the way of computer functioning, whose development was so fast that some permanent adaptations are necessary, caused the way of thinking similar to this electronic machine. It means that binary logic dominates. The consequence is that the complex ways of behavior are simplified and digitalized exaggeratedly, and economic flows are optimized by neglecting aims, as ecological balance, good mood, and so on, which can be hard modeled by algorithms.

We can draw the conclusion that sustainable self-regulating development in the future can be provided only by regulation systems based on cybernetic methods that are capable to discover the structure of system functioning: nature –society – man. However, we can hardly imagine that presented regulation circles can be used by social institutions and people authorized to make decisions. Competitive handling by this system requires expert knowledge and the way of thinking which need more time than it is necessary for setting the model. Thus, we are in the regulation cycle, which, today, exerts influence on creating the future. The problem of regulation, however, cannot be solved only by cognition that it is necessary to think differently and affect in the frameworks of regulation circles. Even the most perfect stimulation models can bring to wrong interpretation and cause wrong decision-making. Especially, if we disregard that cybernetic regulation by means of closed models has its limits; in reality, all the models are open. The presented regulation circle: science – technology – economy in its independence has a big inertia. The system can become vital if it successfully breaks the autonomy of internal circle. To reach this, it is necessary to eliminate the following deeply formed habits:

- One-sided suppositions of science for making technological solutions,
- Hasty technological solutions for economic problems,
- Practice of economy to require from science to solve irrational tasks.

The process can start by forming new views in science, before all, by forming educational systems, new aims and contents. The way that the nature functions, which permanently changes and develops, has been formed for billions of years. The basic characteristic of the system of functioning is the cyclical movement, the cyclical repetition. The system exists in the nature and the human society. The cyclical movements are not isolated occurrences but they are complex processes that are mutually conditioned in the interaction. The obstacle to understanding and preserve the living environment represents event the thinking of some experts framed only in their narrow specialties, as well as that the system of functioning nature has not yet been known. The move can be attained by the recognition of the system of natural cyclical flows and their application in solving the problem of education, upbringing, development and modernizing the society overall.

We are continuing to consider the analysis of cyclical course in spheres: 1. Inhabitants and industrial capital, 2. feedback system: human population – capital – agriculture; environmental pollution, and 3. global model functioning, and the problem of modeling sustainable development.
III. THE CYCLICAL COURSE IN THE SPHERES OF POPULATION AND INDUSTRIAL DEVELOPMENT

During the last several decades, methodology for investigation of dynamic behavior of complex systems has been established at Massachusetts Institute of Technology. The name of methodology is the system dynamics. Its base is cognition that the structure of any system, i.e. feedback of the interactive connection of coefficients that is sometimes realizes with time tardiness, is often as much important for defining the system behavior, as some individual coefficients. Researches of the cited Institute described the global model in the form of the dynamic system model.

The theory of dynamic modeling shows that every exponentially increasing variable is specially connects with one positive retroactive curve or feedback. This curve is called circulus vitiosus (vicious circle). For instance, we can cite the spiral of wages and prices. Wage increase follows price increase, which repeatedly causes wage increase, and so wandering in a circle. In case of the positive feedback, the causality returns to its starting point, therefore, the increase of one curve coefficient initiates the chain of changes resulting in a bigger growth of the changed parameter. To illustrate this, the behavior of the dynamic model of human population increase and industrial capital is cited in Figure 3.

Self-regulating system: Nature – Human – Society and Sustainable Development

The right side in Figure 3 illustrates the positive feedback that results in exponential parameter increase. The population with the constant rate of increase, the annual rate of newborn infants is proportional to the population size. Continuous population increase is continuing with the constant rate while the rate of natural increase remains unchangeable.

The population size is regulated by the second feedback process, presented by the curve on the left side in Diagram, regarding that this feedback is with the negative sign. The positive feedback causes progressive increase of the number of population, and the negative acts in the direction of regulating and maintenance of the system in the stable state. The process of negative feedback acts by average mortality rate. The result of average mortality rate and the number of population gives the number of the dead per year. It is necessary to answer the following questions:

1. What causes super-exponential population increase, especially from the time of the Industrial revolution?
2. What is the destiny of the humankind in the future?

The long historical period of the human society development, until the first Industrial Revolution, is characterized by the high birthrate, but also the high mortality rate. The average birthrate was insignificantly bigger than mortality rate; therefore, the human race was increased exponentially but very slow and in an unequal tempo. For example, the expected length of human life of most nations was about 30 years about 1650. Thanks to development and modern medicine, hygiene and health care, new production methods, food preservation, processing and distribution, as well as other life means, the average mortality rate has been radically reduced. The expected average of life length today is almost 60 years, with tendency of further growth. In the world proportion, and on the average, the resultant of positive cyclical course, i.e. the natural increase has been slowly reducing, and the resultant of negative feedback process, i.e. mortality rate has been quickly decreasing. Thus, an exponential population increase follows.

To illustrate this, at the beginning of our era, estimated population number was about 900 millions, at the beginning of the 19th century about one billion, in 1930 it was two billions, and in 1960, three billions and today there are about 6.7 billions of inhabitants in the world.

The dynamic structure of industrial development is very similar to the curve of population increase, thus the rate of industrial production increase is significantly bigger than the number of population. We should add that time factors exert influence on the regulation circle of industrial production. For example, big and complex capital investments, as steam power plants or oil refineries building can last for several years, but industrial capital investments have a limited period.

Figure 4. Model of synthesis system (exit)

The interaction between population size and industrial capital affect by means of invested capital in agriculture, size of arable land and environmental pollution. Interactions can be positive or negative. They can influence directly or with time tardiness, according to the suppositions of computer simulations.

There are different interactions between population and capital. For example, part of industrial capital products is agricultural capital, i.e. instruments of labor in agriculture: agricultural mechanization, irrigation systems, fertilizers, and so on. Agricultural capital and size of cultivated soil significantly exert influence on the volume of food production. Both industrial and agricultural production pollutes the living environment. The level of pollution retroactively influences on mortality rate and reducing the volume of agricultural production. All considered factors are mutually connected. Population number cannot be increased without enough food, food production increase is the function of economic development, and industrial increase requires more raw materials and sources of energy. It increases pollution, which, retroactively, limits population increase and food production. The described feedback system relating to population, capital, agricultural and environmental pollution is illustrated in Figure 6 [Moser, 1998, p. 53]. Conclusions relating to the presented complex system of interactive connections follow.

Population increase, expansion of agriculture and technological revolution turn our planet into a uniform connected system. There are not mutually isolated problem in the contemporary world. Superficial and palliative solving of individual problems causes the occurrence and intensification of other problems. Solving global problems requires the global perspective, radically new instruments of analysis, planning and decision-making, and, before all, considering humankind perspectives.

Self-regulating system: Man – Society – Sustainable development

At the First World Conference on Global Modeling, September 1978, seven different models were presented. Three researchers of MIT, Donnell Meadows, Gerhard Bruckmann and John Richardson presented the most important results of these models [Meadows, et al., p. 87]. They were surprised seeing that all the models resulted in the same qualitative consequences on the position and perspectives of the world. We shall cite only the most important:

1. There is no reason not to satisfy elementary needs of the humanity. However, the cause of unsatisfying needs today should be searched in current social and political structures, accepted norms and understanding of the world, not in the shortage of resources.

2. Most human population, physical and material values cannot be endllesly increased in the limited area of the Earth.

3. There is no complete and reliable information on physical capabilities of the Earth to satisfy needs of increasing population and accumulation of fundamental values. Only abundance of incomplete analyses and materials are available, evaluated both optimistic and pessimistic by different people.

4. If in practice, the previous development policy continues in the next several decades, the desired future or satisfaction of basic human needs will not be realized. Its continuation will result in deepening the gap at the level of living standard of the rich and the poor, exhaustion of most natural resources, destruction and degradation of the living environment and aggravation of material and other life conditions of the population.

5. Exact prediction of the future, better or worse, is not possible. It depends on today’s determination and decisions.
6. Technological process is natural and necessary, but the results of global modeling simply show that no technological revolution itself guarantees the desired future.

7. The people and countries increasingly depend on one another in time and space. Decisions made in the given time and given countries have far-reaching consequences, which cannot be predicted intuitively. Now, computer models with necessary detailing and exactness cannot simulate them.

8. The stable equilibrium does not characterize the structure of today’s social and economic systems. The present structure causes either conjuncture or stagnation. History points to the cyclic development as enthusiasm, then recession, stagnation at the low level, then conjuncture again. To form the stable system, the conscious transformation of social structure is necessary.

In addition, after three decades of development, we can say that actuality of previous conclusions is not disparaged; on the contrary, it is increasingly relevant.

V. CONSTRUCTION OF THE GLOBAL MODEL

Researchers of MIT constructed a simplified model for regular functioning of the global model by the computer simulation for the period from 1900 to 2100. For the next period, they started from the supposition that bigger changes will not follow in physical, economic and social conditions, i.e. development will continue based on today’s tendencies. The model includes five variables, which are included based on development since 1990. The model, presented in Figure 5 [Moser and Palmai, 2006, p. 1150], illustrates that food production, industrial production and number of population increase exponentially until, because accelerated exhaustion of natural resources, do not begin the collapse of industrial prosperity. Because of factors whose influences are manifested by some tardiness, the population size and environmental pollution will increase for while and after the rapid decline of industrial production. All the five fundamental factors, i.e. the increase of population numbers, food production, industrial development, consumption of unrestorable natural resources and the level of environmental pollution, are increasing now rapidly. That is, almost every today’s activity of humankind can be presented by curves, which exponentially increase.

By the global model construction, collaborators of MIT tried to sum up knowledge about the causality level of connectivity of the cited factors and express them in the language of their mutual involves interactions. The main aim of model construction is to define the most characteristic ways of behavior of parameters when the world system attains the maximal growth limits.

The anticipated flow of defining the global behavior system has the character of predicting. The value of population, raw material sources and other parameters do not represent the exact prognosis of their movement in individual years, but they only extrapolate the tendencies of system behavior. The more exact prognosis requires a much more complex system, besides, more precise and clearer information are necessary on the system behavior in relation to those which we have today.

In the period from 1970 to 1984, the world began to construct detailed global models. Thirteen main models are known. The models were constituted in different places in the world and with different aims. Model methodologies differentiate according to complexity, i.e. input and output variables, the length of time perspectives and results. Data choice was done in different way. The interesting, and at the same time worrying statement, that only three models analyze data about reserve and exhaustion of the natural resources and environmental pollution, and one model processes the problem of policy and war. Some models are constructed with a view of denying the statements of other models. Finally, we came to the perception cited by John Richardson, Director of the Research Institute for Applicative Systems in Washington. He said: “We can research any global problem if we are available to define values and political aims of the society and individuals and understand why the people are as they are, and why they make such decisions and especially if we understand how it can be changed” [Moser and Palmai, 2006, p. 153]. Although it looks strange, adequate answers have not been answered. The work on constructing the global models stopped. Today, many authors consider that the exit is possible in the model of synthesis system.

VI. THE MODEL OF SYNTHESIS SYSTEM

The aim of researching the global synthesis system is modeling mutually dependent life conditions and suppositions for functioning the nature and humankind in order to percept the long-term behavior, discover the past and predict the future. Previously, it was stated that the attempts of global modeling got into a dead end street. It is manifested in the fact that some researchers and research institutions often give contradictory prognoses. The main causes of failures are known as predomination of mathematical models, overrated economic aims, non-existence of methodologies for including numerous crucial aspects as human behavior, political and economic structure, and some other things.

It is considered that the cited contradiction, i.e. the failure of global modeling is possible to solve by the general system theory, i.e. scientific knowledge on the system of universal validity, which can explain the substance of functioning the nature and society. Attempts to create the universal system theory or general system theory have lasted for half a century, but thirty-three obstacles have been discovered to define the theory of synthesis system. However, it is worth of trying to point to the essence of general system theory because it is considered that without new analyses, summing up and synthesis is not possible to define a real model of sustainable development. In addition, it is considered, at
least in principle, there is a correct defined methodological basis of the synthesis system model.

To present the essence of this theory we are pointing to the three examples:

1. “The general system theory represents an unusual mixture of analysis and synthesis, basis and applied theoretical and experimental, holism and reductionism (researching parts and the entirety), science and philosophy. There are attempts, originated from the general system theory, which compare the suppositions of this theory to practicality of the West and mysticism of the East, predicting that it is possible to bridge the gap between them, illusively opposed branches of the human civilization. Probably, there are individuals laughing at these beginning steps to eliminate the gap between science-technology and the human values. Others are aware that we have to do quickly something against this “schizophrenia” of the human society if we want to survive for a long time.” (Len Troncale, The International Institute for Researching Applied systems, Austria, Luxemburg, 1989) [Moser and Palmai, 2006, p. 169].

2. “...Until all the structures representing our social-economic system are not completely analyzed, we cannot successfully deal with them, just the same as no any motor vehicle can be maintained in order if we do not know the mutual functioning of its parts ...” (The Limits of Increase, 1, Report of the Club of Rome).

3. “...” For complex situations, many our contemporaries are not capable to recognize eternal values and their harmonization with new values that are arising. . . Therefore, they are upset when they think about the current course of occurrences and they are shaken up in the danger between hope and anxiety. However, just the current course of things provokes the people, forcing them to look for answers. However, the course of history is intensively accelerating so that an individual can hardly follow it. The destiny of the humankind in the future will be one and identical; it is not expanding in mutually separated histories... Therefore, the humankind passes from the ideas that the world order is one and identical; it is not expanding in mutually separated histories... The great majority of questions are put in the new interdependence, requiring new analyses and new syntheses.” (The Second Vatican Council, known as Vatican II, 1962-1965) [Moser and Palmai, 2006, p. 169].

Based on the previous considerations, we can say that the solution is not possible without new analyses, summing up and syntheses, as A. Pececi [Pececi, 1984, p. 107] cites in his pretty somber evaluation of the situation:

“This day’s organization of the human society quite disables to manage it and it is the main obstacle to start to solve huge tasks which the humankind must solve. In these circumstances, no project of the global size can be successful, even planned, disregarding to the importance of its aims. Although the history of humankind in the global size is similar to a system, no political-philosophical system or institution capable to govern its development has yet been formed up to now. The humankind in its development has attained huge knowledge more or less in an archaic way, further deepening the gap between different societies. However, this “progress” has not been followed by the appropriate development of social and political ingenuity and creativity. This gap and imbalance between human-inventor and human-manager started in the Homo sapiens, then widening to every human community, creating the societies incapable to govern rationally and efficiently, coordinate and orient available volume of resources of knowledge and experience towards to useful aims. All this represents our collective wealth. Therefore, the whole world is still in a disorganized, labile state, without possibilities to govern it efficiently...”

As previously said, competent scientific circles consider that the solution can be found in designing the model of synthesis system, whose methodological foundations, in spite of obstacles, have been established. Instead of the conclusion, we can say that nowadays development orienting to the desired direction represents the realization of sustainable development. Sustainable development supposes the constant development of science and technology and the rehabilitation of self-regulating capabilities of the nature and society. Only in this way, the living environment can enable the future generations to have qualitative life conditions. The future will show if the previously said is reality or utopia.

REFERENCES
[4] Lorenz K., Mensétek meg a reményt! Európa Könyvkiadó, Budapest 1999