

International Conference on Research Paradigms Transformation in Social Sciences 2014

# Specificity of social systems development prognosis in conditions of transition to knowledge society

Yuliya Nikitina\*

*National Research Tomsk Polytechnic University, Tomsk, Russia*

---

## Abstract

Based on the system approach, the article investigates the prognosis specificity for social systems development trajectories. It is demonstrated that conditions of transition to knowledge society determine the development of completely new features of social prognoses. Peculiarities and conditions of social prognosis, which provide the adequacy of control actions, are revealed. Recommendations on social prognosis under conditions of transition to knowledge society are developed, considering the specific features of social systems and external environment instability. The functional load of social prognosis in modern conditions is evaluated.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

Peer-review under responsibility of Tomsk Polytechnic University.

*Keywords:* social system, development, prognosis, management, knowledge society

---

## 1. Introduction

The dynamics of ongoing change, influence on the environment, management complexity and importance of social prognosis intensify with transition to the knowledge society. Information becomes the basic resource in these conditions, and prognosis of social system development acquires a key significance.

Social prognosis as a theoretical base, providing the adequacy of management actions, is characterized by an increased complexity, which is specified by peculiarities of social systems, their ability for self-organization and self-development in the first place. Interaction with such systems is characterized by nonlinearity. It means that level of a system response to a contributing factor influence can be disproportional to the intensity of the latter, subject to the non-linear law. Moreover, social systems are open, therefore, regularities of their functioning and development are also described by continuous variations, what results in an increased complexity of reliable forecasting.

## 2. Subject and methods of research

---

\*Yuliya Nikitina Tel: +7-3822-563-529

E-mail address: [Ynik@tpu.ru](mailto:Ynik@tpu.ru)

Multiple uncertainties of a social environment aggravate the management complexity, determined by non-linearity of social processes in conditions of transition to the knowledge society. Potential multivariance of social systems development specifies the range of possible trajectories, as well as complexity of emerging problems.

Under the circumstances, development of relevant prognoses, considering dynamics and tendencies of contemporary social processes, becomes one of the most urgent, and, at the same time, the most challenging tasks. It determines the specific nature of prognosis making for social systems development under conditions of transition to the knowledge society as the subject of this research.

To solve the stated problem, the author uses such general research and philosophical principles and methods, as: the dialectical method, the systems approach, the comparative analysis method, the principle of determinism, and the development principle, applied in the context and with consideration of specific features of globalization processes; as well as some provisions of the theories of social management and global evolutionism, which were engaged due to complex and multidimensional nature of the research.

### 3. Results obtained

Possibility of forecasting of social process development trajectories with an acceptable accuracy has been the subject of a continuous polemic for many years. Thus, for example, K. Popper denied the existence of social development objective laws and stated that history has no sense and social predictions can only lead to a disaster (Popper, 2012). An American philosopher and sociologist, Alvin Toffler, in his attempt to forecast the future of the society extrapolates the vast changes to the future. His forecasts concern the exponential complication of society, an increase of its development alternatives and, as a consequence, increase of decision making complexity (Toffler, 1987, Toffler, 1980).

In our opinion, one of the first theoretically significant attempts of social prognosis was made by D. Bell in his book “The Coming of Post-Industrial Society” published in 1973 (Bell, 2000). As Bell himself noted, the objective of his researches was to determine the trends, aimed at defining the image of the human community in the 21st century. The concept of post-industrial society, owing to which Bell has become the most recognized theorist of the social prognosis in the West, specifies general frames of a social search without strict restrictions.

Importance of social systems development forecasting was emphasized by many authors. In 1943 a German sociologist, O. Flechtheim, introduced a special term “futurology” to define some “philosophy of the future”, which was further widespread as the notion, fixing the prognostic functions for the whole set of science disciplines. Today “Future studies” are an interdisciplinary system approach to past changes analysis, studying of trends and results of changes at present for developing alternative scenarios of possible changes in the future. Nowadays, an active search of forecasting effective methods for social system development trajectories is carried out, with many specialized international and national organizations being established for it. Thus, the International Futures Research Academy - a group of researchers from different countries – was established for dealing with problems of theoretic and practical forecasting. There are four structures leading futurological researches in the United States Congress. In Russia the branch of International Futures Research Academy, Association for Cooperation with the World Future Studies Federation, the ‘Forecasts and Cycles’ Association, the Society of Financial Analysts and Forecasters, N.D. Kondratyev International Fund, the ‘Strategy’ Center, ‘Applied Prognostics’ Center and other.

A contemporary stage of social development is characterized by an entire complex of global threats, forming an unprecedented risk level for the human community and making the prognosis for some term period practically impossible (Fukuyama, 2002, Toffler, 2002, Beck, 1992, Castells, 2010, Held et al., 1999, Jansen, 2000, Masuda, 1990). All of this defines the importance of relevant prognosis for social systems development.

Awareness of the society about global threats and modern world contradictions was accompanied by conceptualization of a special society – the knowledge society, which condition is determined by priority development of knowledge. The foundation for this concept was laid by such scientists, as Drucker (Drucker, 1993) and Machlup (1962). The role of knowledge in economic processes was studied by Schumpeter (Schumpeter, 2012). In the 1970s D. Bell proposed the concept of ‘post-industrial society’, where scientific knowledge becomes the basis for social transformations (Bell, 2000).

Nowadays the ways of using scientific knowledge are changing dramatically. Here, the innovative way of development certainly becomes a prerequisite for the knowledge society formation. According to Drucker (1993, 2012), knowledge changes the way of society functioning as a complex interconnected system.

It should be mentioned that under conditions of transition to the knowledge society the long-term prognosis for social system development is complicated significantly. Thus, Tolstoukhov (2003) states: “Modern-state of a global social context in the 21st century is subject to more and more drastic transformations, initiating a rising wave of various mega-risks, mega-hazards, mega-threats (nuclear, chemical, biogenetic, ecological, socio- economic, and existential). During these transformation processes a new condition of a global social context appears where production of the mentioned risks acquires an industrial scale. The industry of such mega-risks undermines the fundamental principles, on which lied the traditional forecasting and prevention practice of coming global context conditions.”. A specific significance of the reliable social prognoses development for effective social system management was emphasized by Malinetskiy and Kurdyumov (Malinetskiy, 2012).

The problem of forecasting is complicated by the fact that prognoses can have an active influence on the reality formation. Moreover, the existing forecasting methods cannot take into account both the external environment and the system behavior uncertainty. Prognosis of a system development with human involvement, where main peculiarities are memory, non-linearity and feedback availability, is determining of their development possible ways, provided that information about pre-history of events and system changes, happening at present, is available. However, the existing models of complex systems cannot not always give an unambiguous prognosis of possible outcomes due to different uncertainties, decreasing the model adequacy:

- uncertainty due to lack of knowledge or inaccurate knowledge of factors or processes, influencing the situation;
- uncertainty due to mathematical incommensurability of numerical evaluation of values, describing the system dynamics;
- uncertainty due to nonlinearity and some equilibrium states and attractor structures of the system;
- uncertainty due to inappropriate definitions structure and impossibility of facts identification.

Consequently, the following problems arise when making decisions, concerning the selection of social system development trajectories. The first problem is finding the parameters, required and sufficient for defining the system condition and providing its manageability (so called formalization). Formalization of social system behavior, for which heterogeneous components (technical, biological, political, etc.) are typical, requires common complex of parameters for describing the situation. The second significant problem of social system functioning in modern conditions is information overload, caused by increase of available information. Tendency to take into account as many parameters and factors as possible leads to the information oversaturation. The decisions made will become less relevant before their implementation due to insufficient speed of data processing in relation to speed of environment and system changes. The phenomenon called by different authors as the “phenomenon of supersystem”, “synergetic effect”, “emergence”, etc. is the third essential problem. Systems in the process of interaction create a higher level system, possessing its own properties different from other. The difficulty is impossibility of accurate forecasting of evolution ways for the emerging supersystem, based on the properties and characteristics of the composing systems.

The above uncertainties worsen the management complexity, caused by social process nonlinearity, and potential multivariance of social system development determines both the range of possible trajectories and complexity of emerging problems. This peculiarity was mentioned by many researchers. For example, Toynbee (Toynbee, 2011) emphasizes that human communities have a number of development alternatives in the moments, defined as bifurcation points, when the system position becomes unstable. In these circumstances the investigation of social prognosis development possibilities becomes one of the most urgent and challenging problems, solved for achieving an effective social system adaptation level in the nonlinear environment. Malinetskiy (Malinetskiy, 1997) emphasizes the objective difficulties of social development prognosis and points out that many systems (due to “memory”, “inertness” of the subject) have the forecasting horizon of their behavior, which limits the prognosis capability considerably.

Zadeh (Zadeh, 1973), one of the pioneers of the synergetic paradigm, the founder of the fuzzy approach, by drawing attention to limitation of prognosis possibilities, formulated the so called incompatibility principle, according

to which the increase of the system complexity results in the decrease of its accurate description capability. The given principle introduces serious limitations in the social development management capability, which enhance with system transition in a highly unstable condition.

At the same time, another founder of modern synergetics, Prigozhin (Prigozhin, 2011), made an assumption about fundamental unpredictability of the system development in nonlinear conditions, the assumption is being criticized more and more lately. We believe that the approach, developed by the S.P. Kurdyumov's scientific school and based on the theory of strange attractors, can provide a more adequate theoretical basis for social systems development models (Kurdyumov et al., 2012). According to Kurdyumov's approach, the evolutionary process is realized as "wandering around the field of development ways" and selection of an evolution trajectory is a case of eventuality. As the variety of possible outcomes is limited, the system behavior is not absolutely unpredictable, therefore, we can speak about prospects of forecasting of such system development not in terms of unambiguous predeterminacy, but the outcome belonging to the given limited variety of conditions.

Transition to the society where knowledge becomes a key resource deserves special attention. Knowledge introduces corrections not only to behavioral models, but also to the nature of social system external environment. High dynamics and environment uncertainty have become one of the most significant consequences of the global information space creation. Combined use of information and communication technologies created conditions for quality changes in the ways of social interaction and adaptation.

One of the most prominent manifestations of information and communication technologies impact on social processes became the information revolution which stimulated the formation of macrotendencies, based on the expansion of the social systems interaction and mutual influence. These tendencies, which appeared due to growing integration processes to a great extent, in their turn, became a kind of a catalyst for globalization processes. On the one hand, globalization formed new favorable conditions for social systems development; on the other hand, it made their external environment extremely dynamic and uncertain. Along with that, absence of the strict predeterminacy in social system development forms prerequisites for entirely new social structures formation. Such structures are characterized by a high degree of adaptability, assuming ability for searching and effective decision-making that, in our view, expands the limits of social system forecasting and management significantly.

In conditions of varying environment and lack of information for effective social system management, it is necessary to increase their adaptation capabilities significantly which depends on forecasting capability of social systems evolution ways and the direction of environment changes to a considerable extent (Nikitina, 2007).

Growing instability and dynamics of the external environment became an integral factor, defining the peculiarities of social system functioning and development to a great extent. At the same time, it does not simply contribute to entirely new possibilities occurrence, but also results in a set of additional problems. One of the most important problems is that of improving social system adaptation capabilities to the complex and dynamic external environment. Well-adaptable system is that which carries out constant changes, required for survival and development in the external environment; and the adaptation itself is the system adjustment to changed conditions. Traditionally, adaptable systems are divided into self-adaptive and self-organizing systems. As a response to the external environment changes, self-adaptive systems change their functioning parameters without the system internal structure changing; self-organizing systems are able to reconstruct their internal structure in the same conditions. Thus, for example, structural changes of social systems can be expressed as management system modification, changes of internal relations, etc.

An adaptable system is able to overcome crises, determined by its internal dynamics or external environment change more successfully. In modern conditions the adaptable social systems are characterized, as a rule, by a variety of elements, relations flexibility, decentralized decision-making and the orientation towards external environment. An adaptable social system needs less correction and, if necessary, it is more successful in achieving the objectives than systems without a high level of adaptation capabilities.

Adaptation capabilities of social systems specify a possible range of behavioral models in the unstable external environment to a considerable extent. At present the most significant approaches for analysis of social systems adaptation capabilities are the following. According to the first approach, an adaptable social system is characterized by certain uniformity, meaning that the system essence is expressed at all levels. In this case, the analogy with a

fractal system is relevant, in which the same geometrical pattern is reproduced on a reduced scale over the whole system.

According to the other approach, a social system functions as one organism. The same as cells are different from each other by their functional purpose, and nevertheless contain all information about the organism, necessary for survival and development, the social system subsystems contain general information about the system and achieve a common goal of survival and development in spite of their difference in nature and relations.

Although there are fundamental differences between the approaches, their common feature is acceptance of an integrating origin as an inherent feature in all subsystems and elements of the adaptable social system and reflecting the system essence. For example, the purpose of functioning, the accepted type of relations, way of information interaction, etc., can serve as such origin.

Obviously, in modern conditions the social system adaptation is a complex mechanism, which effectiveness is determined by a variety of factors. As a key adaptation factor, one can point out information accumulation and knowledge transfer as well as information orientation of the social system. The systems using the so-called group dynamics approach, based on the self-organization paradigm, have the greatest advantage. Such systems have higher ability for adaptation due to their capability to generate, select and save new changes, thus providing constant self-renewal.

As Nonaka (Nonaka, 2008) mentions, the essence of self-renewal processes in the social system can be expressed in four main stages:

- emergence of chaos or instability in the system;
- increase of disorder and concentration on contradictions;
- emergence of self-organizing subsystems and formation of their interaction;
- information transformation into knowledge.

At the same time, creation of information and its transformation into knowledge is the most important part of the system renewal.

In our opinion, first of all, ability for self-renewal is demonstrated by the systems, corresponding to the description, given by Ashby (Ashby, 2011) in “The Law of Requisite Variety”: “In order to create a system able to cope with problem solving and having a certain variety, it is necessary for the system to have a greater variety than that of the problem being solved, or the system would be able to create this variety in itself”. In essence, it means for social systems that under the influence of a quite big number of external factors, the system is able to adapt successfully only if control parameters expand. At the same time, analysis of different nature systems shows that their viability, capabilities of adaptation and development primarily depend on the degree of subsystems and relations variety. In our view, successive change of self-renewal process stages in the social system is simply a mechanism of variety increase, oriented to the system capabilities expansion for solving the adaptation problem.

Majority of social system adaptation problems are caused by their dynamics complexity, described by the following features:

- development evolutionism;
- non-equilibrium;
- self-organization and self-reproduction;
- process asymmetry.

Nevertheless, the dominant factors, determining the social system adaptation outcome, are not external factors, but their internal dynamics that is primarily a result of their ergativity. In particular, the presence of immanent objectives and criteria of a subjective nature in a social system functioning and development allows speaking of the predominant role of internal interactions in forming their evolution direction.

Multiplicity of possible development trajectories selection in bifurcation points, peculiar to complex systems in the non-linear condition, is increased for social systems due to their ergativity that is determined by predominance of informative, cultural, psychological relations over physical interactions. Besides, the variety of changeable and often contradictory subjective goals and criteria of the subsystems forms the factor of additional variability, defining the predominance of unpredictability over determinism. All of these peculiarities form the requirement of a high level flexibility and adaptability for a social system in order to provide an effective adaptation in unstable conditions.

Changes in social systems structure and functions, caused by globalization processes, allow speaking of a continuously growing flexibility and external changes sensitivity of the system. The systems evolution is constantly accompanied by increase of their complexity, determined by the adaptation necessity to open, dynamically transformable environment, which is expressed in a growing significance of successful innovations for social systems, sometimes essential. From our point of view, survivability of social systems in such conditions mainly depends on innovations, based on co-adaptation and co-evolution principles.

In this case, co-adaptation is expressed both as a balance between social system assimilation and accommodation and their mutual adaptation. Besides, the essence of social system adaptation processes is changing. They replace telogenesis (adaptation to the given state) with arogenesis (extension of sets of existence environments) more and more actively. It can be seen in their relations diversity, distinguishing by flexibility and changeability, variety of mutual coordination ways, high internal structure heterogeneity, as well as self-reorganization and self-reproduction. This specific nature of the co-adaptation mechanism creates conditions for co-evolution, which is a sequence of changes, replacing one another, mutually caused, inseparably coordinated, and occurring at different levels of the social system evolution.

Thus, an increased complexity of social system management is determined in modern conditions, on the one hand, by their specific nature; on the other hand, by a high level of the external environment dynamics, determined by the conditions of transition to the knowledge society, limiting the forecasting horizon and admissible time frame of management. At the same time, these conditions dictate the necessity of developing the effective social system management methods on basis of an effective prognosis of their development, providing fast adaptation to extremely unstable external environment. In such conditions, the self-organization methods provide the best guidelines in searching solutions for forecasting and social system management problems.

It should be particularly noted that social prognosis as a theoretical base, providing management adequacy, is distinguished by an increased complexity, caused by the social systems features, first of all, by their ability for self-organization and self-development. Interaction with such systems is characterized by non-linearity, which is showing in the level of a system response to a contributing factor impact is disproportional to the intensity of the latter, subject to the non-linear law.

As it was mentioned, social systems are also open and it means the continuity of their interaction with the environment, expressed in the substance, energy and information exchange. Thereby, the regularities of their functioning and development are also characterized by continuous changes, determining an increased complexity of the reliable prognosis development.

Specific nature of social prognosis is determined by the feedback between the subject and the object which finally is able to lead to the prognosis of self-realization or self-destruction. In other words, the predicted future influences the future being realized. For the first time this effect was investigated in detail by Merton (2012), an American sociologist-neopositivist. The basis for prognosis self-realization or self-destruction is a significant positive or negative response of social forces to the prognosis.

#### **4. Conclusions**

Thus, no matter what social prognosis is, it has a hypothetical nature, that is it refers more to development trends rather than not future conditions of the social system. Under conditions of transition to the knowledge society, due to a variety of possible outcomes and prognosis instability towards both external and internal impacts, a considerable part of social prognosis is considered incorrect. Nevertheless, even in case of prognosis incorrectness, its development has a significant functional load: revealing the possible variety of social system development alternatives, the prognosis allows estimating social consequences of a decision-making, and it is also a signal, warning about an increased risk or even disastrous consequences of certain development trajectories.

#### **Acknowledgements**

The author expresses a deep gratitude to National Research Tomsk Polytechnic University for an opportunity to get a valuable feedback and suggestions from colleagues on the subject of research during this scientific and research forum.

## References

- Popper, K. (2012). *The Open Society and Its Enemies*. Moscow: Feniks.
- Toffler, A. (1987). Previews and Premises. *Sociological research*, 5, 118-131.
- Toffler, A. (1980). *The Third Wave*. New York: William Morrow.
- Bell, D. (2000). *The Coming of Post-Industrial Society. A Venture in Social Forecasting*. New York: Basic Books.
- Fukuyama, F. (2002). *Our Post human Future: Consequences of the Biotechnology Revolution*. New York: Farrar, Straus and Giroux.
- Toffler, A. (2002). *Future Shock*. New York: Bantam Books.
- Beck, U. (1992). *Risk Society. Toward a New Modernity*. London: SAGE.
- Castells, M. (2010). *The Rise of the Network Society*. London: Blakwell Publishers.
- Held, D., McGrew, A., Goldblatt, D., & Perraton, J. (1999). *Global transformations*. Cambridge: Polity Press.
- Janszen, F. (2000). *The Age of Innovation*. London: Prentice Hall.
- Masuda, Y. (1990). *Managing in the Information Society: Releasing Synergy Japanese Style*. Oxford: Blackwell.
- Drucker, P. (1993). *Post-capitalist society*. New York: HarperCollins.
- Machlup, F. (1962). *The Production and Distribution of Knowledge in the United States*. Princeton: Princeton University Press.
- Shumpeter, J. (2012). *The Theory of Economic Development*. Moscow: Progress.
- Bestuzhev-Lada, I. V. (2011). Prognostic rationale for social innovations. Moscow: Academia.
- Drucker, P. (2012). *Innovation and Entrepreneurship*. New York: Collins.
- Tolstoukhov, A. V. (2003). Global social context and outline of eco-future. *Voprosy filosofii*, 8, 49-63.
- Malinetskiy, G. G., & Kurdyumov, S. P. (2012). Synergy, prognosis and risk management, Synergetic paradigm. Nonlinear thinking in science and art. Moscow: Progress.
- Toynbee, A. J. (2011). *A Study of History*. Moscow: Progress.
- Malinetskiy, G. G. (1997). Nonlinear dynamics and "historical mechanics". *Obshchestvennye nauki i sovremennost*, 2, 99–111.
- Zadeh, L. A. (1973). Outline of a new approach to the analysis of complex systems and decision processes. *IEEE Trans. Syst. Man. Cybern.*, 1, 28–44.
- Prigozhin, I., & Stengers, I. (2011). *Order out of Chaos. A New Dialogue of a Human with the Nature*. Moscow: Progress.
- Kurdyumov, S. P., & Knyazeva, Ye. N. (2012). *Laws of Evolution and Self-Organization of Complex Systems*. Moscow: Nauka.
- Nikitina, Y. A. (2007). Innovative activity of social systems as an effective mechanism of adaptation in conditions of growing instability of external environment. *Bulletin of Tomsk Polytechnic University*, 310, 3, 142-146.
- Nonaka, I. (2008). *Creating organizational order out of chaos: self-renewal in Japanese firms*. New York: Oxford University Press.
- Ashby, W. R. (2011). *An Introduction to Cybernetics*. Moscow: Nauka.
- Merton, R. K. (2012). *Social Theory and Social Structure*. Moscow: AST.