SYSTEM ANALYSIS IN ECONOMICS – 2018

V INTERNATIONAL
RESEARCH & PR ACTICE CONFERENCE-BIENNALE

FINANCIAL UNIVERSITY
UNDER THE GOVERNMENT
OF THE RUSSIAN FEDERATION

«SYSTEM ANALYSIS IN ECONOMICS – 2018»

PROCEEDINGS OF THE V INTERNATIONAL RESEARCH CONFERENCE – BIENNALE

1919

ФИНАНСОВЫЙ УНИВЕРСИТЕТ
ПРИ ПРАВИТЕЛЬСТВЕ РОССИЙСКОЙ ФЕДЕРАЦИИ

21-23 NOVEMBER
2018
Moscow

УДК 330.46(08)
ББК 65.050.03
С40

Reviewer:
Doctor of economics *V.I. Maevsky*, Doctor of economics *B.Ie. Erznkyan*

С40

System analysis in economics – 2018: Proceedings of the V International research conference–biennale (21–23 november 2018). – Moscow, Prometheus publishing house, 2018. – 348 p.

ISBN 978-5-907100-59-6

Since 2010, department "System Analysis in Economics" of Financial university under the Government of the Russian Federation has been organizing an international research & practice conference-biennale "System Analysis in Economics" (http://sae.systemeconomics.ru/en/). In 2018, the conference was held in a multiprofile format, bringing together scientists from different cities of Russia and other countries of the world, in the following directions (scientific sections): “Modern theory of socio-economic systems”, “Methodology and methods of system modeling”, “System measurements & soft computing”, “System analysis in solving urgent social and economic problems”, “Social and economic cybernetics”, “Systemic problems of digital economy development: Internet people, Internet of things, Internet ideas”. The conference was held too round tables “Scientific and technological progress and socio-economic development: problems of systemic balance” and “System analysis of pension reform in Russia”. Working languages: Russian, English.

In this collection the proceedings (articles and reports) of scientists and practicing specialists who participated in this conference are presented. Dedicated to different aspects (theory, methodology, tools and practical application of system analysis and economic modeling) the scientific materials are combined by the system paradigm as a common foundation. This Collection is designed for those who are interested in system approach to re-search and problem solving in social-economic life of society. The articles are published in the author’s edition. According to the results of the conference, two collections are published: the first collection in Russian - in printed form, the second in English - in electronic form. Together, by joining forces, we can better propagandize system thinking and system approach as the best theory and methodology of research, structuring, modelling and solving of social and economic problems.

ISBN 978-5-907100-59-6

JEL D20, L22, M20

SOCIO-ECONOMIC ECOSYSTEMS IN THE LIGHT OF SYSTEM PARADIGM

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Abstract. The article examines the essence, concept, features and structure of socio-economic ecosystems from the standpoint of the system paradigm. It is shown that the internal structure of an ecosystem is isomorphic to the structure of a tetrad — a complex of four stably interacting systems: object, environment, process and design. The concept of apoptosis is introduced as a predetermined cessation of the functioning of the system after a certain period of time or when the system leaves the boundaries of a certain zone of space. Apoptosis has been shown to be a natural mechanism for the functioning and development of ecosystems. The relationships between ecosystems, clusters, platforms, networks and incubators are revealed. It has been determined that the concept of an ecosystem can serve as a kind of umbrella for the concepts of clusters, platforms, networks and innovative incubators, and each ecosystem contains subsystems similar in structure and functions to the four systems of the indicated classes.

Keywords: socio-economic ecosystems; clusters; platforms; networks; innovative incubators; unit of socio-economic analysis; apoptosis of socio-economic systems.

The system paradigm which goes back to the teachings of ancient philosophers, first of all, Aristotle, developed in the works of the founders of the general theory of systems, first of all, L. Von Bertalanffy and his followers, and being the basis of social studies of T. Parsons, N. Luhmann and others [1, 2], applied to the economy, was explicitly formulated by Y. Kornai [3, 4] and subsequently developed and extended to the sphere of various socio-economic phenomena and formations [5, 6, 7, 8].

According to the system paradigm, the main unit of the socio-economic analysis including the general social analysis proposed by V.M. Polterovich [9] as the main direction of the development of the complex of social sciences, should be a socio-economic system, which is a relatively stable in time and space integration of social and economic agents, socio-economic benefits and institutions. The transfer of the center of gravity from agents to systems forces us to revise the bulk of the economic theory of orthodox and neo-orthodox directions. The system paradigm allows not only to break down the existing barriers between institutional and neoclassical theories (the formation of neoinstitutional theory, in essence, did not change the composition of the units of analysis), not only to bring together an evolutionary approach and agent-oriented modeling, but also to create a single research space for the whole complex of socio - economic phenomena.

The level of generalization set by the system paradigm, combined with the space-time analysis and concepts of the general systems theory, allows us to hope for the creation of a unified multi-level and multi-purpose socio-economic theory similar to the unified field theory in physics.

The system paradigm in its developed form introduces us to the world of socio-economic systems and their interactions, including interactions regarding the creation and circulation of material and symbolic artifacts (goods). System analysis on the basis of the system paradigm, hopefully, can become a conductor of consistency not only in economics, but also in politics, management, national economy and national ideology [10].

Over the past 25 years, ecosystems have become one of the most actively studied types of socio-economic systems - a complex of agents, organizations connected by common location, functional relationships and participation in creating common socio-economic values [11, 12, 13, 14, 15, 16, 17, 18]. They often speak of the ecosystems of Sberbank, AvtoVAZ, Apple and others. Ecosystems can also be formed on a territorial basis (regional, city and municipal socio-economic ecosystems), and on mixed grounds (ruble zone, euro zone, etc.).

Around the same period other types of socio-economic systems — clusters, platforms, networks, and innovative incubators — were mentioned in the economics literature. The objective of this article is to analyze, on the basis of the system paradigm, the characteristics of these socio-economic systems, show their interrelation and give clear definitions of these phenomena. We show that the concept of an ecosystem can serve as a kind of umbrella for the concepts of clusters, platforms, networks and innovation incubators, and each ecosystem contains subsystems similar in structure and functions to the four systems of these classes. Thus, the choice of such entities as ecosystems, clusters, platforms, networks, and innovative incubators as units of a socio-economic analysis is not arbitrary, but determined by the universal structure of the space of socio-economic systems.

1. Socio-economic ecosystems

Socio-economic ecosystems (hereinafter - ecosystems) are now becoming a central element of the socio-economic landscape of countries. Despite the significant number of domestic and foreign publications on ecosystems, there is no exact and generally accepted definition of the term “ecosystem”. Thus, M. Jacobides, K. Kennamo and A. Gaver consider an ecosystem as “a group of firms in different positions across a sector or set of sectors that have mutual co-specialization at the group level and are not unilaterally managed hierarchically”[19]. R. Adner believes that “an ecosystem is determined by the alignment structure of a multilateral set of partners that need interaction so that the focused value proposition materializes” [20]. See also [21].

In this work, an ecosystem will be understood as a spatially localized complex of uncontrolled hierarchically organizations, business processes, innovative projects and infrastructure systems that interact with each other during the creation and circulation of material and symbolic goods and values, capable of long-term independent functioning due to the circuit of these benefits and systems.

The system economics method makes it possible to identify the features of ecosystems compared to other socio-economic systems, to determine the natural systemic structure of ecosystems, to reveal the essence of the processes of interaction of ecosystem components with each other and with the external environment, ensuring its homeostasis, including the exchange of space and time resources and intensity and activity of their use.

The features of ecosystems compared to other socio-economic systems can be summarized as follows.

1. Localization in space and continuity (unboundedness) of existence in time.

2. Internal integrity, territorial proximity, close links between components and participants of ecosystem activities.

3. Ability to self-reproduction of the ecosystem as a whole and its main components. The presence of mechanisms that keep the ecosystem from spatial expansionism and spatial contractionism. Homeostasis.

4. Self-development through the use and mutual transformation of non-consumable

environmental resources (space, time, energy) and in-system genetic selection.

5. Circularity (isolation, wastelessness).

6. Structural isomorphism of the ecosystem and its environment, close connection of the internal environment with the environment surrounding the ecosystem (high permeability of the spatial boundaries of the ecosystem).

7. Existence of mechanisms for equalizing the scale of ecosystem participants (individuals, organizations, projects) ensuring the sustainability of the development of the ecosystem.

8. Maintaining a balance between diversity and uniformity, variability and stability of ecosystem components.

9. The presence of the core and the protective layer.

10. Presence of internal stock and internal structure of values of the ecosystem as a whole.

11. Systemic non-hierarchical coordination of participants.

2. System structure of ecosystems

According to the definition adopted in this work, the following are distinguished in the ecosystem as relatively independent components:

1) organizational component - a set of organizations and independent individuals functioning as part of an ecosystem;

2) ecosystem infrastructure environment represented by various intrasystem institutions, regulations, procedures, mechanisms;

3) communication and logistics component that provides the processes of interaction of the organizational components of the system;

4) an innovative component - a set of activities, each of which is localized in space and in time, aimed at adapting the ecosystem to changes in the external environment.

Organizational component provides the structural framework of the ecosystem, the discreteness of the internal space of the ecosystem (autonomy of its participants), the continuity of functioning of the system in time. The infrastructure component ensures the coherence of the internal space and the life cycle of the ecosystem. Communication and logistics component realizes the possibility of communication and transfer of benefits between the ecosystem participants. The innovation component of the ecosystem realizes the creation of new goods, the transformation of individual components and the ecosystem as a whole.

In the system socio-economic theory [22], the basic typology of socio-economic systems is based on the identification of four fundamentally different types of systems depending on the system configuration in space and time. Systems with precisely defined boundaries in space and defined boundaries in time are among the object systems; systems with certain boundaries in time and indefinite boundaries in space are among process systems; systems with indefinite boundaries, both in space and in time belong to environmental systems; systems with precisely defined boundaries in time and in space - to design systems. In reality, most socio-economic systems can be attributed to one of these types due to the dominance of the properties of the object, environment, process or project subsystem. Object systems are discrete in space and continuous in time; infrastructure systems maintain continuity both in space and in time; communication and logistics systems function as discrete processes for the exchange of resources and information in a batch mode and contribute to increasing the homogeneity and continuity of space; innovative systems maintain discreteness both in time and in space. We see that for object, process, and design systems, mechanisms exist to limit their functioning in space or in time. The implementation of these functions is carried out through mechanisms that, by analogy with biological systems, can be called apoptosis. By apoptosis we mean here programmable, i.e. predetermined, termination of the system after a certain period of time or when the system goes beyond the boundaries of a certain area of space. Thus, for systems subject to apoptosis, space and / or time are fundamentally heterogeneous. For object systems, apoptosis is spatial in nature and automatically stops the operation of an object outside its spatial (usually territorial) boundaries. In particular, it can be said that "there is no enterprise beyond the borders of the enterprise". Of course, there are various connections of an enterprise with other systems, including other enterprises, however these connections are realized outside the boundaries of the enterprise itself. For design systems, apoptosis means the cessation of the functioning of the system after the expiration of the normative (or physical) period of its existence, as well as beyond the limits of the space allocated for its functioning. In particular, the construction project of a building is usually completed after the building has been commissioned and is limited to the territory set aside for construction. For process systems, apoptosis means the cessation of the functioning of the system after a certain time has elapsed or the disappearance of the conditions that determine the possibility or necessity of this process. In particular, the process of delivering a certain cargo by rail is terminated upon receipt of the cargo by the addressee. Environment systems do not have apoptosis mechanisms.

In real socio-economic systems, the behavior of systems is influenced by both the mechanisms of apoptosis embedded in them and the awareness or perception of these mechanisms by the participants of these systems. Thus, depending on the psychological characteristics of the participants, approaching the system to zones or periods of action of the mechanisms of apoptosis may be accompanied by an increase or, conversely, a decrease in the activity and / or intensity of their activity. Psychological features here concern the participant's energy concentration near the system's borders ("claustrophils") or, conversely, in space-time zones remote from the system's borders ("agorophiles"). The perception and implementation of apoptosis mechanisms in socio-economic systems, as well as in biological ones, are very complex and insufficiently studied processes. Their research can be a significant reserve for improving the management of socio-economic systems. The above four-component description of the ecosystem structure corresponds to the representation of the socio-economic system in the form of a tetrad — a complex of four stably interacting systems of object, environment, process, and project types [23]. At the same time, the basis for the stable functioning of the tetrad is the interaction of its subsystems in the sharing of space (S) and time (T) resources. Object-type systems (objects) possess certain reserves of space S and have access to unlimited time resources T, and also demonstrate the ability (I) to efficiently use the available space; environmental-type systems (environments) have unlimited access to the resources of the space S and time T, but are not endowed with sufficient capabilities (I and A) for their effective use; process-type systems (processes) have unlimited access to spatial resources S, limited time reserves T of their operation "without rebooting" and have abilities (A) for its effective use; project-type systems (projects) have limited reserves of time T and space S and sufficient abilities (A, I) for their effective use. In a free socio-economic space in the course of their livelihoods, each system seeks to compensate for the lack of existential (space-time) and energy (intensity-activity) resources that are deficient, for which it joins stable alliances with other systems that have this type of resources in excess. The active force in the formation of such alliances are project systems. They interact with object and process systems, receiving from the first access to time resources T, and from the second - to space resources S. In turn, the design systems allow the object systems to develop the primordial abilities (A) for the efficient use of time resources, and the process systems - the primordial abilities (I) for the efficient use of space resources.

Environment systems share resources of space S with the object systems and time resources T with process systems, receiving from the first opportunities (I) to effectively manage space resources, and from the second - opportunities (A) to effectively manage time resources.

As a result, the search for partners for sustainable interaction leads these systems to be included in tetrads (see Fig. 1).

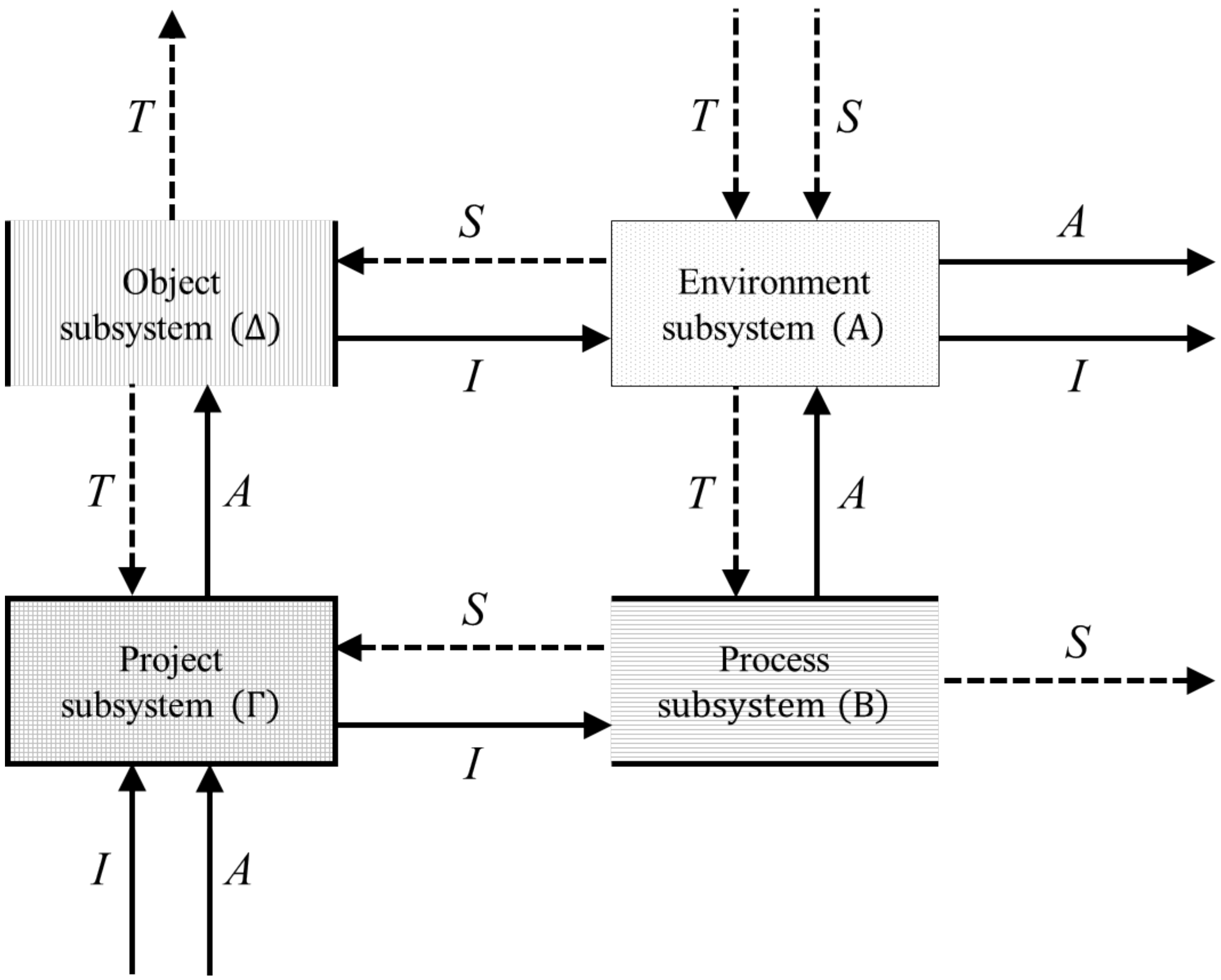

Fig. 1 **Structure and functions of the tetrad**

As a result, the balance of resource allocation A, I, S, T between the components of the tetrad (internal AIST-balance) is achieved by providing access to all resources A, I, S, T for each subsystem. The external AIST - balance is realized: in terms of space and time resources - by continuously receiving resources S, T from the external environment (through the environment subsystem) and returning the resource T through the object subsystem and resource S through the process one; in terms of activity and intensity resources - by a one-time acquisition of a stock of resources A, I by the project subsystem from the external environment as well as by providing the external environment with access to these resources through the environment subsystem.

The functions performed by the four tetrade subsystems are reflected in Table 1.

Table 1

Functions of the tetrade subsystems

tetrade subsystem	functions of the subsystem
Object subsystem	Converter S → T, A → I. Donor T for the external environment
Environment subsystem	S, T recipient (receiving from the external environment), donor A, I (direction to the external environment)
Process subsystem	Converter T → S, I → A. Donor S for the external environment
Project subsystem	Recipient A, I from the external environment, the recipient S, T from the internal environment. Converter S, T to A, I

It should be emphasized that the tetrad, despite its relative simplicity as a small-sized model of an ecosystem, is a kind of microcosm, in a generalized form reflecting the structure of a very wide class of systems of various scale and nature. In a certain sense, the tetrad can be considered as a universal archetypical model of a socio-economic system.

The correspondence between the components of the ecosystem and the structural elements of the tetrad as a system model of the ecosystem is presented in Table 2.

Table 2

Tetrad as a model of socio-economic ecosystem

Ecosystem components and characteristics	Tetrade elements
Organizational component of the ecosystem	Object Subsystem of the tetrad (δ)
Infrastructure component of the ecosystem	Environment subsystem of the tetrad (α)
Communication and logistics component of the ecosystem	Process subsystem of the tetrad (β)
Innovative component of the ecosystem	Project Subsystem of the tetrad (γ)
Types of existential resource flows circulating in the ecosystem	Exchange of space resources (S) and time (T) between the tetrad subsystems, as well as with the external environment
Types of energy flow circulating in the ecosystem	Exchange of abilities between active (A) and intensive (I) activities of the tetrad on the use of

	space and time
Ecosystem area	The amount of space available for the functioning of the tetrad
Ecosystem life cycle	The period of functioning of the tetrad

Thus, a picture of the functioning and interaction of the system components of an ecosystem, presented in the form of a tetrad, looks like.

3. Clusters, platforms, networks, incubators

The functioning of a modern market economy is based on the formation of various kinds of systems for coordinating socio-economic subjects [24]. By the end of XX century coordination of economic entities such as clusters [25, 26], platforms (see, for example, [27]), networks [28, 29], and innovative incubators [30] are in the focus of attention of researchers. The study of each of these types of socio-economic entities is carried out independently, using independent approaches and methods. The use of the system paradigm allows us to systematize these objects, highlight the key properties of each of them and answer the question whether this list is complete and whether we can expect the emergence of new units of socio-economic analysis. We show below that each of these formations in a stylized form can be identified with one of the four tetrad subsystems, and each ecosystem contains clusters, platforms, networks and incubators. There are many definitions of each of these concepts in literature. The following definitions are intended to reflect the key features of these systems, placing them in the context of the system paradigm.

Cluster is understood as a set of object systems connected by relations of functional dependence and territorial proximity. Obviously, the cluster itself, as well as its components, is one of the object systems. The cluster is a discrete system relative to space and continuous - relative to time.

Platform is understood as the union of technological, communication, institutional and other infrastructure environments in which the studied socio-economic systems are functioning. The platform as an association of environment systems also belongs to the class of environment systems. Platforms are continuous in space and in time. The network allows dual understanding. On the one hand, the network can be considered as one of the types of infrastructure for the implementation of logistics and communication interactions between socio-economic entities. In this case, the network is considered as a kind of environment system. On the other hand, a network is often understood not as a static structure, but as a dynamic process of exchanging material, informational or symbolic goods. With this understanding, the network is considered as a set of time-limited processes of moving material, informational, symbolic and other values and, therefore, from a functional point of view, is among the process systems.

Incubator (in the broad sense of the word, including incubators of innovations, business incubators, incubators of institutes, etc.) is defined as the totality of innovative projects implemented within this socio-economic system. The incubator, as well as its components, is one of the design systems. The incubator should be considered as a discrete system in time and space.

These properties of the types of systems considered allow us to arrange them in the quadrants of the two-dimensional space-time coordinate system, reflecting the discreteness / continuity of each given system relative to space and time (Fig. 2).

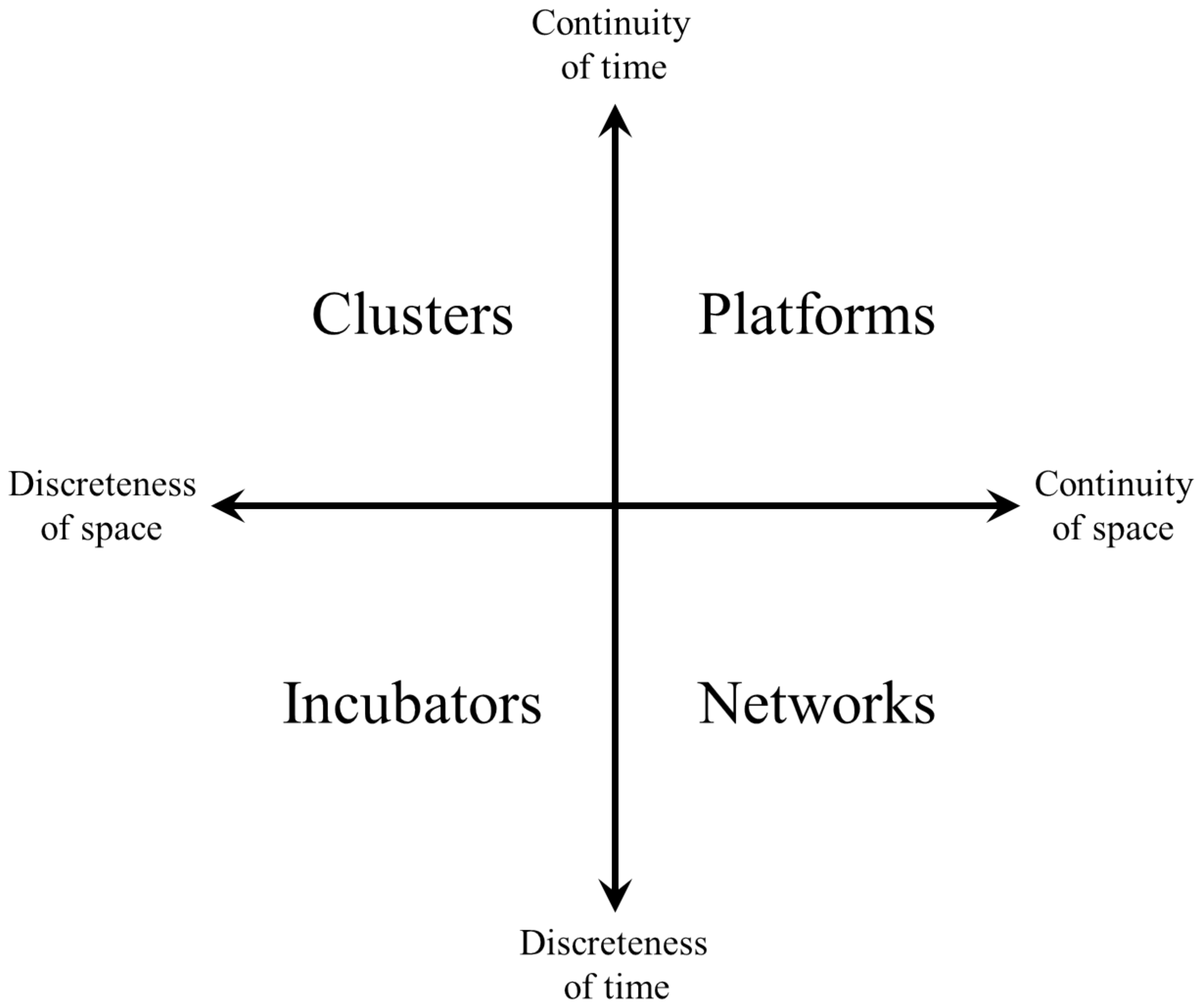

Fig. 2. **Clusters, platforms, networks, incubators in a discrete-continuous structure of relations with space and time**

4. Clusters, platforms, networks, incubators as components of ecosystems

The organizational component of the systems consists of separate organizational units, each of which arose in connection with the implementation of functions common to the ecosystem and therefore is functionally connected with a number of other similar units. In addition, due to the localization of the ecosystem in space, all components of its organizational component are in relations of territorial proximity. This means that the organizational component of an ecosystem is nothing more than a cluster. The infrastructure component of the ecosystem is designed to create opportunities for unobstructed (direct) interaction between the participants of the ecosystem, primarily between the elements of the cluster entering the ecosystem. Thus, the infrastructure component of the ecosystem plays the role of the environment necessary primarily for the effective functioning of the cluster. The communication and logistics component of an ecosystem provides the realization of the opportunities provided by the infrastructure component to support the exchange of material, informational, symbolic and other benefits between organizational units. Finally, the innovation component, which includes activities related to various kinds of innovations, practically plays the role of an innovation incubator.

Together, clusters, platforms, networks and incubators belonging to the same ecosystem complement each other, ensuring that the ecosystem can function independently due to unlimited repetition of production and reproduction cycles (circulation of resources and products). It can be noted that neither clusters, nor platforms, nor networks, nor incubators have such a property separately from each other. Thus, in the clusters there are no (or are in their infancy) integration-communication mechanisms and innovative impulses; platforms lack a mechanism for concentrating efforts on a limited portion of space-time to exist independently which leads to the dominance of centrifugal tendencies; the main feature of network structures is the lack of mechanisms for the emergence and incubation of innovations, which leads to the attenuation of such systems; Finally, the long existence of innovative incubators is impossible without the support of organizational, communication and logistics systems.

Thus, the successful functioning of cluster, platform, network and incubation systems is possible only within the framework of ecosystems that ensure their mutual support, interaction and reproduction.

In general, we see that ecosystems should be considered as the basic units of socio-economic analysis. And clusters, platforms, networks and incubators are integral parts of ecosystems.

Final remarks

Since producer-user chains in ecosystems are locked within the system itself, ecosystems are a type of systems with a pronounced “egocentric” orientation. The main goal of such systems is to maintain their own functioning and - to a moderate degree - their own development. In this sense, ecosystems are closer to object and project systems than to environment and process ones. Therefore, the platform component of ecosystems plays a role rather of a connecting link, or a border strip between the ecosystem and the surrounding world. The value vector of the ecosystem is directed inward, not outward of the ecosystem. Creating shared values in ecosystems should be the main focus of their activities.

Accordingly, the consolidation of efforts and organizational units and individual participants in ecosystem activities should be supported through the distribution of available funds in favor of the cluster and incubation components of the ecosystem, as well as intra-ecosystem networks and platforms. A special role here should be played by the methods of strategic planning of ecosystems (see [31]), as well as the methods of matching the type of enterprise collective with its strategic profile [32]. Transferring these methods from enterprises and clusters to ecosystems requires further research.

The development of an ecosystem approach to structuring an economy undoubtedly leads economic theory away from neoclassical ideas about the market as a homogeneous “pile of sand grains”, differing from each other mainly in size. Each ecosystem is a special planet with its own history, culture, genetic mechanisms of inheritance of characters. Since ecosystems, by definition, lack centralized management, self-organization mechanisms, including self-restraint and self-moderation (“alignment”), should be organically built into the institutional structure of ecosystems.

It is possible that the period of “open innovations”, which followed the period of “closed corporate innovations”, will move into the period of “ecosystem innovations”, synthesizing the development of open innovation platforms and isolated innovation incubators.

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JEL

SYSTEMIC INTERVENTION: THEORY, METHODOLOGY AND PRACTICE

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Abstract. This paper describes the theory, methodology and practice of systemic intervention, emphasizing the need to explore stakeholder values and boundaries for analysis; address marginalization processes; and draw upon a wide range of methods from the systems literature and beyond to create a flexible and responsive systemic action research practice. After presenting an outline of the methodology of systemic intervention, the author discusses several other well-tested systems approaches with a view to identifying their potential for further supporting systemic intervention practice. Two practical examples of systemic intervention are provided to illustrate the arguments.

Keywords: Boundary Critique, Critical Systems Thinking, Marginalization, Methodological Pluralism, Systemic Intervention

1. INTRODUCTION

Because of the complexity of many of the environmental, social and organizational issues that we face in contemporary society, where numerous interacting variables need to be accounted for and multiple agencies and groups bring different values and concerns to bear, it is not uncommon for people to call for a systems approach. The desire is for a 'bigger picture' understanding, both of complex, non-linear interactions and the dynamics of multiple stakeholder relations and perspectives. To address this call, I offer a set of methodological concepts that I have found useful in my own systemic action research practice.

Of course, many different systems methodologies have been developed over the years. There are far too many to list, let alone their review (see Midgley, 2003, for a four volume set of readings). However, the methodology I want to introduce here, which I have called "systemic intervention" (Midgley, 2000), has the advantage of taking a pluralistic approach to the design of methods. It provides a rationale for creatively mixing methods from a variety of sources, yielding a more flexible and responsive approach than might be possible with a more limited set of tools.

I will outline this methodology before reviewing a selection of other systems approaches that have been designed for different purposes. We can borrow some useful methods from these approaches, which can then be woven into systemic intervention practice (and more traditional scientific methods, plus methods from other sources, can be drawn upon in the same way). Two brief practical examples of systemic intervention illustrate my argument.

2. SYSTEMIC INTERVENTION

I define 'intervention' as purposeful action by an agent to create change. I accept that this definition raises questions about purpose and agency, but these are addressed elsewhere (Midgley, 2000, 2008). My emphasis on intervention contrasts with the usual focus of science on observation. However, unlike some authors who champion intervention, I do not regard it as incompatible with scientific observation: methods for observation can be harnessed into the service of intervention.

Building on the above definition, I characterize *systemic* intervention as purposeful action by an agent to create change in *relation to reflection upon boundaries.* One common assumption made by many systems thinkers is that everything in the universe is either directly or indirectly connected with everything else. However, human beings cannot have a 'God's-eye view' of this interconnectedness. What we know is that any situation has limits, and these limits are called boundaries. Comprehensive analysis is therefore impossible. Nevertheless, by acknowledging that this is the case, and by explicitly exploring different possible boundaries for analysis, we can paradoxically achieve greater comprehensiveness than if we take any single boundary for granted. I call this process of exploration 'boundary critique'. For me, this is the crux of what it means to be systemic.

2.1 Boundary Critique

The term 'boundary critique' was first coined by Ulrich (1996) to refer to his own methodological practice, but here I am using it more broadly as a label for the concern with boundaries that is present in the writings of several authors, starting with Churchman (1970).

Churchman's basic insight is that boundary judgements and value judgements are intimately linked. Values direct the drawing of the boundaries that determine who and what is going to be included in an intervention, so the most ethical systemic practice is one that involves pushing out the boundaries as far as possible so that a wide set of stakeholder values and concerns can be accounted for (but without compromising comprehension through over inclusion).

However, Ulrich (1994) argues that, in practice, it is often difficult to push out the boundaries in this way: time, resource and other constraints can intrude. Ulrich therefore stresses that boundary critique should involve the justification of choices among boundaries, and should be a rational process. The widest possible boundary is not necessarily the most rational, given practical considerations. For Ulrich, rationality is inherently dialogical: all rational arguments are expressed in language, and language is primarily a tool for communication, so a boundary judgment is only truly rational if it has been agreed in dialogue with all those involved in and affected by an intervention. Stakeholder participation (of those involved in or affected by decision making) is therefore crucial to boundary critique.

2.1.1 Marginalization

In my own research on stakeholder participation and boundary critique, I have been particularly interested in what happens when two or more groups of people make different value/boundary judgments and then find themselves in entrenched conflict. As an aid to understanding and intervening in such situations, I offer several generic models of marginalization and stigmatization processes that explain the persistence of conflict between stakeholders (e.g., Midgley, 2000; Midgley and Pinzón, 2011, 2013; Midgley, 2016). Stakeholders and issues can both be marginalized, and this marginalization can even become institutionalized.

The most commonly used model of marginalization can be found in Figure 1. I argue that, in conflict situations, if one group makes a narrow boundary judgment and another makes a wider one, there will be a *marginal* area between the two boundaries. This marginal area will contain elements that are excluded by the group making the narrow boundary judgment, but are included in the wider thinking of the second group. We can call the two boundaries the 'primary' and 'secondary' boundaries (the primary boundary being the narrower one). (See Figure No 1.)

In the Figure, the primary and secondary boundaries both have a set of ethics (or values in purposeful action) associated with them. Between the two boundaries is the marginal area. Within this are people or issues that are of concern to those operating with the secondary boundary but are excluded from the concerns of those using the primary boundary. The two ethics come into conflict, and whatever is in the margins becomes the focus of this conflict.

The conflict is then stabilized by the

imposition of either a 'sacred' or 'profane' status on the marginal people or issues. These terms are not meant in a religious sense, but indicate the valued or devalued status of marginalized elements. I use them in preference to more 'neutral' language to reflect the strength of feeling that accompanies the derogation or exaltation of other people on the basis of their status, roles, interests, identities or beliefs.

In a conflict situation, there is rarely a consensus about whether marginalised people or issues are sacred or profane, but by institutionalising value judgements in social rituals, the conflict comes to be stabilized with one set of values dominating. So, if the profane status of marginal elements is institutionalised, then the primary boundary is reinforced because people can quite justifiably ignore or derogate whatever is in the margins. But if the sacredness of marginalised people or issues is institutionalised, then this challenges the narrow boundary judgement by encouraging the exaltation of whatever is in the margins, and this reinforces the wider secondary boundary.

These kinds of processes operate at every level in society, from small groups to international relations. Many different stakeholders and issues can be marginalized for all sorts of reasons, and when they are made profane the effects can be quite devastating. Some forms of marginalization are relatively easy to overcome because they have their roots in quite localized histories of conflict, but some stem from conflicts that are structured into society as a whole, and these are the ones that are the most difficult to change (Midgley, 2000). It is vital to take processes of marginalization into account as part of boundary critique and systemic intervention.

2.1.2 Boundary Critique in Action

I will offer a brief illustration of how boundary critique can be used in systemic action research. In the late 1990s, I worked with colleagues on a project to facilitate the design of new services for young people (aged under sixteen) living on the streets. We recognized, and all the relevant stakeholders concurred, that it was crucial for young people to be core participants in the research. This was a boundary judgment about participation that would have important consequences for the issues to be considered in the design process. The young people had quite specific concerns that they wanted addressing, and some of these would almost certainly have been omitted if participation had been limited to professionals alone.

However, when involving young people, we had to be aware that there was a double danger of marginalization: in general, young people under sixteen are viewed as less 'rational' than adults. Also, these particular young people could easily have been stereotyped as troubled and untrustworthy teenagers because, in order to survive on the streets, many of them had to resort to begging, petty crime or prostitution. Therefore, in setting up design workshops, we gave the young people space, out of the hearing of professionals, to develop their ideas (an empowerment technique), and we used exactly the same planning methods as we used with the adult participants to generate proposals for change. This allowed a direct comparison to be made between the ideas from the young people and adults, and prevented the kind of marginalization that might have occurred if we had used a more 'playful' approach with the young people and a more traditional 'rational planning' method with the professionals. It would have been easy, if we had done the latter, for the professionals to have viewed only their own output as the 'proper' plan. This was just one of many issues that we explored and addressed through our boundary critique. See Boyd, Brown and Midgley (2004) for further details.

2.2 Methodological Pluralism

In addition to boundary critique, I also advocate two forms of methodological pluralism. The first is learning from other methodologies to inform one's own. This way, each agent has a continually developing systemic action research methodology. We no longer have to accept a situation where people build a methodology like a castle and then defend it against others who want to breach the castle walls. Rather, if people begin to see methodology as dynamic and evolving, they can learn from others on an ongoing basis (Midgley, 2000; Midgley, Nicholson and Brennan, 2017).

The second form of methodological pluralism involves drawing upon and mixing methods from other methodologies (e.g., Flood and Jackson, 1991; Jackson, 1991; Flood and Romm, 1996; Mingers and Gill, 1997; Midgley, 2000). The wider the range of methods available, the more flexible and responsive our systems practice can be. No methodology or method (whether it comes from the systems tradition or elsewhere) can do absolutely everything people might want. Therefore, being able to draw upon multiple methods from different paradigmatic sources can enhance the systems thinking resource we have available for intervention.

2.2.1 Methodological Pluralism in Action

As a brief illustration, the project to facilitate the design of new services for young people living on the streets (discussed earlier) used a number of different interlinked methods and techniques:

- Individual interviews with young people, foster caretakers, and retailers;
- The use of photographs and cards with evocative pictures to stimulate ideas;
- A focus group with staff working in a children's home;
- Rich pictures (visual depictions of the problem situation using drawings and arrows showing the links between key issues—see the Soft Systems Methodology section of this chapter for the origins of this technique);
- A synergy of two systemic planning methods (see the Interactive Planning and Critical Systems Heuristics sections of this chapter for details) implemented in separate stakeholder and multi-agency workshops;
- Values mapping (a method we developed to visualize people's values and the logical connections between them);
- Small group, multi-agency action planning;
- The production of reports, magazines, and posters for multi-audience dissemination; and
- Formative evaluation (feedback questionnaires filled in by participants).

In my view, no single previously existing methodology was able to provide all the methods needed for this project. Methodological pluralism was absolutely necessary (Boyd, Brown and Midgley, 2004).

2.3 Added Value

Arguably, the main added value of systemic intervention compared with earlier systems approaches is its synergy of boundary critique and methodological pluralism. If boundary critique is practiced on its own, it is possible to generate some interesting sociological analyses, but there is a danger that these will not effect change unless other more action-oriented methods are used too. Also, embracing methodological pluralism without up-front boundary critique can give rise to superficial diagnoses of problematic situations. If a complex issue is defined from only one limited perspective without reflecting on values and boundaries, and issues of marginalization are neglected, then the outcome could be the use of a systems approach that misses or even exacerbates significant social problems. The synergy of boundary critique and methodological pluralism ensures that each aspect of systemic intervention corrects the potential weaknesses of the other.

3. OTHER RESOURCES FOR SYSTEMIC ACTION RESEARCH

Arguably, one of the great strengths of previous research on systems thinking is the variety of methods that have been developed to serve different purposes. If we can begin to harness this variety into a form of systems practice that still keeps the idea of reflecting on value and boundary judgments at its core, I believe we will have a great deal to offer people in the public, private, voluntary and community sectors who are seeking to address highly complex environmental, social and organizational issues. Below, I provide some examples of other systems approaches which have methods that can be incorporated into systemic intervention. These have been widely applied in practice, and offer tools that I have found useful in my own systemic action research.

3.1 System Dynamics

System dynamics (e.g., Forrester, 1961; Sterman, 1994) offers methods for modeling complex feedback processes and considering possible impacts of changes to the system of concern. By experimenting with a model, decision makers are able to anticipate possible emerging scenarios that could follow from a new policy initiative or intervention.

System dynamics gives practitioners some useful tools to model feedback processes in a manner that can not only help to make transparent why certain system-level effects might occur, but can also help them anticipate counterintuitive effects of interventions. As Forrester (1971) has demonstrated, some policies, introduced with the best of intentions, have the opposite effects of those that are desired. By modeling the feedback loops that stabilize and/or destabilize the system of concern, the approach can highlight surprising side effects of policy options that might not otherwise have been visible in advance of implementation.

3.2 The Viable System Model

The second methodology of interest is the viable system mode1 (e.g., Beer, 1985), which proposes that, for an organization to become and remain viable in a complex and rapidly changing environment, it must have each of the following 5 functions:

1. Operations: the provision of products or services that address particular needs in the organization's environment;
2. Coordination: ensuring that the operational units work together and communicate effectively;
3. Support and control: especially with regard to distributing resources, providing training, gathering and distributing information about quality, etc.;
4. Intelligence: the forecasting of future needs, opportunities, and threats. This involves a comparison between the external requirements placed upon the organization and its internal capacity; and
5. Policymaking: setting long-term goals and objectives, and maintaining the identity of the organization.

According to the viable system model, the key to effective organization is not only to make sure that all five functions exist, but also to ensure that communications among the functions are appropriate and effective. Together, these functions manage the information and decision flows necessary for effective organization. The model can be used to diagnose current organizational failings or to design entirely new organizations.

For people to be able to respond adequately to complex issues, they need to have an effective organizational infrastructure behind them. The viable system model can make a useful contribution to organizational development.

3.3 Interactive Planning

Although system dynamics and the viable system model involve modeling ecological, social, and/or organizational systems, other methodologists have moved away from this to focus on the facilitation of dialogue among stakeholders who bring different insights to bear on complex issues. An example is Ackoff (1981), whose methodology of interactive planning seeks to liberate the knowledge and creative abilities of everybody in (and often including stakeholders beyond) an organization to produce a plan of the ideal future that the organization can work toward. The plan may take some time to implement, perhaps many years, but it offers a feasible set of targets for the longer term. A key idea is that the plan should be wide enough and creative enough to 'dissolve' any disagreements among participants. The transformation it proposes should result in the commitment of all concerned.

The approach can be represented in the form of 3 stages:

1. Establish planning boards (every role in the organization should be represented in planning, with participation as widespread as possible);

2. Generate desired properties of the organization's products and/or activities (this is 'ends planning', conducted under conditions of minimum constraint with only technological feasibility, viability, and adaptability limiting proposals); and

3. Produce the plan itself ('means planning',where all sections of the organization agree on how to move forward).

I have used aspects of Ackoff's work in my own projects; for example, to look at how the mental health and criminal justice systems would have to be changed to prevent people with mental health problems from inappropriately ending up in prison (Cohen and Midgley, 1994). If organizations are willing to commit the resources to participative planning, I believe this is a useful approach that can help people move beyond everyday fire fighting toward the formulation of inspiring (but still feasible) long-term visions of how policies, services and products can be improved. My only caveat is that most of Ackoff's projects were undertaken within the boundaries of a single organization, while I have found it necessary, when undertaking complex policy and community-based action research projects, to extend participation to a wide range of agency representatives and community groups. I have always used interactive planning in this wider participative manner, and it puts some responsibility on the researcher to ensure that marginalized groups are properly included.

3.4 Soft Systems Methodology

Another approach that can be used to facilitate dialogue among stakeholders is soft systems methodology (e.g., Checkland and Poulter, 2006). This encourages participants to generate issues to address through ongoing explorations of their perceptions, and it supports people in modeling desirable future human activities. These models of future human activities can then be used as a basis for guiding actual human activities in the world. However, to ensure that the models will indeed be useful, it is necessary for participants to relate them back to their perceptions of their current situation. In this way, possibilities for change can be tested for feasibility.

The methods of soft systems methodology, which are often utilized in a workshop format, can be summarized as follows:

4. Consider the problem situation in an unstructured form;

5. Produce a 'rich picture': a visual representation of the current situation, with pictures and arrows to represent links between issues;

6. Identify different possible 'relevant systems' that might be designed to improve the situation, and harmonize understandings

of these by exploring, for each relevant system, who should be the beneficiaries of a proposed change, who should carry it out, what the transformation should be, what worldview is being assumed, who could prevent the change from happening, and what environmental constraints need to be accepted;

1. Produce a ‘conceptual model’ for each relevant system: a map of the interconnected human activities that need to be undertaken if the system is to become operational;

2. Refer back to the rich picture to check the feasibility of the ideas;

3. Produce an action plan; and

4. Proceed to implementation.

Of course, participants need to move backward and forward among these activities, harmonizing the outputs from each one with the others. The activities should not be implemented mechanistically in a linear sequence.

Soft systems methodology provides a useful language to ensure that ongoing planning retains a systemic focus, and can support people in making accommodations to find acceptable ways forward when they have different perspectives on an issue. I have found it particularly useful for multi-agency planning; for example, when facilitating a debate among nineteen agency representatives who wanted to cooperate on the design of a counseling service that could be activated in the event of a major disaster, but their different perspectives were obstructing progress. Over six days, the agencies came to an agreement that resulted in the design, funding, and implementation of the counseling service (Gregory and Midgley, 2000).

3.5 Critical Systems Heuristics

The final methodology I want to review is Ulrich's (1994) critical systems heuristics. As we saw earlier in the section on boundary critique, an important aspect of Ulrich's thinking is that boundary and value judgments (made by the researcher or participants) are intimately linked: the values adopted will direct the drawing of boundaries that define the knowledge accepted as pertinent. Similarly, the inevitable process of drawing boundaries constrains the values that can be pursued. Being concerned with values, boundary critique is an ethical process. Because of the focus on dialogue among stakeholders in dealing with ethical issues, a priority for Ulrich is to evolve practical guidelines that planners and ordinary citizens can both use equally proficiently to conduct boundary critique. For this purpose, he offers a list of twelve questions that can be employed by those involved in and affected by planning to interrogate what the system currently is, and what it ought to be. These twelve questions cover four key areas of concern: motivation, control, expertise and legitimacy.

In my view, there is significant potential for using Ulrich's twelve questions in the public sector in particular, not least because they cut to the heart of many issues that are of fundamental concern to people in communities who find themselves on the receiving end of policies and initiatives that they either do not agree with or find irrelevant. In my own practice, I have used these questions with people with mental health problems recently released from prison, older people in sheltered housing, young people who have run away from children's homes and others (e.g., Midgley, 2000). Ulrich claims that his questions can be answered equally proficiently by ‘ordinary’ people with no experience of planning as they can by professionals, and I believe that he is right—with the caveat that the questions should be made specific to the plans being discussed, and also need to be expressed in plain English. If the questions about what ought to be done are asked early on in planning a new public policy initiative or service, I have found that ‘ordinary’ people are usually able to think just as systemically as professionals (indeed, sometimes more so!).

4. A FURTHER PRACTICAL EXAMPLE OF SYSTEMIC INTERVENTION

To further ground this presentation of methodology, I briefly outline another systemic intervention that I undertook with colleagues. Only a sketch is provided here, and therefore many of the social dynamics that were important to the intervention have been omitted. More details can be found in Midgley, Munlo and Brown (1998).

The initial remit of the project was to work with local governments in the UK to find out how information from assessments of older people applying for health, housing, and welfare services could be aggregated to inform the development of housing policy.

However, some initial interviews with stake-holders quickly revealed that there were two major problems with the boundaries of our study. First, it became apparent that if the housing 'needs' expressed by older people fell outside local government spending priorities, they were not recorded. This meant that aggregating information from assessments would paint an artificially rosy picture, making it seem as if all needs were being met. Second, many urgent problems with service provision, assessment, and multi-agency planning were being raised by stakeholders (including older people themselves). We felt that ignoring these would be unethical, especially as we had already come to the conclusion that the initial remit of the intervention was flawed. As a consequence, we worked with the funder to expand the remit of our systemic action research to look at the wider system of assessment, information provision, and multi-agency planning for older people's housing, and what could be done to improve it.

Semi-structured interviews with 131 stakeholders from a wide variety of organizations (including older people themselves) yielded data that we used to create a 'problem map'. This is similar to a system dynamics model, except that problem mapping is purely qualitative. The purpose is to demonstrate to stakeholders that their problems are strongly interdependent, and therefore they require changes to the wider system to be resolved.

Having demonstrated the systemic nature of the issues, the next stage was to ask what kind of system change was needed. To answer this, we held a series of interactive planning workshops, asking what ideal (but still technologically feasible, viable, and adaptable) housing services would look like. We integrated the critical systems heuristics questions so we could explore issues of motivation (or purpose), control (including governance), expertise and legitimacy. To prevent the marginalization of older people, we worked with them separately from professionals, allowing them more time and space to develop their views. Our workshops demonstrated a widespread agreement among stakeholders on housing policy, with only a few relatively minor disagreements needing resolution.

We then brought together senior managers from health, housing, and welfare organizations to look at what kind of organiza-tional system could deliver the housing services that the stakeholders had asked for. We introduced the viable system model as a template for the organizational design, and systematically evaluated this design using criteria derived from the earlier work with older people and frontline professionals, thereby ensuring that these perspectives were not marginalized now that participation had been narrowed to managers. In this way, we could be confident that the managers' proposals would either meet the stakeholders' requirements directly or would provide the organizational means to address them in future years.

This example of systemic intervention demonstrates the benefits of boundary critique. The initial problematic remit of the project was usefully expanded, and the potential for marginalizing older people was identified and addressed. It also demonstrates the value of methodological pluralism. In my view, no single set of methods yet developed could have addressed all the issues in this intervention. It took a combination of semi-structured interviewing, problem mapping, interactive planning, critical systems heuristics and viable system modeling to support stakeholders in both defining the issue and responding to it systemically.

5. CONCLUSION

I have presented a methodology for systemic intervention, incorporating boundary critique and methodological pluralism, and have discussed several systems approaches from which we can borrow useful methods. I have also provided two practical examples of systemic intervention. I suggest that this kind of approach is not only able to address values, boundaries, and marginalization in defining complex issues, but it also has the potential to deliver all the utility of other systems approaches because it explicitly advocates learning about and drawing methods from those approaches to deliver maximum flexibility and responsiveness in systemic interventions.

Acknowledgments

The project to facilitate the design of new services with young people living on the streets was funded by the Children's Society; National Children's Homes; and the Manchester and Salford Methodist Mission. The project on housing for older people was funded by the Joseph Rowntree Foundation.

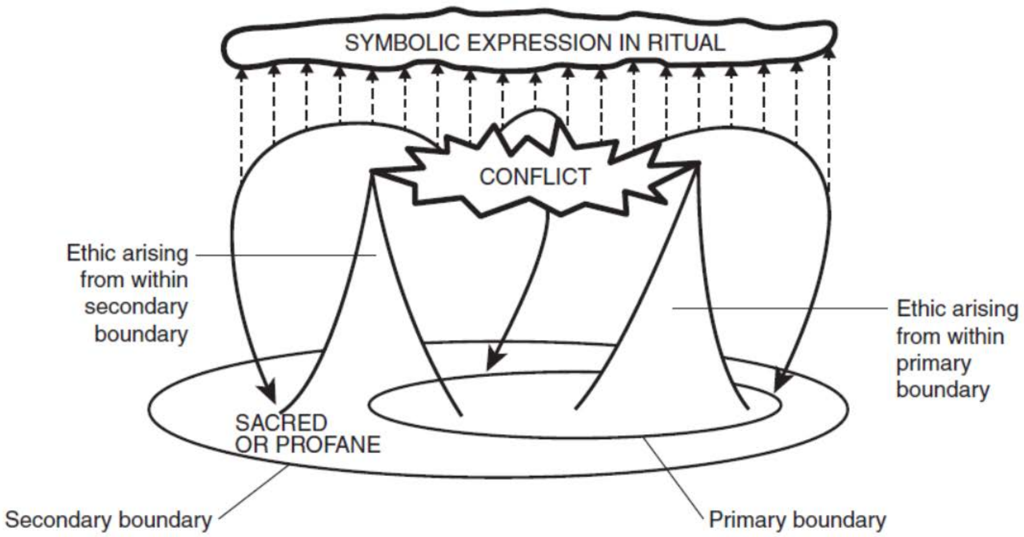

Figure 1. Process of Marginalisation

Source: Midgley and Pinzón (2011).

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JEL

THE POVERTY OF ECONOMISM

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Abstract. Popper criticized Marx for his *historicism*, which he described as the belief that the course of history is predetermined by scientific laws. But he described Marx's historicism as 'economism', since 'Marx, in opposition to Hegel, contended that the clue to history, even to the history of ideas, is to be found in the development of the relations between man and his natural environment, the material world; that is to say, in his economic life, and not in his spiritual life'. I do not know whether Marx ever used the term 'economism' himself. But Popper used it to describe 'the claim that the economic organization of society, the organization of our exchange of matter with nature, is fundamental for all social institutions and especially for their historical development'. He said that economism 'is perfectly sound, *so long as we take the term 'fundamental' in an ordinary vague sense, not laying too much stress upon it*'. But he criticized Marx for overemphasizing it, and for trying to reduce all thoughts and ideas to economic conditions. He said that 'the general importance of Marx's economism can hardly be overrated', but that 'it is very easy to overrate the importance of the economic conditions in any particular case'. It is important, however, to understand that economism is not peculiar to Marx, and that it is entirely consistent with a market approach to economics.

In this discussion, I will use 'economism' to describe any theory or attitude that attributes decisive or conclusive importance to economic considerations in making policy decisions. It is the view that our policy decisions should be ultimately based upon their expected economic consequences. And it is, in the present context, the view that we should not value freedom as an end in itself, but primarily as a means to prosperity. Economism, thus understood, is not a theory in economics, but the *philosophical* stance that economic facts, interests, and goals are the facts, values, and goals that matter most. This stance, however, is often bolstered by the claim that the study of economics is a *science*, and that its theories and predictions have the cognitive authority that only a science can have. The most obvious proponents of economism are economic reductionists who believe that all facts, values, interests, and goals can ultimately be defined in economic terms—or, in other words, that economic facts, values, interests, and goals are the *only* ones that really exist. Marx is probably the best known and most influential proponent of this view, and the prevalence of economism in contemporary thought is undoubtedly due to his influence. But if I am right, then Hayek retained elements in his own thinking that are economistic as well. Thus, Hayek argued that scientific study has shown that socialist economic programs and aims are both empirically and logically mistaken, and he said that the fact that the socialists were wrong about the economic *facts* was crucial to his critique of socialism. He also argued that scientific study has shown that socialist programs and, in particular, central planning, *cannot* succeed in achieving their aims. But what is, perhaps, more to the point is that Hayek held that freedom is important first and foremost for its economic consequences. Whereas Popper thought that it was wrong to base the rejection of tyranny on economic arguments, Hayek was apparently 'prepared' to sacrifice individual freedom, if his analysis of the economic consequences of socialism proved wrong.

Keywords: Popper, Hayek, Marx, economism, freedom, prosperity

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JEL O21

SOCIAL AND ECONOMIC DEVELOPMENT FROM THE POSITION OF THE SYSTEMIC-TRANSDISCIPLINARY WORLDVIEW

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Abstract. Justification of creation and the use of the new methodological tools necessary for a research of social and economic development is given. The practicability of using this approach as an approach and a necessary tool of systemic-transdisciplinary approach and systemic-transdisciplinary models of spatial, informational and temporal order unit is justified. Multiplex of development is a methodological instrument of transdisciplinary approach. Multiplex includes all the combination of different calendar duration development waves. Within the multiplex these waves play role in intensive and soft development programs. This circumstance allows to significantly increase a verification of researchers' results, evaluation and prediction of human society development. The authors try to justify thesis of crucial role of systemic-transdisciplinary worldview and system thinking not only for fundamental scientific research, but also systemic explanation of a new model of the world social and economic order.

Keywords: system; system approach; worldview; transdisciplinarity.

Arguing about the problems of cognition, understanding and description of the world, the element of which is society and social and economic development, the president of the International Society for the Systems Sciences David Rousseau said: "By making further careful observations of the puzzling phenomena, and then strictly applying our principles, we might find better or further laws, which we can use then to develop the better theories and models. If we still cannot devise good theories, we question the principles. We can refine or extend them by generalizing from laws we already have, or distilling them from the assumptions entailed by our worldviews. If new or improved principles cannot be found, or what we do find does not help us to improve/extend our laws such we can build good theories, then we must question our worldviews, reflecting on how we balance between knowledge, experience and intuitions to find the core beliefs that ground our judgements and actions, and form an adjusted worldview from which we can then adjust or extend our principles, laws, theories and models" [2].

Systemic worldview is a way of reflecting the world as a whole within the limits of the human consciousness. Whereas, human consciousness is capable of systemically reflecting the world within the rationality of science, religion, philosophy and myth. Fundamental features of the systemic worldview are worth mentioning. It has different vector directions in the discrete structure of the "horizons of cognition". Implementation of systemic worldview and systemic thinking within scientific rationality is possible due to four types of systemic approaches: systemic disciplinary, systemic interdisciplinary, systemic multidisciplinary, as well as systemic transdisciplinary approaches.

The first two approaches are characterized by a *centripetal* cognition vector. The features of this cognition vector were figuratively described by Stephen Weinberg, an American physicist, Nobel laureate in Physics in 1979: "All the explanatory arrows points downwards" and remarking that this is "perhaps the greatest scientific discovery of all" [3]. In essence, an object being perceived in the image of a system within the systemic disciplinary and systemic interdisciplinary approaches, instantly and inevitably "falls apart" in the researcher's view of individual research subjects. This circumstance plays an important role in the process of cognition, the purpose of which is the accumulation of an array of scientific knowledge and the allocation in this array of the amount of so-called intersubjective knowledge forming the basis of the current scientific paradigm.

The next two approaches are characterized by a *centrifugal* cognition vector. Put in other words what S. Weinberg stated, we can say that all the explanatory arrows within these types of systemic approaches "point upwards" which is also no less important scientific discovery of all. By "point upwards" is meant the cognition of the object through the generalization of its constituent research subjects, as well as through the generalization of the objects themselves within their functional groups.

The philosophical principle of *holism* (the integrity principle) is the basis for such generalization of research subjects (parts of the object and their interactions) within the systemic multidisciplinary approach. The intention to justify integrity distinguishes so drastically the object from the environment, that a loss of their interconnections occurs. The assumption that the environment or any part thereof, the element of which is an object, is also an integral object, allows to build a common structure (construction) of the integrity of the world. This circumstance determines the directions of scientific cognition resolving itself to the search for solutions to the problem of preserving the integrity of objects under the influence of the external environment, as well as the problem of describing the mechanisms of self-organization and stability of objects, which actually determines the "horizon" of the systemic multidisciplinary approach in the cognition of the world.

The generalization basis of research objects within the systemic transdisciplinary approach is the philosophical principle of *single-centrism* (the principle of unity). In case of such generalization, the world, objects and research subjects cease to be a system consisting of interacting parts. In each specific case, they are represented as a corresponding unified functional group of objects and research subjects. The role of the system in such a functional group is played by the universal order, which determines the unity of its elements (parts and their interactions). As a consequence, the generalized object of research of the systemic transdisciplinary approach is manifestation of the general order in categorial aspects: in the own space, time, information of the object and functional group of objects, in their existential aspects: organized nature, direction and effectiveness of development, and, what is even more important, the content of the principles of the so-called "sphere of oughtness" determining the boundaries of the homeostasis of such development [1, p. 40-46].

It should be noted that the environment, which partially falls out of the "field of vision" of all previous types of systemic approaches, is present in the systemic transdisciplinary approach in the form of potentiality (hidden power or capabilities) associated with the Big Bang. This circumstance allows us to consider the space, information and time of the objects themselves and their functional groups as forms of existence, manifestation and transformation of this potentiality, respectively. The presentation of philosophical categories as forms allows them to be translated into the category of methodological ones, presenting them as systemic transdisciplinary models of space, information and time units of order.

The creation of a systemic transdisciplinary methodologies made it possible to apply it for the research of objects of various scientific trends, including socio-humanistic sciences. This is a scientific direction in which research is always accompanied by a personal attitude towards the problem, needs to be strengthened by methodological tools able not only to eliminate the effect of personal interpretation but also bring research results closer to the level achieved in the natural sciences. Thus, for example, the use of systemic transdisciplinary models of information, time and space units of order for the research of social and economic development of society, the state, development of economic entities (agents) and various economic horizontal and vertical functional groups, made it possible to introduce concepts of predetermination and predisposition of such development.

Predetermination and predisposition of development is manifested in the structure of *information features* determining the characteristics of development, and in the structure of the *periods of time* during which a complete transformation of the original potentiality will take place in certain *fragments of space*. As a rule, the initial ideas (the idea of a business plan, the idea of a statehood, a political idea, a religious idea, etc.) play the role of the bearer of the initial potentiality in social and economic functional groups. In this case, it can be shown that the goals and results of the development of various social and economic objects and their functional groups are fully coordinated in a single space, time and information. By setting quantitative parameters of systemic transdisciplinary models of order units, it is possible to differentiate a single process of social and economic development into the structure of various space, time and information realities. Parameters of the signs of information and time periods revealing all the objective and subjective characteristics of social and economic development will correspond to each such reality.

Therefore, in order to develop an effective strategy for managing an economic object, an economic functional group and the social and economic development of the state and society, it is necessary to recognize the features inherent in the information feature and the period of time of the level of reality being researched in combination with the opportunities offered by other types of systemic approaches.

The researches carried out related to the social and economic development of a society have allowed to reveal the special importance of the year 2016 (see Figure 1).

With the help of the systemic transdisciplinary model of the time unit of order, it was possible to determine that in 2016 there was an overlapping (synchronization) of time cycles of different duration (time units of order) and synchronization of content of information periods of different content. This circumstance gives the current moment of social and economic development a status characterized by the search for a new model of the world social and economic order. Since the reason for the emergence and formation of such a model is objective in nature, the content description of the forthcoming social and economic development period will also be objective. Which allows us, in its turn, to describe the temporal and content characteristics of operational, tactical and strategic goals, tasks and results of forthcoming periods and signs of social and economic development, as well as to form objective principles of a new model of the world social and economic order.

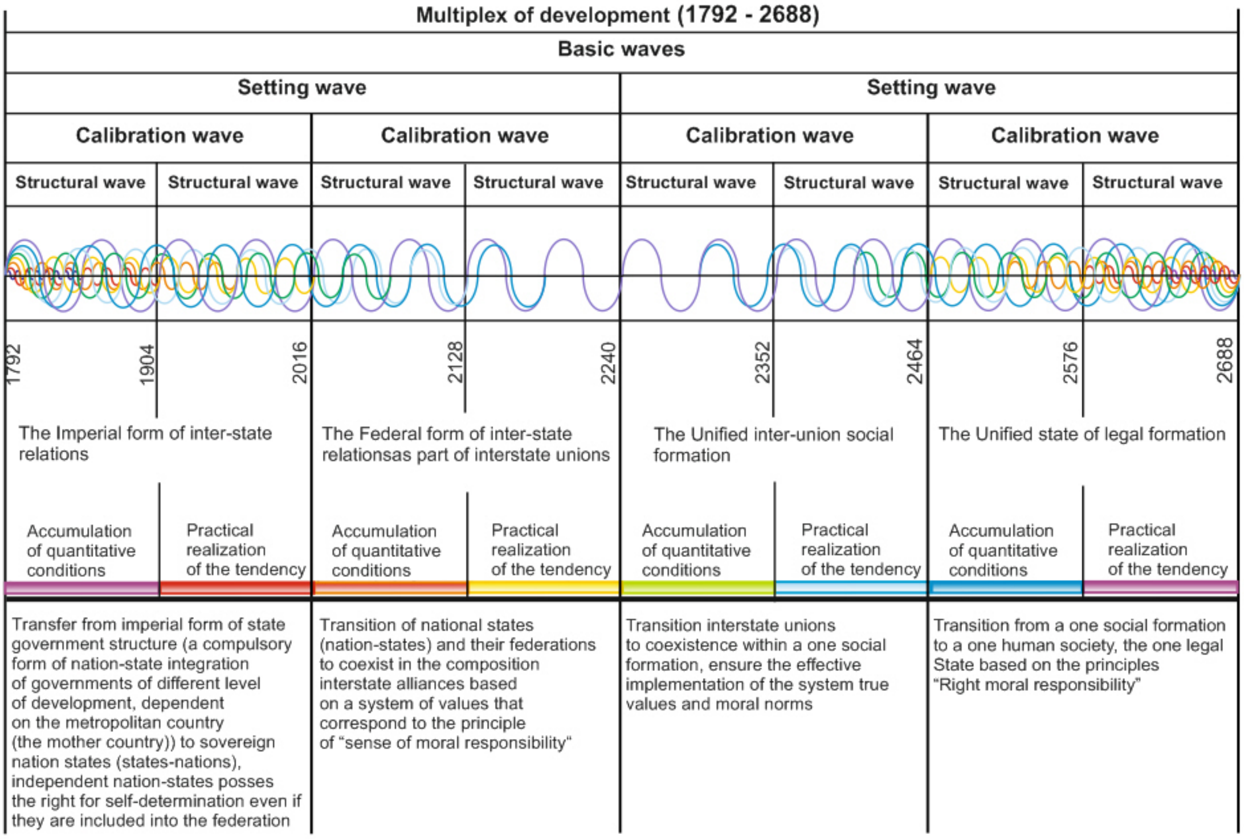

Fig. 1 Systemic transdisciplinary model of the multiplex of social and economic development of society in the period from 1792 to 2688. Source:(adapted from [1])

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JEL C18

DEVELOPMENT OF SYSTEM ANALYSIS IN ECONOMICS

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Abstract. In spite of a big age of economics its complex systemization becomes reality only in current millennium. Beginning of 2000s is associated with changes of dominant paradigms in many fields of human activities, including education. In this period a new discipline appeared in studying plans of preparing professional economists. This discipline is called "System analysis in economics". The Department of mathematical modeling economic processes in Financial University prepared methodical base for this discipline. Later this material got common social respect. In the present article we describe the main stages of system approach's development and expansion in the problem field of economics.

Keywords: theory of systems, system analysis, system economics, system management

As a particular discipline "Theory of systems and system analysis" appeared in studying plans of economists' and managers' professional education not long ago. It was in the beginning of current millennium. And our university (in that period it was an academy) had a straight relation to this process. In that period there was the Department of mathematical modeling economical processes. The Department prepared studying program of this discipline and its methodical base. In 2005 these materials were published inside the university, and then in 2007 they were published as a fundamental student book in "Finance and statistics" editorial house.

Publishing this material, which was originally oriented to the economic problem field, played a big role in developing and popularizing this discipline in economical specialties.

In the following 2 – 3 years a discipline named "System analysis in economics" appeared in different variants in job studying plans of all economical specialties and educational programs. However, faculties' administrators didn't understand the whole integrative character of this discipline and included it in studying plans of the first courses. It lowered the results of studying this discipline. For the best understanding methodology of system analysis there should be knowledge of basic elements in many connected studying disciplines, such as higher mathematics, philosophy, economics, theory of probabilities and mathematical statistics, theory of quantities and algebra of logic, general management, etc. The experience has shown that the best results of studying this discipline are demonstrated by bachelors of the 3^{rd} and the 4^{th} courses and by magisters of course.

Scientific and educational society provided big hopes with the appearing of a new integrational discipline in studying plans of economists. It was expected that success of system methodology in studying nature and space, projecting and creating big technical systems in the nearest time would give the same effect in economical field. There was faith that finally we'd be able to give more system character and organization to reforms and restructuring in national economy. However, the representatives of system approach tried their best to adapt its methodology to the economic problem field, and finally they were more and more convinced that in present system paradigm it was impossible.

It appeared, that economics systems are different in roots from natural and artificial systems, which were the objects system analysis, it's creating, development and improvement. In these types of systems basic connections between the elements have natural base: the like-charged particles attract each other and oppositely charged particles repel each other, water molecule always includes two atoms of hydrogen and one atom of oxygen, a wolf hunts for a hare, etc.

So far, for successful exploring natural and artificial system it is enough to identify the basic connections between the elements and include them into the relevant experimental model. Then you may use it for many times so as to find the truth, construct new mechanisms, make synthesis and restructuring explored system.

Differently from natural and artificial systems, basic connections in economic systems don't have natural base. They have *cultural base.* It means that in fact they are absent. They exist only in imagination of humans, who are the active elements of economic systems. In mentality of the active elements there are deeply rooted relations to other active elements. These relations cause real activity or passivity of active elements, which immediately impacts the present state of the explored system. No doubts, that it also impacts future of the system.

We may conclude, that for successful exploring economic system analytics should take in account cultural connections between the elements instead of natural connections. And here we meet two problems which are very difficult for being overcome. First: in methodological apparatus of system analysis created to the present time there are no instruments for finding and identifying cultural connections between the elements of explored systems. Second: connections between active elements change constantly, and it is impossible to identify the dominant one in certain moment of time.

For overcoming these problems there should be a new paradigm and – so far – a new theory of systems and system analysis, originally oriented to cultural specifics of the economic systems. And we should be thankful to wisdom of our university's management in that period. In highly ballasted stream of scientific information it was able to find the start-ups of new-born theory of systems. Our management invited representative of this theory, famous scientist George Kleiner to constant work and comfortable conditions for further development and practical realizing his scientific achievements in studying process. According to the order of rector from May, 18, 2009 the Department of System Analysis in Economics was established. It united the best forces of academic and university science which were present in that period. Just that year in order to provide wider borders and system character to integration between system analysis's methodology and economic problem field the scientific and methodical seminar was organized. It connected specialists from all universities of Moscow and was called "System analysis and modeling in social and economic problems' decision". Besides All-Russian scientific and practical conference called "System analysis in economics" was established. In the first time it took place on November, 24-25, 2010. George Kleiner published the main thesis of a new system economic theory called "System economics". These ideas were pleasantly accepted by teaching corpus of our university and by all scientists and lecturers of the national high school. The new approach allowed to summarize economical knowledge accumulated to that period, as well as find the economic problems with system character, which demand immediate decisions.

For instance, the basic classification of economic systems, which divides them in environments, objects, processes and projects, led to necessity of increasing present nomenclature of products' types. Now it includes services, jobs and goods, and reforms should be added here. These are the typical results of project systems. The same thing is provided with offer to reform the structure of law-making body of the state. According to it Federal Assembly should be increased by to chambers – house of branches and house of organizations. This structure provides representation of economical agents on meso- and micro-levels in law-making bodies. It allows to provide system balance and organizational unity of national economy. And following to the principles of system economics (subject of conservation, optimization, stability, competition, cooperation, substitution of import, etc.) was accepted by many specialists as a general of overcoming crisis in economical subjects and national economy as a whole.

What is more important, system economics allowed to create theoretical base for many stable economical ideas. For example, the solid theoretical base was created for Charles Handy's classification of organizational cultures [7]. These types are known as autocratic (culture of Zeus), administrative (culture of Apollo), project (culture of Athene) and personnel (culture of Dion). In the same way it was proved that there are limits of manager's activities classification created by Adizes. This classification includes P (producing), A (administration), E (entrepreneurship) and I (integration) [1]. Particularly it is necessary to point out theoretical base of a concept, which is very popular in economical society. It's a concept of balanced system of indicators created by David Caplan and Robert Norton [3]. According to it, each one of its four elements is associated with certain type of system: the "Finance" element is associated with object system, business-processes are associated with process system, the element named "Studying and growth" is associated with project system, and the consumers are associated with environment.

Unfortunately, we can't validate that the main ideas of systems economics are easily accepted and learned by the students. Firstly, it is caused by their original unreadiness to understanding such highly integrated scientific material. Secondly, there is no really valuable students book provided with system economics, and usually there is no time for finding necessary information in monographies and scientific articles. And in thirds (it is the main thing), there are no formalized methods for supporting system analysis's process in the context of new system economics.

The problem is that, as a rule, social and economical system includes the features of all four types of systems: object, project, process and environment. Electing certain elements from the whole system is untrivial creative task for cognitive abilities of a student. And if it is also demanded to model the system on different hierarchal levels, connect these hierarchies between each other, and balance the quantity of types of systems on each level, the task becomes quite unacceptable. Only talented people can find its decision without instrumental and methodological support. So, we may conclude, that there should be a hard work on instrumental and methodological apparatus of system analysis in the context of new system economics. In the same time, we should understand, that this work cannot be done by a particular person and even by a whole department. Creating methodology and instruments of new system analysis should involve analytical society as a whole. It seems, that pointed circumstance is one of the bases of movement for establishing association of system economics.

The weak place of system economics in its present state is a definition of system. From easy position of Yanosh Kornai system is expected as a part of space-time, which is relatively particular in space and stable in time; it has external unity and internal differences [6]. Here we take in account that independence, stability, unity and difference are identified from the point of social explorer. He is a normal participant of business activities and his ability to identify system characteristics depends on his ability to receive and analyze the information. It's not difficult to expect that there may be a mistake in the results of identifying a system in space-time. In this case, that's not wright to use system methodology for exploring elected formation which is not a system. I can expect that in formulated definition fixed external system character should be forced by validating internal system character of elected element in space-time.

There are also other problems which don't still allow wider using of system economics for solving practical tasks of system analysis. Nowadays its practical using is associated first of all with art, nor with habitual engineering.

Finally, we have to conclude the following thesis. In modern system two theories are present and live in peace. These are classical and system theories. The base of classical theory is paradigm, which's main ideas were created by Ludwig von Bertalanfy in 1930s [3]. According to his ideas a system is identified through the internal connections between the elements. The base of system economics is a system paradigm, which's ideas were formulated by George Kleiner in the beginning of current millennium [5]. According to his ideas a system is identified through external acceptance. I think, as usual, the truth is in the mid. It follows, that there should be an active work for organic integrating formulated approaches of system theory and synthesis a new one, which's name is still in project.

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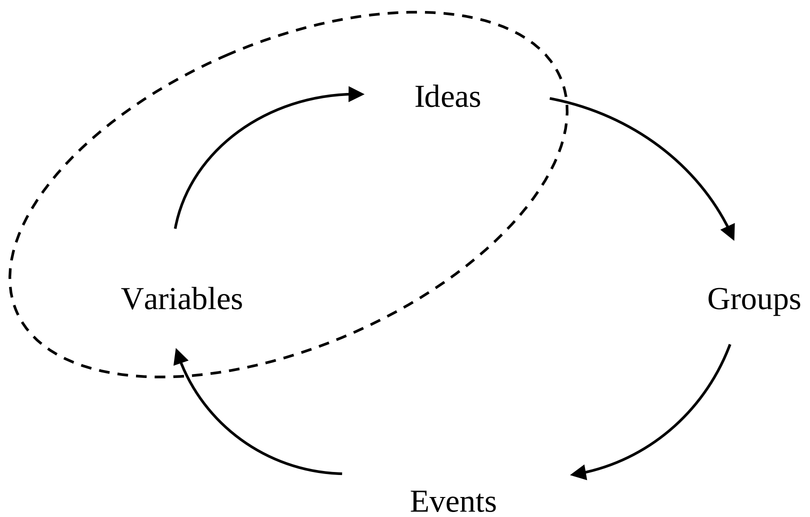

Figure 1. A reflexive theory operates at two levels

Table 1. Two Theories of Economics

Equilibrium Theory	**Reflexivity Theory**
Information becomes immediately available to everyone	People act on incomplete information

People are rational actors	People are influenced by their biases
Economic systems go quickly to equilibrium	Social systems display boom and bust cycles
Scientists should build theories using quantifiable variables	Scientists should use a variety of descriptions of systems (e.g., ideas, groups, events, variables)
A theorist is outside the system observed	Observers are part of the system observed
Theories do not alter the system described	Theories are a means to change the system described

JEL

A SYSTEMS-BASED ARCHITECTURE/DESIGN FOR THE HUMAN SOCIAL SYSTEM

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Abstract. If we do a deep systems analysis of the global human social system (HSS), taken as a subsystem of the whole Earth ecosystem (the Ecos), we soon find major deviations from what we find in the governance and economics of natural complex adaptive (and evolvable) systems (CAES). Though most governments are roughly designed as hierarchies, the natural organizational structure of CAESs, the distribution of decision types is generally not what one finds in other systems. We examine the metabolism and physiology of living cells as a basic architecture of a socio-economic system, and extend this view to multicellular animals. We also examine supra-living systems such as species and ecosystems along with examples of organizations such as corporations wherein a specific architecture of hierarchical cybernetic governance is responsible for the stability, sustainability, resilience, and productivity of the system in which it operates. We suggest that the various governance models that have been tried out for the past ten thousand years have been experiments, most of which have failed, because they, rather than evolve as natural distributed hierarchies, have had human guess-work as well as some of the worst forms of human selfishness imposed on their designs. Humans started from ignorance of the nature of systems and so have made irrational choices in how governments are organized and operate. The main problem with almost all current governments is the establishment of top-down command and control hierarchies, good for militaries, perhaps, but not a way to establish and exploit the human being's natural tendency to cooperate for mutual benefit.

If we were to attempt to design an HSS socio-economic system based on what we have learned from the analysis of natural CAESs we would discover a completely different architecture that would support completely different dynamics. For example, as a first principle, in keeping with the fact that human beings are first-and-foremost biological entities, we would recognize the primacy of the family as the core system component. Reproduction is at the heart of a species' success. But reproduction has to be contained within the natural carrying capacity of the Ecos. We humans have managed to transcend the normal biological restraints on reproduction, which means we have to self-manage our populations. Thus, the governance architecture needs to maximally support the success of families, while maintaining a set of regulatory mechanisms that do not permit other subsystems from getting out of control and threatening the success of families. As things stand today we have an unfortunately excellent example of this out-of-control situation in the form of global warming and climate change. The future success of the human species is now in grave jeopardy owing to the unconstrained (ungoverned) expansion of the ability to obtain not-always good uses of power for our machines from fossil fuels. This is largely a result of the neoliberal notions of free markets and unregulated capitalism coupled with individual greed. The hierarchical cybernetic governance system (HCGS) that we propose as the basic architecture for the socio-economic system of the HSS puts the success of the family as the supreme good and organizes a structure around the aggregates of families that ensures the success of every individual's metabolism, physiology, and potential for self-actualization. The objective of such a system is not the production of material wealth per se, but of that wealth which supports the evolutionary success of families without jeopardizing the future of the Ecos.

Basically, we suggest that we need to throw out most of what we think we understand about economics, politics, and governance and adopt a more systems-based approach.

Keywords: systems science, governance, economics, agents, agency, archetypal models

Introduction

Humanity is faced with some very difficult existential challenges and tough decisions to make. Global warming and climate change, the peaking of high-power fossil fuel energy sources, distressed fresh water supplies, degrading quality of soils, loss of species diversity in ecosystems, and general over-population and subsequent social dysfunctions, all of these stresses are building to a crescendo that cannot be ignored. And they are global in scope.

Which means that finding solutions will require a global perspective. And how should we seek solutions? First we recognize that the whole world is an extremely complex system, and that the human social system (HSS) is just a subsystem of the whole. I will use the term "Ecos" when referring to the whole; all of the geospheres, lithosphere, hydrosphere, atmosphere, and biosphere. We must apply a systems theory-based method of analysis to the whole. For example, it has become clear that the burning of fossil fuels has elevated the stock of CO_2 in the atmosphere and hydrosphere. That, in turn, is contributing to greenhouse gas warming and acidification of the oceans. It is the HSS economic subsystem that is responsible for the burning of fossil fuels, as humans pursue the creation of wealth by extracting resources from all of the geospheres, doing physical work on those resources to increase their utility (to people), and then dispose of the refuse without concern for the Ecos' ability to process and degrade and recycle them. It is one big system.

The HSS is an example of a complex, adaptive, and evolvable system (CAES). Evolvability is not the same as adaptivity. The latter is based on existing subsystems which are capable of modulating their functions to compensate for changes in environmental parameters to which they are already responsive. A prime example is homeostasis. An evolvable system, on the other hand, is capable of constructing new structures and functions in anticipation of the development of new threats or opportunities afforded by a changing environment. Genetic mutations that prove fit are the paradigm example, but a corporation creating a new division to produce a different product for a potential new market is also. The former is an accidental adaptation, whereas the latter is an intentional one.

Previous researchers have investigated the properties and behaviors of CAESs though under different rubrics, such as Viable Systems Theory [1], Living Systems Theory [2], biological energetics [3], and complexity [4]. The CAES provides an overarching or archetypical model of all complex systems such as ecosystems, species, and societies.

Archetype Models in the CAES Framework

Within the framework of the CAES archetype we find three additional archetype models that comprise the architecture of the CAES. The first is the model of an adaptive agent, the decision maker in any cybernetic process. The second is an overarching governance architecture in which agents are embedded in maintaining regulation of the whole system. It is hierarchical in structure with each level operating on different time scales. This is comprised of low-level operational management of work processes, the standard feedback control loop but admitting some amount of feedforward information to implement cooperative networks. Mid-level decision processes are engaged in coordination between low-level processes when cooperation is not sufficient due to scale issues (e.g. communications delays between work processes in a supply chain lead to instabilities). There are actually two kinds of coordination governance processes. The first is tactical management or the coordination of resource extraction processes within the system of interest with external sources (e.g. mining operations in obtaining metal ores) and waste extrusion processes to external sinks (e.g. garbage dumps). Internal to the system of interest are logistical governance, which helps coordinate the activities of internal work processes to optimize production of products and services.

Lastly, at the top of the hierarchy are strategic management activities wherein agents monitor the external world as well as the internals of the system (through the tactical and logistical agents), produce a long-term set of goals and plans and give direction to the tactical and logistical agents for what work needs to be accomplished in the future. Strategic management is most applicable to intentional evolvable systems such as human organizations and societies. This archetype model constitutes a hierarchical cybernetic governance system (subsystem of a CAES) or HCGS.

Another archetype is of the *economics* of a CAES. Economics here means the regulation of the flows and uses of energy (to do work) and materials (to produce wealth). In the realm of living systems, from single cells to whole societies we find a hierarchy of organization of economies. In single cells the economy is called metabolism. Cells take in nutrients and oxygen and produce their own structure (autopoiesis) as well as subsidize the expansion of life through reproduction. In multicellular organisms the economy of the body is the physiology that includes ingesting foods, digestion to obtain fundamental resources (not unlike mining!) and inspiration to supply oxygen to the cells that make up the tissues and organs. Humans, in their societies (an ecosystem for social being) participate in what we call the economy, which is, in fact, a form of external physiology (termed exosomatic physiology). The economy is a system for managing the flows of energy and materials, doing work on input, high entropy materials, to fashion lower entropy (more useful) goods and services that support the biological and psychical needs of human organisms and families.

But the fundamental problem with the way in which the present human economy and governance subsystems have evolved is this. Being intentional evolvable systems, and given that humans started out (in the Paleolithic) as ignorant of any scientific knowledge of how the world actually worked humans asserted what I can only term their "best guess" on how to manage increasing social and cultural complexity (for example through the Agricultural Revolution). The result is the kinds of governance and economic systems we see today in various cultures. From the time of the earliest agriculturalist societies humans have been trying to design social systems that were fit to the environments they occupied. But the history of civilization collapses shows us that their intentional designs were flawed.

Enter general systems theory and systems science. We are now able to learn from the natural systems about the nature of agency, governance, and economics and use these archetypes to consider a more holistic human social system.

Understanding from Naturally Evolved CAES that are Fit

We can glean from natural systems such as populations, species, and ecosystems the dynamics of evolutionary success or fitness. Several principles of CAES successes in nature include:

- Growth to a plateau and stability thereafter
- The hierarchical cybernetic architecture of governance
- Clarity of the decision agents' roles in the hierarchy (strategic, tactical, logistical, or operational)

We can add to this, the precautionary principle when it comes to novelty – invent and explore, of course, but don't rush to market with a new product until you grasp the long-term consequences.

The implications of a systems approach to social organization and economics for humans produces a quite different implication from the current rush to liberalism and neoliberal capitalism. The former asserts the freedom of the individual even in the face of what we now know about human sociality, that we are, as a species, eusocial. The latter makes excuses for selfishness and personal aggrandizement in the face of unbelievable income and wealth disparities. These ideologies ignore systems consequences completely.

Human beings are autonomous agents but wedded to social contexts so neither autocratic rule or libertarian forms of governance are going to work. The only means of governance for human societies is going to be found in the HCGS model.

A top-down deep analysis [5] of the HSS will reveal a "natural" organization of society as well as a natural governance and a natural economics. For example, as already applied, the systemic organization of social units involves the social organization of families (not necessarily strictly defined) into communities like bands and tribes (just as we evolved in the Pleistocene) which are part of a hierarchical organization of more complex polities. Families are "contained" in domiciles and are end-consumers of resources. The economy is organized to produce consumable and supporting assets (e.g. food and housing). The co-organization of political economies into states and empires has produced a wide variety of "experiments" in organizing the domiciles and means of production. Superimposed on the classical view of firms and households is a variety of institutional entities in which individuals participate at various times, such as schools, churches, etc. These too have evolved many varieties of forms and functions.

In all of these experiments in state and institutional organization, many eventually collapse in one way or another. From history we can see the kinds of instabilities and effects of complexity on the workings of the social and economic systems [6, 7, 8]. All suffered the same pattern of growth, expansion, over-consumption of natural resources, increasing complexity of processes (markets, governments, etc.) beyond returns on investment in complexity, and increasing brittleness making some or perhaps all vulnerable to disasters such as climate changes.

All of these various experiments in governance and economics are subject to natural selection in a manner not unlike applied to the evolution of species. In the human context much of the selection force comes from the very cultures that emerged from the social organizations themselves. But some of the selection force is due to natural events such as climate change that put extra stress on a society's capacity to adapt, e.g., drying climates may diminish food production and lead to malnutrition if not starvation. For the majority of human history, when such collapses occurred some portion of the affected population could migrate to more favorable locations. But today we are talking about the whole world as a single HSS. Collapse of the global social system would have no refuge to escape to.

From the numerous experiments we can also glean the systemic factors that lead to a negative selection outcome. In every case examined, if we match up the socio-political-economic structures against what we now understand about the archetypal models of agents/agency, HCGS, and economy, we find major discrepancies. This becomes especially glaring if we include in our analysis the deep historical evolution of societies themselves [9, 10, 11]. Starting with early humans in the Late Pleistocene, in hunter-gatherer family bands, through the advent of sedentary agriculture, and through the industrial revolution we find case after case of humans inventing social mechanisms that are likely well-intentioned with respect to governance and things like economic well-being, but are too often anti-systemic. And, of course, as societies became more complex and more productive of wealth surpluses (e.g. grains stored in granaries) [10] the human propensity to accumulate and take possession led to a breakdown in more egalitarian eusocial tendencies. It led to power hierarchies and the top-down command and control version of governance mentioned above.

Model-Based Design of the HSS

The deep systems analysis of the HSS, guided by the CAES model and its three subsidiary archetype models provides us with a basis for considering a redesign in light of our knowledge of what a stable, resilient, and sustainable subsystem of the whole Earth Ecos should be. In this section I will discuss a few representative aspects of governance and the economy to show that a systems science approach could, at least in principle, provide guidance for the design of such an HSS.

Economics

Several examples from the field of economics should suffice to demonstrate how far from a systemic design we currently have. These examples will not depend on specific political-economy models, i.e. differences between capitalism vs. socialism, as they are inherent to all economies.

Money

Money is a universal mechanism in all modern economies. Indeed, one specific currency, the American dollar, is widely used to price other sovereign currencies. The concept of money and how it is created and circulated has grown increasingly distant from its original role as the means of comparing values of disparate assets and facilitating transactions of trade. The way money is created by the banking system, through debt, is a major source of pathology in a world that is not seeing the growth of free energy (to do useful work) per capita. The latter is in decline due to the declining availability of fossil fuels coupled with the increasing costs of obtaining what remains in the ground over time – the energy return on energy invested (EROI) [12]. It takes free energy to create useful wealth (like food and housing) and in an era of declining per capita energy, the belief that in a future time we will have created enough surplus wealth to pay back the debt, along with interest as a service charge, is a delusion.

The amount of money in circulation should be tied to the availability of free energy to society. Money is part of a feedback control mechanism to regulate the flow of free energy to work processes that are deemed of value to society. Inflation is the result of there being more currency units in circulation than there is free energy to do economic work. Admittedly, the consequences of a policy of tying money to free energy, in an era of declining free energy per capita, implies deflationary conditions. Normally this would be considered a bad thing, but given that the consumption of products, and the work needed to produce those products is directly the result of using free energy (fossil fuels), a deflationary spiral is very likely what it will take to curb the burning of fossil fuels (or the high costs of those fuels will lead naturally to such a decline). Either way a decline in living standards is inevitable unless miraculously some form of alternative energy magically produces a compensating supply of free energy (and we can convert to all-electric work almost instantaneously).

Profit

In every other CAES in the Ecos, excess return on energy investment is stored in a stock that buffers the system against short-term downturns in flows of energy. These are "savings" and are used to smooth out the fluctuations in natural flows. With the advent of agriculture, humans learned how to increase the stocks beyond the normal buffering function. Excess stocks turned into "profits" that could be converted into other forms of wealth through trade and slave labor [10]. Attribute this to human ingenuity and the reorganization of social systems to manage the logistics of agriculture. Nevertheless, the subtle transition of stored wealth from a buffer to a treasure subverted the normal relationship between flows, stocks, and buffers for adaptation and resilience. Settled agriculturists, at least as long as the climate remained favorable, started to hoard commodities (energy) and trade these with nearby others for material goods that may have satisfied hedonistic desires, but were not always forms of true wealth (which is defined systemically as things which, through their use, increase the free energy available to the society, i.e., tools).

In the modern capitalist economies, profits have come to be associated with growth and "normal" returns on business enterprises. Now, capitalists "invest" in enterprises that promise to produce excessive returns on operations, which they will reap as a rightful payoff for taking risks with their wealth. Space does not permit a full analysis of this pathology, but the simple story is that profits and wealth accumulation were only possible during eras of increasing free energy per capita, as was the case during the industrial revolution through the 1970s. Toward the end of this era, the growth in per capita free energy started to decline and both economic growth and increases in productivity started to decline as a result [12]. The period from the late 1970s to the present are marked by declining wealth production overall but redistribution of what wealth is produced to create an ever widening gap between the rich and poor [13].

Governance

The governments of numerous states, whether democratic, autocratic, or something in between, demonstrate the degree to which the human understanding of governance for stability, resilience, and sustainability is extremely flawed. Regardless of the prevailing governance philosophy of a state, the construction of a top-down governance hierarchy seems to be the norm. This is a holdover concept from early agricultural states where the emphasis was on the logistics of raising and preserving foodstuff along with distribution mechanisms to keep the workers able to work [10]. This is in high contrast to the way in which humans evolved to be cooperative organizations in which the higher levels of an HCGS (even tribes were organized in this fashion) existed to serve the facilitation of lower levels. That is, a coordinator, e.g. for a hunt, served to help the hunters be successful so that the whole tribe might benefit. Our modern, and very warped, view of hero hunters commanding others is not in accordance with the evidence gleaned from contemporary hunter-gatherer populations.

The agricultural revolution, as it played out independently in many areas of the planet, set up a selection pressure that favored top-down command and control with hierarchical power structures subverting cooperative networks. If you could pinpoint one place in the evolution of human consciousness as being the pivot from egalitarian to power hierarchies the agricultural revolution was probably it. Subsequent to that turning point, complex societal states with their class distinctions and morally reprehensible treatments came to dominate the HSS. It would take centuries before the concept of human enslavement for production labor would become appalling to many (but still not most).

This is where governance and economics intersect. Slave labor has been a feature of economic production since the earliest times of the agricultural revolution [10]. Even today, there are still parts of the world where human bondage is used to underlie the means of production of useful work.

Systems science and a better understanding of humans, psychologically, suggests an alternative scenario. It is conceivable that a more natural social organization, namely something similar to social organizations in the later Pleistocene era, might provide a more secure and supporting structure for the human psyche, and thus human behaviors.

The core of human social organization is the family and the aggregation of a few extended families into bands or tribes. Modern society is based on nuclear families isolated within islands of indifference. The number of psychological pathologies that this entails is legion. Social psychologists know what the problem is for modern humans (in western cultures) but are powerless against the causal influences of the neoclassical capitalistic economic model combined with the neoliberal rugged individualist concept that purport that anyone can attain the "American dream" of wealth and power. Nothing could be further from the psychical evolutionary normalcy of the human condition.

The advent of organized large-scale farming in emerging civilizations led to an emphasis on logistical decision-making being selected for. Some tactical decision-making was also needed in terms of protecting territory or capturing same from other neighboring emerging civilizations. Strategic thinking became much less important for the general populations, left to a few individuals in a top-down hierarchical organization.

Throughout the rest of the natural world, the HCGS is not a command and control system. Rather, higher order coordination agents exist to serve the needs of those coordinated and the purpose of the whole system.

Agents/Agency

The problem with humans as agents in either a governance or economic decision process is that each individual retains a hidden agenda that includes many covert socio-psychological motivations, such as fulfilling a need for esteem or dominance in a social hierarchy. In most cases in both governance and economic decision processes, the decision models to be applied, while they may involve some ambiguity or uncertainty, nevertheless are relatively direct in terms of moving the system toward a beneficial outcome. But it is when an individual asserts their own desires or needs into the process that we see a breakdown in a beneficial agency. One might easily conclude that we need to take humans out of the loop so but finding what to replace them with (a computer program?) is an interesting but complex question.

Some decision types can probably be automated and actually are even now. For example we know that computers can make reasonable stock exchange trading decisions much more rapidly than a day trader staring at a ticker tape. Supply chain management is another area (logistical as well as tactical) where automation has taken over a number of decision nodes. Research in the area of automated agency in operational, tactical, and logistical, at least in the management of firms, suggests that this trend will continue. It is much less certain that automated agency will be able to play a role in low-level and mid-level management of governments. Also it seems unlikely in the foreseeable future that automation will take over strategic decision making, so humans are likely to stay in the loop in that respect. But, that is exactly what humans evolved to be good at prior to the advent of agriculture (and later industrialization). So, perhaps, returning human agents to primarily focus on strategic decisions (for family, community, state, firm, institution, etc.) will reinstate the selection pressures that nudge human evolution to better capacities to think strategically.

Fortunately, there are systems approaches to designing structures and functions in which humans can operate as agents and the system not suffer the inherent limitations of human decision makers. Some of these approaches are well known and quite old. They are best described as watching the watchers and double-blind monitoring. Internal auditing is an example of second-order monitoring with feedback to check or correct judgment errors in decision agents. Of course, this assumes that the system in question has an established and routine mission and remains relatively stable in its operations over long periods of time. In other words, the system cannot be growing and/or developing by more than some low rate. It can be shown that when novelty is being introduced into an evolvable system sporadically, episodically, and perhaps chaotically, as when corporations decide to introduce new product lines to enhance their sales and profits (see above) without strong evidence that such introduction will have the intended results without unintended consequences, that disruption to normal routines can lead to failures to adequately audit and report.

Conclusions

We are on the threshold of developing a whole new way of organizing our existing knowledge, discovering new knowledge, and using that knowledge to design human-built systems, such as governments, organizations, and social systems [5]. The core idea is that of systems science or the study of systemness in all organized material structures (which includes social systems). The objective would be to use this approach to transform our more-or-less naturally evolved, but currently unfit HSS into one that could "play nice" with the rest of the Ecos. All CAESs embedded in higher order CAESs (e.g. a species embedded in an ecosystem) produce outputs, material and/or energy, which benefits other embedded CAESs. Even waste products of many systems are useful to other systems as resources. The same must be the case for the HSS as a subsystem of the Ecos. What should our product be? We humans along with our cyber-physical resources are information processors par excellent. That competence, using systems knowledge might make us excellent managers of the planet.

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УДК 303.05
JEL R 49

SOCIO-ECONOMIC PROBLEMS - A CHALLENGE TO THE SCIENCE AND SOCIETY

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Abstract. Modern society is faced with a huge number of problems in various forms. The negative consequences of their existence threaten human civilization and the environment. Attempts to solve these problems modify their manifestations, but do not eliminate most of them. Furthermore, the use of the results of scientific and technological progress brings more coercion and control into human life than freedom and systemic management that improves the quality of life of every member of society. In Russia, this is manifested most vividly and contrastively. Modern science has not formed a full picture explaining the Genesis of the current problematic situation and suggesting ways to solve it. This is a challenge to the international science and community. Changes for the better can only occur through application and expansion of the practices of operational thinking and systematic intervention (management). This is only possible upon condition that the system archetype is changed.

Keywords: quality of human life, socio-economic formations, personality archetype and pattern, system archetype and pattern.

Matthew 12:25.
“Every kingdom divided against itself will be ruined, and every city or household divided against itself will not stand.”

I. INTRODUCTION

At the end of the twentieth century, humanity plunged into a chain of mysterious disturbances. The first was the collapse of socialism. But the return to capitalism led to a decline in birth rates and a rise in mortality, the consequences of which are comparable to the casualties of World War II. The indigenous population of Europe is dying out. The pandemic of international “terrorism” and “color-coded” revolutions is spreading around the planet, sowing pain, fear, enmity and chaos. Distrust and disunity are growing in the society. And as for the scientific and technical progress, not only does it not solve social and economic problems, but also introduces additional restrictions, excessive control and other side effects of external comfort into a person’s life. This situation plunges humanity into depression and bitterness, causing extinction, terror, civil and international wars.

To this day, modern science has neither an explanation for what is happening, nor a vision of how to unravel the tangle of the social and economic problems of our time. The both socio-economic formations (socialism and capitalism), as experience shows, have exhausted their historical potential. In addition, the modern world has reached such a level of complexity at which “guesswork” development becomes extremely dangerous. It is critical to seize the essence and to understand the root causes of social and economic problems and exercise social engineering of the social structure, where not only existence determines consciousness, but consciousness determines existence. The Association of

Independent Scientists "Russia XX-XXI", which began to substantiate the strategy of humanity development in 1997, formulated a hypothesis about the potential possibility of building a different social system capable of ensuring the universal development and improvement of the quality of life of each person.

II. Theory and Methodology of Social Design

The laws of society development and change of socio-economic formations, patterns of socio-economic processes, and the issues of social design and management continue to attract the attention of scientists in various areas of social sciences [1, 2, 3, 4, etc.]. The understanding of what underlies the evolution of society changes over time, but a holistic picture is yet to be produced. The puzzle of the separate "fragments of the world" is to be assembled relying on the systemic paradigm.

The systemic vision of society implies not only its consideration within the coordinates of "time and space" in the context of the nine quadrants [5], but also an understanding of the contour cause-effect relationships in its existence, among which the mutual influence of the system and the personality development is critical [6]. From this it follows that the statement "existence determines consciousness" that originates from historical materialism sets a one-sided view of the evolution of society, and the relationship of the basis (productive forces and production relations) and the superstructure (various institutions and worldviews) require clarification.

The most important factor influencing the development of society is the mental models of individuals, which leave an imprint both on the interpretation of what is happening and on the justification of individual choice. In the context of the structure of society, the relations of individuals with the system (based on mental models-antipodes "I am part of the whole", "There is me and there is the world, separately") and with each other ("interests are unequal" and "interests are equal") are fundamental. It is they that give rise to patterns of individual behavior and a certain social structure that are significant for development of the society. Of course, these opposing formulations are practically not found in real life in their pure form, but, despite this, taking them into account makes it possible to determine the direction of individual behavior. If a person considers him-/herself an integral part of the system, then doing something for the system, he/she does it for him-/herself. Otherwise, the person considers the system to be a source of satisfaction of his/her requirements. In the extremes, it is the intention to give and take, respectively.

The conviction of unequal interests creates competition and the desire for power (the "one man's victory is another man's defeat" model), while in the opposite case the basis for mutually beneficial agreements and cooperation (the "we do it together, we win together") is created.

The limited rationality and organic irrationality [7] (including the mental and cognitive processes generating them) of an individual must also be considered in explaining his/her behavior and contribution to the functioning of society. The most important are the "person to person, "person - good", and "person - information" relations.

It's worth noting that almost any technology and technical means can be used both for the benefit of society and an individual, and to the detriment, depending on the intentions of the actor. Intentions are determined, in turn, by the worldview and interests of individuals.

The level of awareness (knowledge) of individuals and their spirituality also have their effect.

In general, the explanation of socio-economic dynamics should be disclosed as a contour influence in the following sequence: personality archetypes - personality patterns - system archetypes - system structure - system patterns - personality archetypes.

This means that the classification of socio-economic formations should be formed at the cross of several characteristics, reflecting the reference points in the material, informational and spiritual spaces.

III. DISSOCIATION OF ACTORS AS A MAIN CAUSE OF SOCIO-ECONOMIC PROBLEMS

The functioning of the system as a coordinated mechanism can be ensured only under the condition that each of its elements will perform a useful function (or a set of functions) in a system of a higher order. People's misunderstanding of their connectedness in society leads to many problems.

In the behavior of individuals, the following patterns are observed. If a person is driven by an inner impulse - a desire to do something (motivated), then he/she strives to get the best result (effect) under the existing limitations. If a person is forced to do something even to ensure a related attractive outcome (stimulated), he/she minimizes costs to produce an acceptable (not the best) result. These patterns appear in all life situations. They are observed in the behavior of enterprises, government agencies, authorities, countries and even international organizations, depending on the perceptions of the individuals engaged in them.

The greater the dissociation of actors, the more deception, fraud, indifference, mistrust, attempts to profit at the expense of others, formalism and restrictions flourish in a society. The greater the dissociation of actors, the greater the transaction costs that arise as the cost of distrust. This generates an even greater dissociation. A strengthening contour is observed accompanied by an increase in socio-economic problems.

Attempts to solve these problems, giving rise to competition, finding and punishing the "appointed" originators of problems, introducing massive control, and constantly restructuring activities in the search for new forms, are doomed to failure. The structure of a system built on coercion (overt, covert or concealed) creates only mirages of management, pushing people into a rut of endless problems and technical slavery. There is no point in looking for the guilty. Each one plays an important role here. No technology can solve modern social and economic problems.

IV. ASSOCIATION OF ACTORS AS A BASIC PRINCIPLE OF PROBLEM-SOLVING

Institutions play an important role in the structure of socio-economic systems, streamlining relations between actors in society and shaping the possibilities and limitations of their activities. Arising in response to the needs and interests of individuals, whose implementation in society faces various threats, institutions reduce uncertainty by establishing stable patterns of interaction between individuals.

It should be noted that the genesis of formal and informal institutions is different.

Formal institutions (the attributes of which are mandatory norms, controlling organizations and the existing mechanism of coercion) are based on the principle of coercion of those who do not share the established norms of certain behavior regardless of their opinion. However, the basic human need to be free leads to the fact that, other things being equal, one subconsciously prefers the norms that he/she recognizes in comparison with the mandatory norms of formal institutions differing from them. Therefore, great efforts and considerable expenses are required for the existence of organizations that monitor compliance with the norms and ensure the launch and operation of the mechanism of coercion. We also would like to note that formal institutions are not always effective, therefore, in recent times, the phrase (with respect to various problems) has been heard more and more often: "the punishment must be very drastic and, most importantly, inevitable" to ensure compliance with the norms. This path leads to total control and forced right behavior.

But is it good and safe? The existence of formal institutions is often accompanied by the phenomenon of shifting of goals and functions, which manifests itself in significant side effects of the existence of these institutions for society and the individual. Succeeding in one aspect (regulating the behavior of the individual), we have much more serious negative consequences for the development of the individual and society. Depriving a person of freedom of choice, we hinder the development of those discriminative qualities that distinguish man in the living world. He/she turns into a cunning creature inventing ways (often infringing on the interests of others) of realizing his needs, unwilling to think and internally irresponsible for what is happening in society.

If formal institutions and the consequences of their existence are due to the fact that the majority of the population supports their existence by their choice (behavior), despite the acceptance or rejection of basic and related institutional norms, informal institutions, on the contrary, are a direct consequence of the fact that individuals share these norms and rules, and are guided by them in their behavior. No expenses for coercion are required, and in this sense, it is a more efficient form of society organization.

Considering that the threats to the realization of individual needs increase as disunity in all its manifestations grows in society, it is important not to argue about what institutional norms should be, but to ensure voluntary (not forced) acceptance of these norms by each member of society due to the awareness their objective dependence on the environment and understanding of the impact of long-term, non-obvious systemic consequences on the life of a particular person.

Only the freedom of a person against the background of his spiritual and intellectual development can save humanity from degradation and problems.

VI. Characteristic features of socio-humanism

Comparison of social formations should be carried out by the seven basic points: 1) the historical driving force, 2) the goal of development and progress, 3) social relations, 4) economic relations, 5) the government control mechanism, 6) social control of the goal achievement, 7) social policy.

1. *The driving historical force.* In former centuries, humanity developed according to the laws of economic determinism, subject to the action of "blind" material elements and the influence of productive forces. But man is dual in nature, being an individual and collective being, material and spiritual. Capitalism prioritizes one side, communism - the opposite. To unite the interests of society and the individual, a dual social structure is required - “social humanism”. It is more difficult to manage, as it requires the harmony of opposites. But the integration of the opposites energies gives a cumulative creative effect. In the modern world, the impulse for development, along with material factors and constraints, can and should be the conscious desire of individuals to unite, mutually beneficial cooperation and harmonious coexistence. The basis of this is the spiritual development of each person, an understanding of coherence with each other through systems of a higher order (socio-economic, environmental, etc.) and respect for the human dignity of all members of society. The theory of society development should be based on the principle of historical dualism as a balanced interaction of historical materialism and historical idealism.

2. The goal of development and progress. Previously, the goal was to increase material wealth and ensure superiority. As it turned out, putting the financial and economic targets at the head of the table led to large distortions in the life of society. Therefore, in addition to economic benchmarks, in which there was and is no man himself, the concept of “quality of life” (QL) should be adopted. In contrast to the standard of living (the totality of goods and services consumed), QL shows how good or bad people are, whether they are happy or suffer under specific conditions of existence.

To assess QL, it is advisable to use three groups of statistical indicators [8]:

- physical health: mortality, duration of creative life, fertility, and others;
- social health: the presence of the meaning of life (an indicator of hopelessness - suicide), strength of family ties (the proportion of preserved families), social optimism of the youth (weddings), care for children (social orphans), creative work (discoveries and inventions);

- spiritual health: kindness in relations between people (extreme inhumanity - murder), justice of distribution of property (an indicator of injustice - robbery), relevance to society (employment), social polarization (the ratio of incomes of the richest / poorest families).

Together with the blocks of indicators of living standards, investments in the future and the potential of the state, they form the Index of Good Life of the Population (IGLP). Another important characteristic of the quality of life is the case when a person is engaged in creative activities based on internal motives, and not because of external coercion in all its forms.

3. Social relations. Previously, the state was always owned by a part of the population represented by the ruling class. Now an increasing number of people feel the need to "be masters" of their own lives. The people must be the main source of will and power. The organization of society should promote harmonious coexistence and personal development.

4. Economic relations. The abilities and needs of people differ: some prefer work in public state-owned enterprises, others - in self-governing groups, and others - in private production companies. Economic activity itself, servicing cycles of different length and complaxity, requires a diversified structure. For appropriate niches, optimal forms should be justified, productive forces should be freed from ideological chains. As a result, economic relations should be built on the basis of common sense. What is considered to be a healthy thing is what contributes to the development of the productive forces in man and society. Any form of ownership must be sacred: state, cooperative, private. Their proportions should be determined not rigidly (by class dogmas), but flexibly (by production needs). The adopted plan, the market and the contract should serve as regulators.

5. The mechanism of government control. For a high quality of life of the population, a strong state is required, expressing the interests of the majority while respecting the opinion of the minority. Bourgeois and party democracy model failed to solve this problem. In addition, they proved unable to resist the rise of authoritarian regimes. A more reliable mechanism is required, which can be the people's democracy and iterative planning of the society's functioning, combining the "bottom to top" and the "top to bottom" schemes and implementing the contours of information feedback.

Mechanisms for the implementation of people's democracy require a systemic justification, but the general scheme is as follows. The citizens themselves delegate the authority to one candidate out of 200-250 permanent local residents exercising current control over them. The elected representatives form a legislative pyramid from the bottom up by the "delegation" method. The first level is formed by local People's Councils. They delegate a third of the team to the Councils of the next level, and so on, up to the Supreme People's Council (SPC). A representative can be withdrawn from any position by the authority of the level that delegated him/her. An elect can be deprived of the mandate by the residents of the territory from which he was elected. In this context, all representatives report to their voters at annual meetings. The implementation of laws is entrusted to the pyramid of the executive branch. It consists of professionals, who are appointed on the top-to-bottom principle. To this end, the SPC approves the prime minister, who forms the Government and presents it to the SPC for approval. The Councils of each level create their own Executive Committees. An executive committee is subordinated vertically to the executive committee of the next level and horizontally controlled by the Council of this level. Transparency of political and economic relations makes mass corruption impossible. The state authorities are compelled to be effective and moral.

6. Social control over achievement of the goal. The people never had control over the actions of the supreme power. As a result, achievement of goals was paid for by great sacrifices, and the functioning of state structures was detached from the needs of the people. In socio-humanism, the management of a country is carried out through feedback on the final result, where the goal is to improve quality of life, and the result is estimated by the dynamics of IGLP. The responsibility of politicians for the results of their work will provide a breakthrough to political governance of a new type. It is based on the principles of social ergonomics. The actions of the state should be ergonomic, that is, consistent with the values, needs and capabilities of a particular people. Monitoring its parameters is provided by the Good Life Monitoring Center. It consists of scientists selected randomly from the national

general list of scientists each year. The government reports annually to the Parliament on the IGLP indicators. When they deviate and cross the "red line", it triggers corrective and preventive mechanisms.

7. Social policy. No matter what happens in life, no one will end up in degrading poverty. Everyone must be provided with acceptable housing, public services, health care, nursery services, education, public transportation, and summer break recreation for children. Pensions must amount to at least 80% of the previous wage. This is a guarantee of the necessary property equality. At the same time, everyone is given the opportunity to increase personal wealth through their own labor. This is a guarantee of the necessary property differentiation, which stimulates creative activity.

Social justice is ensured by linking wages to the minimum wage. The gap must not exceed the 7-fold value, varying depending on production features. The gap in the incomes of managers and average executives of enterprises, organizations, institutions, and government agencies must not exceed 20%.

The strategic management of social institutions (science, education, health care, culture, sports, media) is implemented by the public councils of relevant specialists chosen from among their members by a rating vote.

VII. Conclusion

The universal significance of the social design of the new formation (social humanism) is great. Spreading the ideology of social ergonomics around the world, we will avoid the brutality of social revolutions. They are not eliminated, but become "tender" by means of the built-in control over the authorities. This ensures a non-violent transition from one qualitative stage of history to another as the objective and subjective prerequisites mature. As a result, there is no need for terrorism and wars, the elimination of social injustice, corruption and extinction of the population is ensured, the objective of peaceful development is achieved. At the international level, a self-adjusting political mechanism will emerge that does not force different countries to the same social and economic model, but finds optimal development conditions for each of them. The main optimality criterion is improvement of the life quality and the living standards of the population. The ideology of social ergonomics can become a unifying worldview for the states of the post-industrial society.

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JEL: B15, B25, P16, P 51

SYSTEM ECONOMICS, MESOECONOMICS AND COMPLEXITY ECONOMICS: ANSWERING MODERN CHALLENGES

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Abstract. The insufficient depth of mainstream neoclassical theory to explore the multifarious economic reality requires the development of new theoretical approaches. These approaches are considered in the paper, including system economics, mesoeconomics and complexity economics.
The methods used in our research, which was carried out in 2014-2018, included the survey and analysis of contemporary Russian-language and foreign literature.
The results identify common and distinctive features of the three theories considered in the research, both between themselves and in relation to mainstream neoclassical economic theory.
Future research will further analyze the initial premises, methods and results of these three theoretical approaches.

Keywords: system economics; meso level of economic analysis; complexity economics; heterodox economics; economic orthodoxy; increasing returns.

The main goal of the article is to show how such new approaches as System Economics (SE) [1, 2, 3, 4, 5], Mesoeconomics (ME) [6, 7, 8, 9, 10, 11, 12] and Complexity Economics (CE) [13, 14, 15, 16, 17, 18] in economic meet the challenges facing modern economic science. It is shown that the development of these approaches has been brought about by both practical needs and shifts in the system of paradigmatic scientific knowledge. The differences between the initial assumptions of SE, CE and ME, and the set of initial postulates of neoclassical mainstream economics are also shown. It is emphasized that SE, CE and ME are based on modern ideas of self-organization of complex systems. At the same time, they restore the traditions of classical Political Economy, since they also consider the organic nature of the economy, evolutionism and historical conditioning. All three approaches explore the logic of the formation of economic mechanisms that create patterns of economic life and the spread of change. Along with the commonality of the approach from the SE methodology, ME perspective and the approach from the point of view of CE, their distinctive characteristics are identified, which allows them to complement each other. Comparison of SE, ME and CE makes it possible to carry out a more in-depth analysis of the methodological features of mesoeconomic analysis, in comparison with the author's earlier works on this subject [9, 10].

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УДК 338.27

JEL C23.

THE THEORY OF TIME IN ECONOMY AND PERSPECTIVES OF ITS APPLICATION TO STUDYING MODERN RUSSIA'S ECONOMIC SYSTEM

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Abstract. This work formulates fundamental provisions and offers the methodological tools of the Theory of Time in economy. The author substantiates perspectives of application of the Theory of time in economy to studying modern Russia's economic system. The proprietary methodology of calculating "underdevelopment whirlpools" is used for determining time disproportions in development of modern Russia's economic system. Based on studying cyclic fluctuations of the Russian economy, the calendar of its development is compiled, according to which the most probable time period of overcoming the disproportions in development modern Russia's economic system is determined. Relative and absolute dynamics of development of modern Russia's economic system in 1995-2020 is determined, and a comprehensive dynamic model of development of modern Russia's economic system from the positions of the Theory of Time in economy is compiled. This model showed that federal districts of the Russian Federation are peculiar for different growth of GDP per capita. The most perspective time period for leveling time disproportions in development modern Russia's economic system is 2020, when, according to the economic calendar of all federal districts of the RF, there will be moderate rise or intensive growth. However, this requires targeted efforts, without which disproportions will be preserved or increased. As a result, it is substantiated that economy has its own time, which is different from physical time, and each economic system has its own time..

Keywords: Theory of Time in economy, time disproportions, "underdevelopment whirlpoolss", economic calendar, Russia's economy.

Introduction

The time aspect of economy is studied fragmentarily and without any system within separate concepts of the economic theory. The attempts of classification of economic systems according to the time principle (according to the level of socio-economic development), within which developed and developing countries are distinguished, are contradictory and do not have a strong evidential basis and methodological provision, thus leading to scientific discussions.

Thus, a problem of imbalance of space and time study of modern economic systems arises, which leads to incompleteness of the picture of national economies and the global economy and thus limits and distorts the information and empirical basis of development and making of managerial decisions at the corporate, territorial, and global levels, leading to their non-optimality, which results in crises of modern economic systems.

This explains topicality of systemic study of the time aspect of development of modern economic systems and development of the Theory of time in economics, which should become a part of the economic theory – together with world economics, macro-economics, and regional economics, which form the Theory of space in economics. This problem is to be solved in this article, which purpose is to develop conceptual provisions of the Theory of time in economics and to substantiate its application to study of modern Russia's economic system.

Literature overview

Various characteristics and manifestations of the time aspect of development of modern economic systems are distinguished and studied within the following concepts of the economic theory:

Concepts that study past time:

– concept of economic cycles (Mohammadi et al., 2018);

– concept of time rows (Shahbaz et al., 2018).

Concepts that study present time:

– concept of economic growth (Kupina and Salko, 2015);

– concept of economic crises (Raźniak et al., 2018);

– concept of lost opportunities, (Stafford et al., 2011);

– concept of economy of human labor (Hecht, 2018).

Concepts that study future time:

– concept of extrapolation (Pirker and Lichtenegger, 2018);

– concept of scenario analysis (Jalles, 2017);

– concept of given indicators (Creemers, 2018).

Separation of these concepts leads to multiple gaps in study of the time aspect of modern economic systems. For filling these gaps, it is necessary to reconsider the provisions of these concepts and to develop (on their basis) a comprehensive Theory of time in economics, within which economic time is viewed and studied continuously and in close connection and mutual dependence between past, present, and future time.

Methodology

Complex analysis of the existing concepts of the economic theory that study economic time showed that there's a relative (as to the objects of comparison) and absolute (as to themselves in past time periods) dynamics of development of economic systems. For studying relative dynamics, it is expedient to use methodology of calculation of "underdevelopment whirlpools", which is described in the works (Popkova et al., 2018a) and (Popkova et al., 2018b).

Result

As a result, relative and absolute time dynamics of development of modern Russia's economic system in 1995-2020 is determined, and a comprehensive dynamic model of development of modern Russia's economic system from the positions of the Theory of time in economics is compiled (Figure 1).

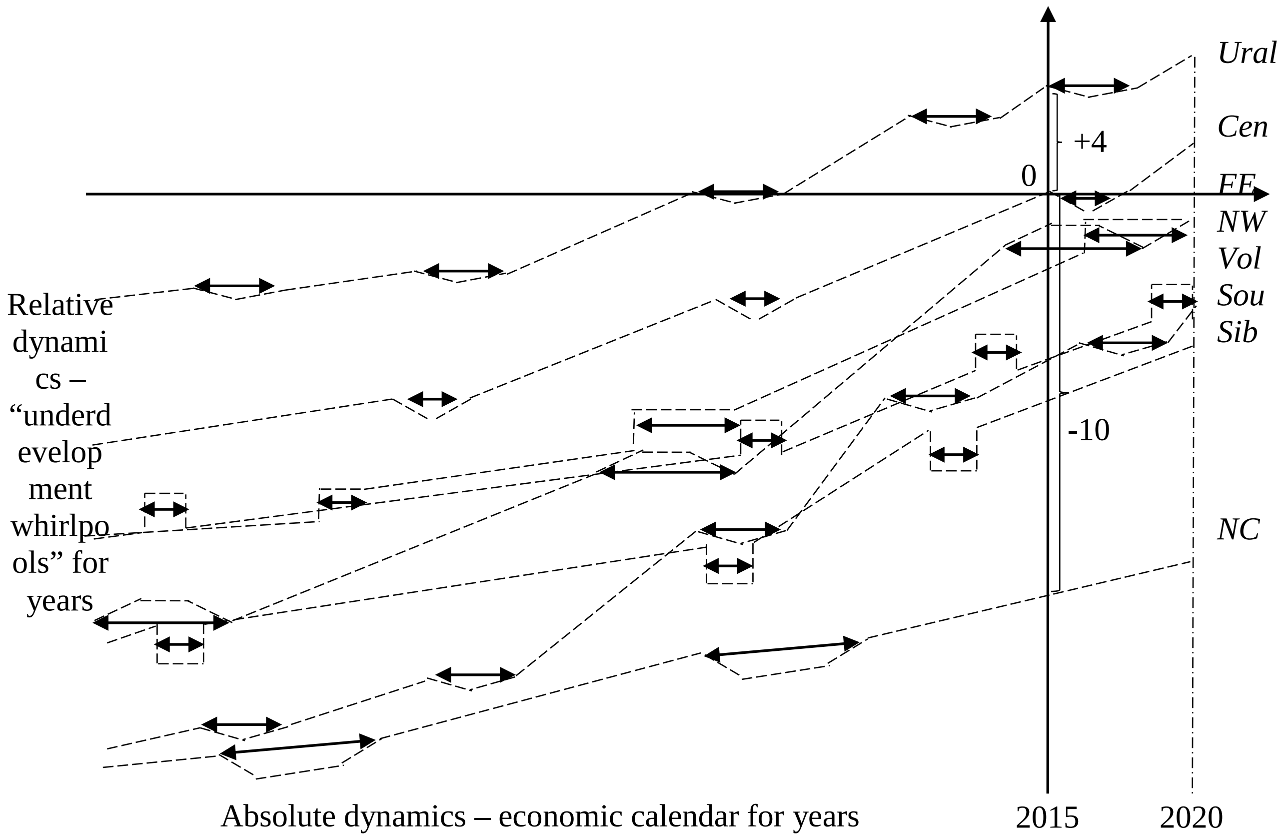

Fig.1 **Dynamic model of development of modern Russia's economic system from the positions of the Theory of Time in economy.** *Source: compiled by the author.*

The compiled dynamic model of development of modern Russia's economic system from the positions of the Theory of time in economics shows that federal districts of the RF are peculiar for unequal growth of GDP per capita. Vertical axis shows economic calendars of development of federal districts of the RF. Horizontal axis shows present time, which corresponds to the Russian level of GDP per capita. Most federal districts, despite the positive dynamics of GDP per capita, are in the past.

The most perspective time period for leveling time disproportions in development of modern Russia's economic system is 2020, when, according to the economic calendar of all federal districts of the RF, there will be moderate growth of intensive growth. However, this will require targeted efforts, without which disproportions will be preserved or increased.

Conclusions

Thus, it is substantiated that economy has its own time, which differs from physical time, and each economic system has its own time. However, the performed research allowed outlining the contours of the Theory of Time in economics, as a lot of provisions remained without attention. In particular, speed of the flow of economic time depending on its density is very interesting. This conceptual provision and development of the Theory of Time in economics should be studied in further research in this sphere.

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JEL M15, M22

THEORETICAL INNOVATICS AND THEORY OF SYSTEMS AND SYSTEM ANALYSIS

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Abstract. Article of science on a joint of the theory of measurements, theories of informatics, the theory of management of technical systems, theories of management of social and economic systems are devoted to classification characteristics of theoretical innovatics. The integration role of the theory of systems and the system analysis when developing methods and models of management of cyber physical systems is presented.

Keywords: digital society, theoretical innovatics, cyber physical systems.

The 00th surely can be called an era of society digitalization..The “digitalization” term is often understood as an introduction of the new information innovative technologies serving for the organization of infrastructures for business, enterprise and society management. Innovative infrastructure is represented as the interconnected set of "layers" of transformation of measuring information on subject domain of a research. The subject domain of a research in theoretical innovatics is connected with social and economic systems. An object of research of theoretical innovatics is social and economic system. The process principle of engineering of resources allows the simultaneous monitoring of all business processes indicators with such difficult dynamic systems as social and economic systems. The theoretical innovatics as a science counts as many centuries as long exists a scientific thought, innovative transformations of the society management, production, business.

Change of technological ways is characterized by a concise type of innovation: transformative, gradual, process, marketing, organizational, explosive, etc. The technological breakthrough is impossible without accumulation of knowledge, investigations, technologies, purposes, market researches, the prepared shots and infrastructure to be shown at a given time.

Historical prerequisites of emergence, formation and development of theoretical innovatics are connected with the works of such scientists as N.D. Kondratyev, Y.A. Shum-peter, B. Tviss, Kosygin A.N., Liberman E.G., Glushkov V.M., Fedorenko N.P., Primakov E.N., Obraztsov I.V., Volkova V.N., Tukkel I.L., Yakovets Yu.V., Gelbreyt D.K. and many others. There are works [1 - 3] on structuring and formalization of the concept "innovation", "innovative process", "funnel of innovations", econophysical models of distribution of innovations, etc.

The terminology database of theoretical innovatics is presented in [4]. As early as in the 90th of the last century the "innovatics of all countries and nations” gathered in the city of Oslo and formulated the main objective of the business analytics of innovative activity: the acquisition of primary measuring information on innovative processes. It is important to define sources of data on innovative processes effectively to operate innovative activity. Such primary measuring information is: bibliometric data, know-how knowledge, inventions, technologies.

In [5] it is emphasized that "the essence of an innovation is made of changes, and the main function of innovative activity is its change function". It is obvious that such interpretation of innovations is concordant with digital transformation of domestic economy. Only the possibility of management of changes, adaptability of control of parameters, indicators, KPI of social and economic system allow to customize the system according to strategic objectives.

This is even more significant in term of the fact that nowadays the social and economy system (the digital enterprise) is suggested to be considered as the cyber physical system, equally represented by technical and socioeconomic patterns. Thus in works [6,7] it is offered to consider the primary measuring information on the digital enterprise in the context of electric, and economics measurements.

[5] also addresses the issue of the place and the role of innovatics theory in conjunction with theoretical, scientific-methodological basis of different theories: the theory of system and system analysis, the change system, the organization system, management system (technical and socioeconomic systems), marketing and management systems (information, marketing, social, logistics, etc), theoretical economics, informatics, etc. The used principle of "an automation pyramid" of management of business processes of the digital enterprise allows to draw a conclusion on a binding role of the theory of systems and the system analysis. Transformation of primary measuring information in output administrative information are offered to be realized on the basis of such CALS technologies as technologies CAD/CAE, PLM, ERP, BPM, CLOUD, SMART, GRID.

Application of the theory of management of CPS-systems allows to apply technologies of the “Internet of things” to management of the digital enterprise, the “Internet of people”, the “Internet of services” in terms of the processes of formation of administrative decisions on efficiency of activity of the enterprise. The special role in processes of improvement of administrative decisions at technological transformations of production is given to the description of life cycle of technological innovations. Understand processes of introduction of new technology solutions of management as technological innovations business - processes. Transition from business - processes "as is" to business - to processes "as it is necessary" - one of the purposes of introduction of technological innovations. In a particular, technologies of informatization and automation of business processes, technologies of processing of multidimensional information, cognitive visualization of information, technology of data mining, technology of introduction of IT services for management of various levels of transformation of information, technology of modeling business - processes, technology of extraction of knowledge, technology of interpretation of data, technology of introduction of corporate information systems, etc. belong to such technological innovations. The main directions of researches at the modern level of development of theoretical innovatics are connected with development of mathematical models of management of innovative processes. So, the environment of introduction and distribution of innovations is considered as multidimensional properties space which is characterized by some "density" and speed of distribution of innovations. Mathematical models of management of processes of distribution of innovations are represented with use, for example, of scenario approach, ecophysical approach at which innovative process is described with application of the corpuscular and wave theory [8]. The theory of systems and the system analysis allows to organize interrelation of methods and models of theoretical innovatics with methods and models of the theory of measurements, theories of management, the theory of informatics, etc.

Use in the theory of systems and the system analysis of cyber-physical approach has significantly enriched processes of formation of administrative content. Administrative content for the digital enterprise as difficult dynamic system contains knowledge of process.

Thus, it is offered to represent theoretical innovatics as the system of knowledge which sources is knowledge of various theories of transformation of primary measuring information on subject domain of a research. The system analysis allows "to sew" necessary structure of knowledge accompanying decision-making process about the effectiveness of the introduced innovations into the uniform operating content.

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JEL O10, B41

VALUE-PURPOSED BASES OF SOCIO-ECONOMIC DEVELOPMENT

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Abstract. The article shows how the cultural and ideological grounds, embodied in the needs-values, goals and interests of individual groups of people, affect the socio-economic development Of mankind the use of methodological principles of systemically transdisciplinary approach allowed to justify the principles of natural science formation of universal human values. The need to preserve the unity and integrity of the planetary system presupposes the co-evolutionary development of all its fragments and the determination of needs in terms of quantity and quality. It is shown that from the position of the system-transdisciplinary approach the change of the vector of socio-economic development is possible only when creating a "critical mass" of people who accept the idea of unicentrism and, consequently, the resulting system of values.

Keywords: socio-economic development, interests, value system, system-transdisciplinary paradigm in Economics

Introduction

In order to survive, throughout their history, people have established norms and rules for living together. These norms and rules established an obvious principle - a person must subordinate his interests to the interests of the group (family, tribe, etc.).). Such subordination made the group viable. The rules and norms of people's living together is an immanent feature of the development of any human community - from the family to humanity in the mass.

The fact is that these rules are based on the interests of individuals or their populations, i.e., on some needful, motivational state of people. Whereas, interests are embodied in the goals to which this group approaches. And it (this group of people), in various ways, does everything to ensure that these rules are adopted by the majority. The hinge of these interests is always expressed in specific needs. The need in relevance gives people the need for joint action to create wealth, its distribution and exchange, i.e., economic relations. Consequently, the basis of socio-economic relations always means the interests of people who determine the form (types) of these relations.

1. The obvious globalization has aggravated the problem of reconciling interests for the sake of humanity's survival. However, what is integral to these interests? What is the criterion for evaluating the correctness of the work changes? And what are the capabilities of people who set the vector of change?

The use of the methodology of the system-transdisciplinary approach makes allows to propose a natural scientific justification for the emergence of interests and to designate a criterion for evaluating their change.

From the standpoint of the philosophical concept of unicentrism, which is the basis of the transdisciplinary methodology, the World conceives a Unified clustered environment. Thereof it follows that the Unity of the clustered environment is achieved by a unified form of organization of both the environment itself and all its natural elements-fragments, as well as interactions and relationships between them. The World as a clustered environment and, therefore, each fragment, has a potency that manifests itself under certain conditions. [1] The mandatory nature of the procedure makes it possible to apply the systematic approach methodology in the studies of socio-economic processes.

Then, conceptually, the order of disclosing the potency in a functional ensemble represents the successive *emergence of carriers* that can perform the corresponding *functions,* and the interrelations between them, providing the ability to perform actions - *the structure***.** Elements function together in the unified world and constitute the so-called vertical and horizontal functional ensembles. [10].The order that determines the unity of the World implies isomorphism, the identity of all the processes of transformation in each functional ensemble. Actions performed by the carriers and the connections between them must ensure the existence of a fragment and the preservation of the ensemble unity. They should have the mode of *co-directed development* or co-evolutionary *mode* [2]. Whereby, the potential image of the system plays the role of the system standard and represents the sphere of obligation. The demonstration of the potency materialization in the form of carriers and connections between them determines the system integrity, i.e., the realization of the reference image. Therefore, the system represents an order that determines the unity and integrity of elements and connections between them. The main function of the system is the transformation of potency.

The isomorphism of the transformation order of transformation stipulates a *strict determination of the quantity and quality of matter and energy in the transformation processes*. Such determinism is a prerequisite for maintaining unity and integrity. A smaller or larger amount of substance and energy leads to a violation of coevolution, an imbalance, and therefore a threat to the preservation of unity and stability. Such a violation is dysfunctional in terms of the main function of the system - the transformation of potency. Determination of the necessary for the substance and energy the potency development inherently stipulates a mechanism for the constant evaluation of the quantity and quality of these parameters.

An important feature of the development of the system is that at each stage of the disclosure of potency in the required quantity and quality, carriers (both tangible and intangible) should appear. That is, a critical mass of carriers should appear, and it allows to make the transition to the next stage of development. In that way, a nuclear explosion requires uranium 236 and its necessary quantity (critical mass).

2. Considering the planet as a system, we must recognize that man and mankind is a fragment of the planetary system. Undeniable is the fact that the corresponding conditions were set to arise for the appearance of mankind on the planet. That is, developing, the planet consistently transformed the original state of its own substance and created the conditions for the man appearance. Appearing, a man (mankind) actively involved in the transformation of the substance and energy of the planet, just as all of its other natural fragments did and do.

To perform the main function - the transformation of substance and energy, people need to evaluate the significance of the substance and energy.

Evaluation of the consumed goods importance is inherent in the human body physiologically, i.e., is laid by nature. A man cannot inhale more air than his lungs allow. For instance, a single overeating will lead to an emetic reflex, i.e., the body will activate the mechanism of neutralizing dysfunction. These are the *physiological, essential, existential needs* of any person. To this extent, the evaluation of the received substance and energy significance, as well as the order of neutralization of dysfunctions for preserving the unity of the organism, is, so to say, "sewn up" in human nature.

In horizontal functional ensembles, from the family to humanity entirely, the mechanism for assessing the value of goods is realized in a set of values. However, a man is not born with this set of needs-values. A set of values is formed in every person in his mind by a social group, society. In this context, it is important not just to eat, but to eat on a gold platter, to wear not just warm clothes, but a mink coat, etc. These are the so-called status requirements. [3]

Thus, the value-objective concept lays at the core of the interests of groups of people and determines the nomenclature and assortment of benefits and generates rules of activities (formal and informal) for their production, exchange and distribution. If the set of values - the value-objective concept is different, then there are conflicts and then: either people should seek a compromise in the interests of preserving the family, the tribe, the state; or these groups decay. Every time a "critical mass" of people with different interests appears in the horizontal ensemble of humanity, this fact causes a change in the value-purpose concept in society. In its turn, this leads to social upheavals in the form of strikes, uprisings and, ultimately, changes in the social system.

So, we are fragments of the planetary system. Our freedom in the choice of the system of values, say the least of it, is strongly limited by the laws and forces of nature. It is impossible to agree and with nature, especially to conquer it. We can only cognize the laws of nature and use them for our own preservation. This allows us to theoretically justify the vector of necessary changes in the coordination of the interests of each person and society in general.

3. As we pointed out above, the evaluating role of the mechanism for assessing the quantity and quality of goods for humanity plays the value-objective concept. To maintain the stability of the development of a planetary ensemble, these status requirements of man and of mankind, as well as essential needs, *must be* precisely defined quantitatively and qualitatively. Why? Because if one person as a member of the vertical ensemble of the planet, for example, uses drugs, he cannot correctly transform the potential of the planetary ensemble, that is, he violates the law of determinism of essential needs, and another man substitutes him. The violation of the determinism law of needs in substance and energy by mankind, which is realized in the nomenclature and in the range of goods and in the ways of their exchange and distribution, is also dysfunctional in the vertical ensemble of the planet. The planet *will have to* "turn on a mechanism" to neutralize dysfunctions, which will lead to the disappearance of this mankind as an element of the vertical ensemble of the planet, followed by its replacement. In this sense, moderation in material goods and other moral norms of the main religious faiths is the embodiment of the quantity and quality substance and energy determinism in the processes of production, exchange and distribution.

4. In order for mankind to survive and pass to the next stage of its development, it is necessary:

- to designate the goal of social and economic development to improve the welfare of the household. Since the household precisely is the ultimate consumer of the goods produced;
- to develop quantitative and qualitative parameters, nomenclature and assortment of needs-values that would meet the law of needs determinism and coevolutionary development of the planetary functional ensemble;
- to form a "critical mass" of people who perceived this elaborated value-purpose concept in society.

Conclusion

We have shown that, according to the system-transdisciplinary paradigm, man and humanity are fragments of nature. Their place and role are determined by the planetary functional ensemble. Own development of man and man obeys the laws of development of this ensemble. According to these laws, the volume and nomenclature of needs; benefits; production, exchange and distribution methods must be co-evolutionary for the development of this ensemble, i.e., they should be aimed at the conservation and sustainable development of the planet. The violation of this condition in terms of the created goods quantity and quality is perceived by the planetary system as a dysfunction. Such are the natural scientific foundations of this vector of change in the value-purpose concept.

If a critical mass of people realizes the described picture of the world and the system of values stem from it, they perceive the necessity of observing such a value-objective concept not because they fear punishment by God or by other people but because there is no any other possibility. This same value-purpose concept will serve as a reference point for finding a compromise in harmonizing the interests of people and nations and countries in the functional ensemble of mankind, and the formed "critical mass" of humanity will allow us to hope for a relatively painless transition to a new value system.

Otherwise, in the planetary ensemble of the planet, mechanisms of neutralizing dysfunction must be included, and humanity will be replaced.

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JEL P51

ECONOMIC FACTORS OF THE WORLD SOCIAL PROCESSES

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Abstract. The work analyzes the causes of the global systemic crisis. Management of a society existing in an aggressive environment is centralized and planned, including the centralized and planned economy. The structure of society on the principle of its formation is oligarchic. The establishment of society controls all social processes, including the processes of distribution in the economy. The principles of distribution in the market are subjective contractual in nature, which opens up the possibility of abuse. Disproportions in the distribution system led to the inhibition of scientific and technological progress. Currently, the leadership in the world elite passes to the technical elite, which determines the level of human development. It sets the task of accelerating the pace of scientific and technological development of mankind. The role of the remaining elites becomes official. The threat of loss of privileges caused resistance to the programs being implemented.

Keywords: the global system crisis, the oligarchic structure of society, the economy, technical development, the change of leadership in the world elite.

Introduction

Currently, the world is in a systemic crisis, which indicates a crisis in the system of elites governing the world. The purpose of this work is to make an attempt to systematically understand the causes of the crisis and trends aimed at overcoming it.

Basic principles of social analysis

The stability of society in an aggressive environment depends on how effective is solution for two main tasks: providing objects for life and protection from objects that threaten people's lives. The survival of society as a whole is impossible without common goals and plans for their implementation. Thus, the solution of the main problems of any society involves the centralization of management and planning of social activities. And these principles do not depend on the specifics of the social structure.

Any social group, including society, is grouped around an active core of group norms and values [3]. Historically, this core has always tended to close down with the formation of a stable ruling group that organizes and controls all social processes, including economic ones. Thus, the structure of any society is oligarchic. Democracy is possible only within an oligarchic group.

Within the social core professional groups are formed: scientific and technical, industrial, financial, political, administrative and military elites with appropriate professional technologies. The criterion of belonging to the elite is the possession of professional secrets and social secrets. The dynamics of social processes is mainly determined by the relations of these elites within the control core.

Principle of economics

The economy as the most important social system, which solves the problem of guaranteed provision of society with everything necessary, has always been a key system of society. Human evolution follows the path of human-machine symbiosis. Biologically man has not changed much. Human biological mutations gave way to" mutations " of technical means. As a result, the technical infrastructure of man has changed dramatically, ensuring his dominance in the world. This infrastructure is the result of creative activity of people. With the increasing role of infrastructure, the social role of the economy is steadily increasing.

In the oligarchic society, the management of the economy is centralized oligarchic in nature. Thus, any economy is centralized and planned. Planned capitalist economy was opposed to the same planned socialist economy. The only difference is in the structure of the governing elites. The elite of the USSR was built on the basis of the theocratic order model, and the capitalist – on the ancient oligarchic model.

The core of any economy is the cycle of production and distribution of products consumed or used by the population. Production is the same in all systems. The only difference between economies is in the way they are distributed. In the modern economy, the market is the main method of distribution, while maintaining direct cashless distribution. Direct distribution is used within critical social systems: production, military, and management systems of society. In extreme conditions of war or natural disasters, direct distribution becomes basic and market auxiliary.

The principles of real economy differ from the principles of liberalism declared in economic theory. In any system, the degree of freedom of the elements is limited. In society, people are also limited in their behavior. Similarly, there cannot be complete freedom of enterprise in a centrally planned system. The reality is that the interests of each entrepreneur are subordinated to the common interests of the whole.

There is no freedom in a market economy. The market is tightly controlled by the establishment. The "free" market is regulated by a variety of controllers: legal control, administrative control (licensing), tax control, financial control, investment control, information control (openness of information about the state of enterprises), power control (force as an economic factor), criminal control.

In the oligarchic society, the management of the economy is inevitably oligarchic in nature. Oligopoly, as a way of economic dominance in all sectors of the economy of several large corporations-is a standard way of managing the economy of developed countries. The coordination of a small number of large companies allows the allocation of quotas for the bulk of production and control of prices. There is no competition at this level. A lot of medium and small companies are forced to operate in the economic conditions formed by large corporations.

Since large industrial corporations are the core of the economy, their bankruptcy leads to serious consequences. Therefore, in almost all critical cases, they are provided with budgetary support for administrative and political elites. As rightly noted in [4] - this is not market management methods.

In a centralized planning system as in a single social organism there is no place for competition. What is served under the guise of competition is a reservation, a standard technical means of ensuring the efficiency and reliability of the system. The parallelization of research and development between different teams is not a competition, but a common way to improve the effectiveness of these studies. The reservation of production is a common way of improving the reliability of output. If, for any reason, the functioning of one of the enterprises deteriorates, its function can be assumed by others, having the appropriate reserves of production capacity. Because of the above, the reason for the prohibition of monopolies is clear. The reliability of the system is more important than the profits of individual representatives of the business elite.

Distribution principles

The most important principle of economic management is the principle of private property, based on the recognized right of the Creator to dispose of his product.

The problem is that any modern product is of a social nature, because the long technological chain of manufacturing modern complex products require the participation of many people in its creation. The contribution of previous generations in the form of accumulated technical solutions, materials and equipment is also great in this product. Because of this, in the USSR and other socialist countries, the entire product was declared as public, but the principles of its distribution were determined by the party elite.

In a capitalist system based on" natural law", the principle of private ownership is maintained, allowing business owners to dispose of the product. In particular determining the price of the product. In such circumstances, in order to ensure the stability of the market system, it had to form the principles of fair distribution of profits between the owners of enterprises directly or indirectly involved in the production of products (ethical principle of acceptable rate of return).

The main instrument of market distribution is money, declared as a universal measure of the value of work of people and things. But in reality, money is not a measure. There is neither an objective unit of measurement nor an objective valuation procedure. As a result, pricing is based on a social contract, largely imposed by the elite on the whole society. All prices on the market are negotiable. The criterion of price is the availability of this type of product to the relevant population group. Accordingly, the work of people is evaluated. The main function of money, as well as cards of direct distribution – accounting. Distribution requires accurate accounting of goods and their consumers. Problems of accounting, the accumulation of unrecorded and shadow economy, lead to failures of the market system.

Since the economy is a means of guaranteeing the security of people, in the case of the inability of citizens to provide for themselves in a market system, the practice of various subsidies is quite widespread in society. Basic needs for food, health and education are subsidized by society. Agriculture-subsidized industry in all developed countries, which ensures the availability of food to all categories of the population. In critical situations society refuses to market and money transfers and all direct rationing, "subsidizes" all.

The contractual principle of distribution of social benefits opens up the possibility of abuse of their privileged position of social elites.

Social dynamics

In different periods of history, the leading positions within the establishment were held by various elites. In modern times, the leader is the industrial elite. In the context of elective administrative and political elites, their activities have become official. The same service was the activity of hired power elites.

In turn, the industrial elite is also heterogeneous. Within the industrial elite, there are three groups with different functions: managers, financiers, engineers and technologists. The leading role in the technical evolution of society is played by engineers and technologists who create new technical systems and organize the process of their production. A new technical world, created by them, changed humanity. The role of managers and financiers in the production system is purely official. The function of management - ensuring the continuity of the production process, and the function of financiers – financial control of the enterprise.

The main problems of the modern economy of developed countries is that servants have become leaders. The dictatorship of management in corporations is well shown in [2]. The financial sector has become the most prestigious. The supervisors assumed the function of economic management. Money has become the "blood of the economy". There was an illusion that only money is an incentive for development. Investment giants have subdued almost all large industrial corporations. The level of financial speculation has risen sharply. Money began to"make out of thin air". The amount of money in the speculative "gambling" business is several times higher than the needs of the real economy.

The wage gap between top managers and workers in the production sector has been growing steadily. Top managers began to receive hundreds of times more skilled workers. Primitive usurious technology began to bring in more revenue than creative activities. As a result of the increase in the level of income in the financial sector, the prestige of the financial elite has significantly increased [1, 4]. There was a gradual outflow of personnel from the industry. The professions of engineer, technologist and skilled worker became low-prestige. As a result, the pace of civilization development began to slow down. The prospect of the loss of leadership by developed countries became increasingly real. In the USSR, where the role of the leading elite was appropriated by party functionaries, there were similar processes.

The degradation of developed countries scared part of the world elite, which took a course to overcome the negative factors. Currently, the only contender for the role of a leader in the elite of society remained the technical elite, the carriers of technical secrets. Technical means allowed to make open information in all other social spheres. Political, administrative and corporate economic information became open, the banking system became transparent, there were no military secrets in the conditions of effective technical control. As a result, the activities of almost all other elites begins to be subordinate to the official character. It is the goals of the technical elite aimed at accelerating the pace of development of civilization that determine the dynamics of social processes in the modern world.

Technical elites who have been given the task of re-industrialization of society and the rejection of the ideology of "consumer society", which became a brake in the civilizational development. Technical means allowed them to begin gradual reduction of number of other elite. Computerization of management allowed to reduce the number of management personnel in the social, corporate and financial spheres. The implementation of the program to reduce the number of management personnel in all areas is now presented as an "attack on the middle class". Naturally, the programs implemented by the technical elites caused a natural resistance of a significant part of the elites, losing their privileges. The conflict that is shaking the whole world.

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UDC 338.24.01
JEL: P25

THE SOCIAL ASPECT OF THE TECHNOLOGICAL SCENARIO OF THE COUNTRY

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Abstract. These highlights are devoted to the consideration of certain issues relating to the social aspect of technological development scenario of the country. Based on official statistics sponsored a number of elements: industrial activities, consumer behavior and, most importantly, the influence of the other or the strategy of technological development on the human potential.
By system analysis methods in particular, analyses the links: productivity-income-human potential. Link the basic characteristics of human potential: the quality and intensity of the processes of education, level of income of the population and the structure of consumption, the volume and quality of vocal training, general level and quality education, way of life, the dominant motivation in production and consumer behavior and others.
When assessing the prospects for the development of human capacity is considered its innovative part.
The results of the research could be used in the development of regional strategies.

Keywords: strategy of social economy development, manufacturing activity, consumer behavior, production capacity, human potential, social environment, innovation, education, training, productivity labor.

In the social aspect of the technological scenario it is necessary to consider a number of elements: production activities, consumer behavior and, most importantly, the impact of a strategy of technological development on human potential. And it is necessary to consider all this in the context of pension reform and taking into account the sanctions.

Production aspect

The average per capita labor productivity, calculated as the ratio of GRP to the number of employed, in the economy of the region ranges from 239, thousand rubles per year in the Ivanovo region to 881 and 890; a thousand in the Moscow region and Belgorod regions, respectively. A number of regions have this figure between 600 and 700 thousand rubles.

This level of economic potential does not allow providing a decent salary for the staff of enterprises and organizations. However, jobs and activities are not always attractive to potential staff, especially young people. There is a shortage of highly skilled workers in many specialties.

The situation is self-replicating: outdated equipment (the average age of fixed assets exceeds 20 years), insufficient innovative potential impose outdated requirements for personnel qualification, while the motivation for training and improving the quality of labor resources is weakened. The low level of human potential does not allow carrying out the necessary research, develop and implement new modern technologies.

The human potential of the region can be adequately described only in conjunction with the characteristics of the social environment where it is "immersed". Moreover, the human potential is formed by the social environment and, at the same time, it forms. Therefore, in the aggregate, human potential is described by indicators and indicators that reflect such characteristics of the processes and the subjects that implement them as the main indicators and indicators of quality of life, the quality and intensity of education processes, the level of income of the population and the structure of consumption, the volume and quality of professional retraining, the overall level and quality of education, lifestyle, the dominant motivation in production and consumer behavior, the overall level of culture and socio-psychological characteristics of the mentality, examples of social behavior of personnel of enterprises and organizations outside of production, the level of social tension, the presence or absence of ethnic or religious conflicts, the level of social and business activity of the population, the characteristics of the institutions of regulation of relations between employers and staff, as well as relations in labor collectives, etc.

The quality of human potential can be considered in several aspects. First of all, it should be considered as a factor in the implementation of production, economic and innovative potential. And here the main importance is the educational and qualification level, as well as the demographic situation. The characteristics of social differentiation of the population are very important, as they affect the level of social tension and social and productive motivation, as well as the income of the population. There is some feedback when not only the level of income of the population determines the level of human potential, but the potential itself affects the level of income of the population in the form of wages and thus affects the realization of production potential. An important characteristic of human potential, in addition to traditional indicators of quality of life, is a group of indicators that reflect the level of potential of social infrastructure.

The social infrastructure system should be considered in terms of budgeting capabilities, its criteria and structure. The level of development of social infrastructure should be considered, first, in relation to the adopted standard and, secondly, in comparison with other regions. As the main analytical indicators for organizations financed from the budgets of different levels, it is advisable to use such as: the provision of the population with the services of social infrastructure, budget expenditures in the context of various sectors of infrastructure, the effectiveness of the functioning of objects in comparison with the amount of funding, the cost of education and health care per capita. If we integrate all the considered economic and social indicators, we will get some characteristics of the internal social environment of the region. This element of potential is managed in terms of a number of demographic characteristics, level of education, social and business activity, motivation, level and quality of development of civil society institutions, compliance with the law, etc.

The regions of the Russian Federation differ significantly in terms of human development. In many of the NCDs, these indicators do not meet the requirements of the modern tasks of transition to an innovative way of development, the formation of a post-industrial society based on the knowledge economy.

An important factor in the competitiveness of the economy of each region is the professional level of staff. Under these conditions, competition between regions and various sectors of the economy for high-quality labor resources is intensifying.

At present, the mass media express the idea of a shortage of specialists with secondary vocational education, primarily technical specialties. In General, the share of specialists with higher education varies slightly by region, which confirms the obvious conclusion that the important factor of success is not the number of specialists, but their quality. From this point of view, the main importance is the difference between the subjects of the Federation in the quality of education: the presence of scientific and educational schools, educational traditions, etc. but, unfortunately, such data are not available in official statistics.

The main strategic directions in this area are: the creation of an effective system of professional retraining of temporarily unemployed or retraining of personnel of unpromising enterprises; the provision of preferential subsidies to entrepreneurs who are starting their own business for the first time; the promotion of small venture funds; the creation of a favorable tax and legislative climate, the modernization of educational programs in Universities and secondary special educational institutions.

Another important aspect of human potential is business, socio-political, innovative activity of the population. These properties of human potential are very difficult to express in the values of certain indicators. Many factors play a role here: historical, socio-cultural, educational and political, i.e. an important part of the complex of objects, processes and phenomena, which G. Kleiner refers to the mental and cultural subsystems or environments. The activity of the company in the economic sphere is manifested in the development of small business.

In a developed society, with a high educational, General cultural level, with high political and civil activity is provided and a high level of business activity, which stimulates the development of small and medium-sized businesses. In turn, the development of small business, a large number of entrepreneurs stimulate a high level of political and social activity and improve the skills and educational level of the population.

Assessing the prospects of human development it is necessary to consider its innovative part. It is this aspect that largely determines the investment attractiveness of the country as a whole, and individual regions with all the ensuing social consequences. A sluggish investment and innovation climate can lead to significant losses in human potential, which is the main and most "perishable" factor of production.

Innovation involves improving the performance and release of employees. The challenge is that even if released people can find a new job, they will be thrown out of the high-tech manufacturing process. That is, the level of human potential will decrease. The task is to the contrary, to draw people into more highly skilled types of labor, and thereby to improve human potential.

In General, the situation in the social sphere is characterized by a number of negative trends, among which the main ones are the differentiation of per capita income that exceeds the permissible level and the presence of a large group of working people with an income level below the acceptable level. The low level of wages significantly reduces the motivation of labor, which is critical for enterprises focused on innovation. A vicious circle is formed: the shortage of qualified personnel reduces the competitiveness of production, which is reflected in the level of wages and working conditions, which makes this type of production unattractive for qualified personnel and, above all, young qualified personnel. Low wages discourage skilled labor, which is also a brake on the introduction of more productive equipment based on new technologies. The low level of wages initiates the search for additional earnings. Moreover, as a rule, the sphere of additional employment, has relatively lower requirements for the level of qualification of personnel, compared with the main activity. Thus, part of the labor potential of a number of industries is not fully used. To date, there is a tendency of non-compliance of job vacancies, the structure of labor supply. In the most vulnerable position here was the age group over 40 years, which is represented by people, on the one hand, the most experienced and qualified, and on the other hand, already unable for whatever reason to change their profession without compromising social status, psychological comfort, the possibility of self-expression. This, in turn, allows employers who create new jobs, firstly, to focus on live labor, and secondly, to restrain the growth of wages.

It can be assumed that the preservation of the dominant role of the commodity sector in the economy, even with its innovative development, will fix the situation of high differentiation of wages and wider incomes.

The main condition for increasing productivity is to increase wages and, conversely, wage growth implies adequate productivity growth, which in turn implies investment in innovation. Without this, wage growth simply reduces the competitiveness of domestic products, both in foreign and domestic markets.

There is a view that the low level of wages in various sectors of the economy is an important factor in the competitiveness of export products. But at the same time, this "competitive advantage" is an obstacle to the technological option of economic development, as in the normal economy, one of the incentives for technological development is saving on live labor, by increasing its productivity in the structure of the cost of production and services, wage growth.

It follows from the above that a number of requirements are imposed on investment projects implemented in the field of high technologies. First, productivity growth should outpace wage growth, which is in line with the concept of innovative economic development. Secondly, the level of wages should be such that these jobs are attractive to highly qualified personnel. Third, since the introduction of new equipment and technologies is usually associated with the release of employees, the level of efficiency should be sufficient to ensure that the increase in the amount of taxes paid is comparable to the additional costs of the budget for retraining and employment of released personnel.

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JEL E31, E32, E37

THE CONCEPT OF SYSTEM ECONOMIC CRISES: THE SEARCH FOR NEW APPROACHES TO UNDERSTANDING OF THE ECONOMIC PHENOMENA NATURE

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Abstract. The presented article aims to researching the origin and nature of one of the most unknown phenomena of the world economic life - world economy crises - the phenomena that nature hasn't received the conventional explanation in economic science yet. The market economy is subordinated to its special laws that spontaneous character is found during crises. However the analysis of the global "crisis experience" draws attention to the difference in the forms of implementation of various crises that persists in all stages of economic development. Some economic shocks, despite the intensity and range, gradually give way to revival and further – to full economic expansion. Others end with weak rise and depression, gradually turning into a new recession. Such crises, depression, periods of weak economic recovery form some "waves of the crisis development", holding the economy depressed for a long time. The impact and consequences of such "waves" go beyond the medium-term economic dynamics. They occur within the limits of the long-term (Kondratieff) cycle and coincide with its descending stage when, according to empirically proved ideas of the great Russian economist N. Kondratieff, the economy goes through a complicated stage of the crisis-depression development, which constitutes parameters of future economic growth. In the presented article economic events of this phase are combined in the term "system economic crisis". The introduction of this concept aims to structure diverse phenomena in a single economic process occurring at the descending stage of the long-term cycle. Each of them may be due to special causes and have a separate story, but initially all these events proceed in the logic subordinated to resolve common system problems and for this reason can be considered as integral parts of a system crisis, overcoming which enables society to move to qualitatively new frontiers of economic development. This article represents an attempt to comprehend the reasons and consequences of system economic crises as a fundamental phenomenon of the long-term economic cycle.

Keywords: economic development, long-term economic cycle, recession, depression, system economic crisis, system problem, innovative renewal, modernization of the economy.

The occurrence of crises as a periodic economic phenomenon, the conditions and the time of their appearance remain a controversial and unresolved issue of economic theory. Most researchers are of the opinion that recurring crises happened long before the formation of the industrial production system. So, one of the most prominent representatives of the American economic science W. Mitchell states the presence of economic crises in the last decades of the 18th century, although then they were less significant for economic development than in the 20th century [9, p. 88]. Some researchers try to find recurrence in the series of economic events of earlier periods, erroneously including quite different economic shocks in the unified process of cyclic development, such as the tulip mania in the Netherlands (the 1620-1630s), the 1696 monetary crisis in England, the fall of John law (France, 1716-1720), the collapse of the South Sea Company (England, 1720-1721), etc.

L.A. Mendelson, by contrast, believes that only gradually economic shocks acquired a character of cyclical crises and discloses a methodological error in the approach of "bourgeois experts", when the nature of crises is interpreted metaphysically and the development process is ignored. Presenting the traditional approach of the soviet economic science, the scientist tries to link the occurrence of periodic crises with the formation of capitalist economy and, consequently, the prospects for alignment of economic development - with the elimination of the main source of "turbulence" in the economy - a capitalist economic system.

The identification of the time of occurrence of economic crises as a recurrent phenomenon is of theoretical interest; however, the determination of sources and nature of this crisis, which is the purpose of this article, also has a practical value. It is possible to form a set of tools and methods to influence the nature of cyclic processes.

Even in the pre-industrial period the economic dynamics was characterized by considerable inconsistency: the periods of economic activity interchanged with the periods of economic stagnation. At the same time, the recurring economic crises were usually represented as financial shocks and their causes were out of the reproductive process. The main factors that provoke worsening of the balance of payments and cause crises were the following: mass epidemics that took away millions of lives; bloody and destructive wars; serious crop failures and epizootic, involving galloping prices for essential food and commodities.

The successive crises were of entirely different nature; they were generated by internal conditions, occurred in time of peace and were provoked by quite sudden phenomena: bankruptcies, poverty, unemployment, etc. These events were recorded in the 2nd quarter of the 19th century, when with the strengthening of market relations and development of industrial society the national economies experienced imbalance between industrial production and solvent demand.

The analysis of the world "crisis experience" draws attention to an important feature in the various crises forms that persists at all stages of economic development since the early industrial period. Some economic shocks, despite the urgency and great scale, gradually gave way to revival and then to full-fledged economic recovery (1825-1826, 1857-1858, 1866-1867, 1890-1894, 1900-1903, 19071908, 1920-1922, etc.), others led to weak recovery or depression, gradually turning into new recessions. Such crises and periods of sluggish economic recovery together formed waves of crisis development, leaving the economy in a depressed condition for a long time. For example, the 1857-1872 period was marked by 2 great economic revivals lasting for 7 and 6 years, preceded by the severe crises of 1857-1858 and 1866-1867, However, the subsequent period of 1873-1886 witnessed a depressive development, called as "Long depression" by contemporaries [8, p. 10]. Such depressive periods were also observed in 1836-1842, 1929-1938 and 1971-1982 [6, 7]. The long period of depressed global economy, which started with the 2008-2009 global crisis and included a number of other economic shocks of regional and country scale, suggests the unfolding of another wave of depressive development, which can last until the end of the 5th Kondratiev's "big cycle", i.e. presumably until 2020.

The extrapolation of crisis to long-term economic cycles reveals a pattern that, in the first case, crises were usually distributed at the ascending stage, and crisis-depressive periods - at the descending stage of the long-term cycle. This is clearly shown in Figure 1.

Relying on the ideas of N.D. Kondratiev, considering economic dynamics as a "continuous and diverse stream of qualitative and quantitative changes" [4, p. 24], we can assume that the above differences in the crises realization are caused by quantitative and qualitative processes in the economy. According to the Russian scientist, in the situation when the economic system elements undergo transformation, not reduced to the change in their number and volume, it is necessary to speak about the presence of qualitative changes (for example, a change in organizational principles, technologies, content and nature of social needs, etc.). In other cases (e.g., for prices, rates, rent, etc.) the movement of quantitative indicators plays the leading role. "The value of quality changes is only important when the nature of these elements changes, for example, when the price changes from free to fixed or from market to monopoly" [4, pp. 20, 24].

This approach (further not developed by Kondratiev) allows us to create and scientifically justify a prospective "method of quantitative and qualitative decomposition", aimed at disclosing the substance of the phenomena observed in economic reality. The division of economic dynamics into two fundamentally different (although connected by feedback channels) types of processes: 1) quantitative (streaming, market) and 2) qualitative (cumulative-transformative) is a powerful way to study the nature of economic phenomena that enables us to understand the essence of events included in the overall cyclic process.

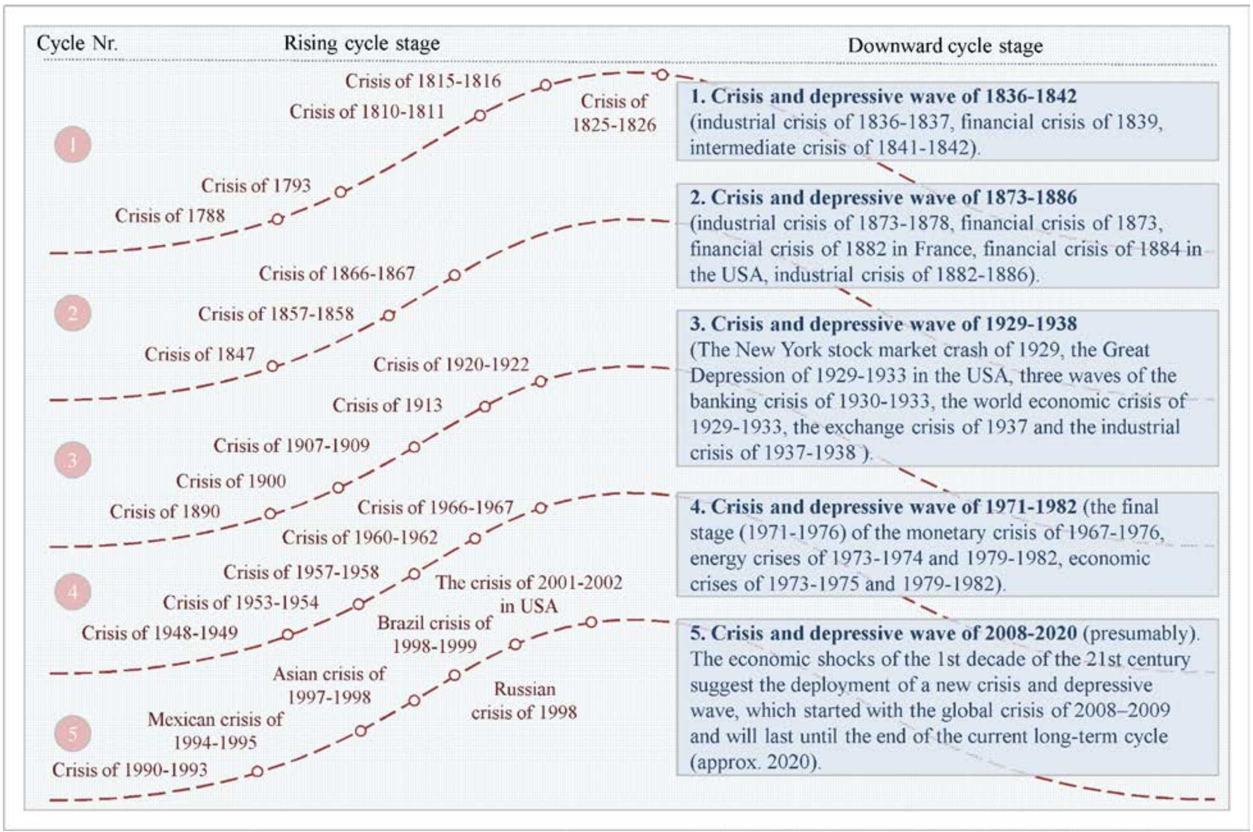

Fig. 1. **Economic crises at various stages of the long-term economic cycle**

Both quantitative and qualitative processes form negative phenomena, which, in the first case, are expressed in the violation of economic proportions (imbalance of supply and demand, price disparities, etc.) and, in the second, - in the violation of internal connections (internal harmony) of the economic system. G.B. Kleiner rightly points to the differences in terms of "disproportionality" and "disharmony", which are often incorrectly presented as identical. In fact, disharmony is a condition of more serious distortion of the economic system than disproportionality. It is caused by the quality problems of the economic system and "hinders the improvement of imbalances within the economy" [3, p. 73]. Accordingly, disharmony as a result of negative processes of qualitative order requires fundamentally different solutions for elimination of its consequences, than disproportionality.

So, the quantitative violations of internal balance of the economic environment (disproportionality), formed in the phase of economic growth, give rise to common (in the "traditional" sense) cyclical economic crises. So, the crisis is "a painful process to liquidate inconsistencies and disproportionality of production and distribution, supply and demand, created under the influence of certain conditions" [5, p. 208]. The crisis processes occurring within the economic system are, in this case, of streaming nature and, generally, realized within the medium-term economic cycle. The crisis is overcome due to the restoration of old or establishment of new quantitative proportions, providing further development for the medium term. In turn, the corresponding change in spatial configuration of the system does not entail changes in its properties and functional content. Such an understanding of the economic crisis allows us to consider it as *an economic phenomenon, caused by the violation of quantitative proportions (internal balance) of the economic system in the phase of economic growth, overcome by the restoration of old or establishment of new quantitative proportions, providing further development in the medium-term economic cycle*.

At the same time, in the economic system there arise contradictions of qualitative nature (disharmony), which are a "reaction against abnormal changes, growths and inconsistencies in the relationship of economic elements and conditions of their development" [5, p. 254]. These contradictions reveal the necessity of institutional changes, management model replacement, new technological base creation, etc. The scale and acuteness of these contradictions do not give an opportunity to eliminate them within the medium-term cyclical process, thus involving the accumulation and transfer of emerging dysfunctions for the next cycle. The accumulation of crisis potential (unresolved problems of economic system development) provokes the system or, as defined by G.B. Kleiner, mega-economic crisis [2], which determines the need to implement drastic changes in the quality of system relations between structural entities in space and in time. In this case, the crisis processes, which are a "consequence of accumulative conditions during the previous time" [4, p. 397], have a cumulative-transformative nature and require modifications of intra-system relations, carried out within long-term (Kondratiev's) cycles.

The term "system crisis" in economic literature is often used to indicate the depth and scope of crisis shocks, the scale and destructiveness of a certain economic phenomenon. In such a context this concept is used associatively and practically does not bear any methodological content. However, when used correctly, it can quite aptly reflect the content of crisis processes taking place in the format of long-term economic dynamics.

In this study *the system (mega-economic) crisis is a set of phenomena conjugate in a single economic process that arise due to the formation of internal contradictions of qualitative nature in the economic system related to the need for fundamental transformations in the institutional environment, the change in a management model, the qualitative renewal of a technological base, etc. Overcoming the system economic crisis requires a radical change in the quality of intra-system connections and relationships between structural entities, carried out within long-term cycles*.

The system economic crisis is not an isolated economic event, but is an economic process - a target-oriented process system (Fig.2), which in the form of functional elements includes a variety of economic phenomena, ensuring the achievement of the fundamental objective - qualitative transformation of the economy. System economic crises (process systems) differ from normal cyclical crises, representing certain economic events (event systems). Each event performs its function and has a separate goal - elimination of quantitative imbalances and restoration of economic balance. System economic crisis are realized in "waves" of sequential or coincident in time economic shocks of different intensity and duration, separated by brief periods of depression or weak economic recovery. Each can be caused by certain reasons and have a separate history; however, initially all these events try to solve common system problems, and for this reason can be considered as parts of a system crisis. Its overcoming lets the society achieve a qualitatively new level of economic development.

The overcoming a system economic crisis is connected with qualitative reconfiguration of inner ties between elements of the system itself, fundamental changes in the system profile. Paraphrasing A. Einstein, believing that no problem can be solved at the level of consciousness it was created [1], we can argue that a system problem can not be solved at the level of system development it emerged. Resolved system problems involve not only the update of technological bases, but also the change (or correction) of organizational principles and governing structures responsible for maintaining quality parameters of the system.

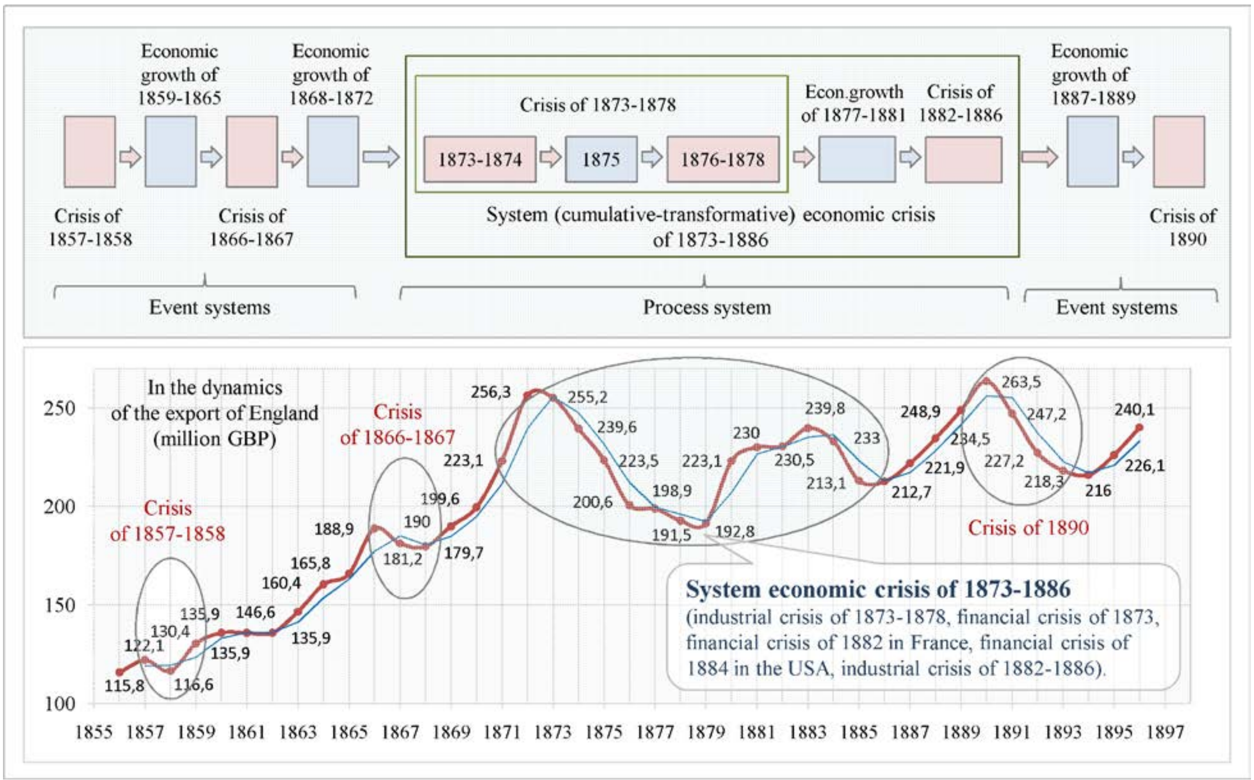

Fig. 2. **Economic development in the 2nd half of the XIX in the categories of system economy**

The analysis of works conducted in the sphere of long-term economic dynamics demonstrates a significant neglect of researchers, focused on identifying the causes for long wave emergence instead of studying the environment, creating conditions for periodic updating of the economic system. However, it is the severity and scale of contradictions exposed in the wave of economic shocks of the long

(Kondratiev's) cycle prepares a depressed economy for undertaking radical measures for its renewal, and the transformation of an economic system genome occurring in the depths of the crisis turmoil becomes a driving force of quality development. For this reason, the content side of events at the descending stage of the long-term cycle requires a deeper understanding, a thorough description and a greater attention on the part of the scientific community.

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JEL A10B30B41

EXPERIENCE OF SYSTEM ANALYSIS IN THE THEORIES OF VALUE OF MARSHALL A. AND TUGAN-BARANOVSKY M.

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Abstract. At all stages of economic science evolution comprehensive theoretic conceptualization of the essence of value has been one of the most pressing research problems. The conducted study is aimed at justification of system analysis critical importance for alternative versions of two-criterion theory of value, proposed in the turn of XIX-XX centuries and based on the methodological principles of early neoclassical research paradigm. To achieve this goal, certain classical political economy maxims about cost-of-production theory of value origin were refuted and provisions stating that theory of value systems analysis in the works of both Marshall A. and Tugan-Baranovsky M. marked the beginning of a truly scientific stage in the interpretation of this theory were justified. It is shown that the former attributed first priority to the idea of value formation through interaction of “blades of a pair of scissors” (marginal utility and marginal cost) in his interpretation marginal theory of value; the latter – to the idea of interaction of labor costs and marginal utility. The author comes to the conclusion that in the past century emerging behavioral theory of value served as a prologue for the next phase of value systems analysis through the interpretation of its origin in the context of the two complementary theoretical bases-marginal and behavioral versions of theories of value.

Keywords: systems analysis; early neoclassicism; cost-of-production theory of value; two-criteria marginal theory of value.

1. Introduction

Theory of value as one of the key components of economic science has always been a subject of scientific economic research. Therefore, both in foreign and Russian economic literature the theory is recognized “not just as special but fundamental” [1, p. 6]. However, despite the centuries-old history of reflection on the phenomenon of value, disputes and discussions on its essential aspects do not fade, but intensify. The truth is, even today, many researchers of theory of value, in essence, stand in solidarity with a position stated by J.S. Mill in his “Principles of political economy” in 1848. According to this position, theory of value is complete and form no subject to further study. According to M. Friedman, who expressed his warnings on this topic: "Any assertion that economic phenomena are varied and complex, denies the transient nature of knowledge, which alone gives meaning to scientific activity; such an assertion is on a par with a reasonably mocked John Stewart Mill's position. Fortunately, value laws have nothing to be determined by any modern (1848) or any future author; the theory of this subject is complete” [2, p. 44].

Founders of value theory in classical political economy, introduced inherently deadlock alternative versions of cost-of-production theory of value by focusing on only one base, which was limited by adoption or rejection of one of the two factors of cost-of-production interpretation. This kind of version one factor theoretical comprehension of value in modern economic literature is usually related either to the theory based on the concept of labor cost (labor theory), or to the theory based on the concept of total costs of production (cost theory). Adherents of the first version from "classical school" were the researchers from Petty W. and Boisguilbert P. in 17th-early 18th centuries up to physiocrats and Smith A. in the second half of the 18th century and then from Ricardo D. to Mill J.S. and Marx K. in the 19th century. The emergence of different version (based on production costs) goes back to another view on the theory of the value of A. Smith, which in post-manufacture period of classical political economy was shared by its adepts, who also considered themselves the Smythians, such as: Say J.-B. and Malthus T.R. in the early 19th century, Senior N.W., Bastiat F. and others until the completion of this direction of economic thought in the middle and second half of the same century [3].

However, "marginal revolution" happened in economic science in the last 30 years of the 19th century led to the qualitatively new stage of the scientific confrontation of researchers in the field of theory of value. This confrontation became evident, on the one hand, due to completion of a research paradigm which dominated almost two centuries in classical political economy and, on the other, due to the emergence of early neoclassical research paradigm on "the second wave" of “marginal revolution" (in the 1890-ies). Today these events are typically characterized asthe turning point in the history of economic science and a crucial – from the perspective of systems analysis – rethinking of the theory of value. In this context, our research is focused on the opposition of one-factor (one-criterion) versions of the theory of value proposed by the classics of political economy, and two-factor (two-criteria) versions of the theory of value introduced by the adepts of neoclassicism, particularly by Marshall A. [4] and Tugan-Baranovsky M. [5;6;7].

2. Methods

While conducting this research through the prism of a retrospective approach the author takes into account various methods and analytical tools used by the classics of political economy, early neo- classics, representatives of heterodox neoclassicism and institutionalism at appropriate stages of economic science evolution in the context of the theory the value research. Historical-economic approach allowed to reveal that at the turn of the XIX – XX centuries prerequisites of manifestations of modifications to the theoretical essence of value in the works of both Marshall A. and Tugan-Baranovsky M. research methodology, based on the systems analysis, became obvious. Each of them did not accept causal methodological maxims of political economy classics, preferring functional method to causal one.

3. Results and discussion

The main results of the study can be limited to stating two provisions. First provision is that innovations of Marshall A. and Tugan-Baranovsky M. in field theory of value are based on a commitment to the values of marginal economic analysis, opposition to causal analysis method of methodological tools for functional economic analysis. Second provision is that both of them saw the formation of value in the relationships and interdependence of two bases, which allows to recognize them as founders of two-criterion theories of value.

Meanwhile in economic literature only Marshall A., who issued his "Principles of Economics" in 1890, is usually regarded as the main (first!) opponent of one-factor theory of value versions from the standpoint of economic marginal analysis and synthetic theoretical essence of value. For example, Blaug M., believes that: "... a strive to make simple conclusions for the theory of welfare basing on utility theory, ignoring inequality in income distribution and difficulties in implementation of meaningful interpersonal comparisons, Marshall was the main lawbreaker there, and that was the main reason for scepticism about the achievements of marginal utility theory [8, p. 329]. In turn, Avtonomov V. also believes that Marshall was the scientist "who attempted to synthesize the main achievements of the classical, marginal and historical schools, becoming a founder of neo-classical direction in economic theory" [9, pp. 98-99].

Given judgments of Blaug M. and Avtonomov V. do not seem not reasoned enough due to the following circumstances. Firstly, not only thanks to Marshall A., but also with a contribution of Clark J. B. and Pareto V. "marginal revolution" entailed undoubtful theoretical and methodological achievements allowing to avoid special analysis of value of each production factor [10, p. 40]. Secondly, since 1890 understanding of synthesized essence of value and justification of its two bases has wrongly been linked only with the works of Marshall A. This is explained by the fact that in the same year, a similar approach to understanding of two bases of value was used in "The doctrine of marginal utility of economic benefits as a reason of their value", the work of Tugan-Baranovsky M., Russian Economist, according to Abalkin L., one of the pioneers of "Russian school of economic thought" [11, pp. 31-32] – Tugan-Baranovsky M.

However, in the Marshall's "Principles" two bases of value are reduced to reflection on marginal utility and marginal cost interaction in the process of value formation ("two blades of a pair of scissors"). Meanwhile in his teaching Tugan-Baranovsky M. implies a collaboration of labor costs and marginal utility, as evidenced by his following conclusions.

First, recognizing the value of the theory of marginal utility and proposing not to absolutize empirical generalization, Tugan-Baranovsky postulates in this respect: "There is a scientific explanation of the long-known fact of price and quantity of goods on market interdependence, given to us only by marginal utility theory. Only from the perspective of this theory one can talk about the law of supply and demand, as rather about a scientific law than rough empirical synthesis" [5, p. 212].

Then Russian scientist gives an explanation, significant from a methodological point of view, stressing that "research of the causes of values should not be discontinued until one gets to such facts that come out of the economic science framework" [5, p. 215]. His final conclusion that the theory of marginal utility "does not only constitutes a refutation of views of Ricardo or Marx", but on the contrary, "this theory, if properly understood, is an unexpected confirmation of value theories of mentioned economists" [5, p. 228].

In conclusion, it is important to outline that during the 20th century as development of innovations proposed by Marshall and Tugan-Baranovsky, there emerged behavioral theories of value by Veblen T., Chamberlin E., Commons J.R., allowing to identify how value can be influenced by consumers or collective institutions through non-price factors such as [8, s. 7]:

- human inclinations, habits and instincts (Veblen T.);
- products quality parameters, valued by consumers, service and advertisement culture (Chamberlin E.);
- legal grounds and collective institutions activities (Commons J.R.).

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JEL F3, G0, G3, Q40, M2

SYSTEM ECONOMIC THEORY DEVELOPMENT ON THE BASE OF CHINESE TRADITIONAL PHILOSOPHY

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***Abstract*.** Combination of system economic theory, space-time analysis, and information theory is the new multidiscipline field of research. In this article we are trying to develop these science directions by using Yin Yang philosophy model in the context of Pythagorean Theorem (at China – Shan Gao' theorem appeared 500 years before Pythagorean), Markov chain model and Theory of general relativity. The idea that economics and philosophy are the two parts of one whole as "Yin Yang" —supported mathematically gives the powerful and fruitful results. Nowadays Chinese philosophy and mathematics are perceived and developed separately, and Chinese philosophy is not associated with the economics. However, in our opinion, ancient Chinese philosophy is a storehouse of knowledge and can form a solid foundation for understanding and open new ways of research the theory of information, systems theory, space-time economic theory and information entropy.

Keywords: Space-time analysis, Information entropy, Yin Yang 5-dimentionnal stochastic model, system economic index.

1. Introduction

The issues of consistency were also of concern to our ancestors. The nature system was considered in the 12th century by Johannes de Sacrobosco in his work "Sphere", where he emphasized on the questions of how many spheres there were, and what the shape of the world was, gave information concerning the circles of which this material sphere was composed and that super-celestial one, of which this is the image, was understood to be composed [1]. Antoine Arnauld and Pierre Nicole in their work "Logic or, the Art of Thinking in four parts" also emphasize attention on the theory of knowledge of metaphysics with attempting to explain system "one" by combining the categorical theory of the proposition with a Cartesian account of knowledge [2]. It was the start of the information theory base points in case of Antoine Arnauld and Pierre Nicole described the Nature of Affirmation and Negation, upon which conversion depended and could explain the Nature of One and links between parts, "complex terms" as well as their universality and particularity [2]. Further, the idea of "wholeness" was developed by Bertalanffy concerning interconnections of elementary units which could be researched independently of each other [3].

In Russia, the academician of the Russian Academy of Sciences George Kleiner considers the limitations of neoclassical Economics and puts forward the concept of space-time analysis of the economic system. In Europe, Professor Terry Baker from Cambridge University also proposed the concept of Space-Time Economics. In China, the central government in 2015 proposed the concept of "new standard" of economic development, economist Lin Yi Fu and other Peking University professors propose the "New Structural Economics," Academician Jia Kang and others proposed the "New Supply Economics". These scholars believe that the neoclassical economy has some problems in explaining the World Economy and tries to seek a new economic paradigm.

In our opinion, the development of a new theory of economic systems as an integral part of the system paradigm would help to overcome the shortcomings of modern economic theory and help it to explain or forecast the current crisis [4]. Thus, the system economy can be explained by information theory and quantum theory and develop as system space-time point of view where it must be developed energy flows, material flows, molecular biology flows as well as monetary flows. As Stephen Hawking emphasized that Universe has no boundaries or edges [5,6]. Quantum physics tells us that nothing is ever located at a definite point because if it were, the uncertainty in momentum would have to be infinite. In fact, according to quantum physics, each particle has some probability of being found anywhere in the universe [5,6].

Nowadays there is a need to develop a new economic paradigm: the system paradigm. The increasing importance of the ideas of the system for science as a whole was expressed in the formation of the General theory of systems as a unified concept of analysis of an extensive class of technical biological systems, social and economic phenomena and entities.

2. Methodology

The yin and yang elements are a unique and systematic view of the world in traditional Chinese culture. The Chinese medicine definition of Yin and Yang is: "Yin and Yang, is China a pair of categories of ancient philosophy, are some of the interrelated nature. A summary of the properties of things or phenomena is on the opposite sides". Much of the current research, it seems that everything is Yin and Yang, Yin and Yang has no definition by itself. Yin Yang math had the metaphysical way of understanding and calculations and based on metaphysics principals as the ancient Chinese philosophical term. Yin Yang together it's the Universe. World not only white and black, also it is the place between write and back. It is optimum space-time equilibrium between white and black.

If we translated from Chinese, "all is one substance, one substance is all" means "one". Author's vision of the Space-time Economy is based on Yin- Tang Philosophy 5 constraint elements - Earth, Fire, Forest, Water, and Gold. Thus, system- space economics consists of 5 parts – Resources (Earth), Society (Fire), Environment (Forest), Water- Energy and Gold- Finance (see **Fig. 1**).

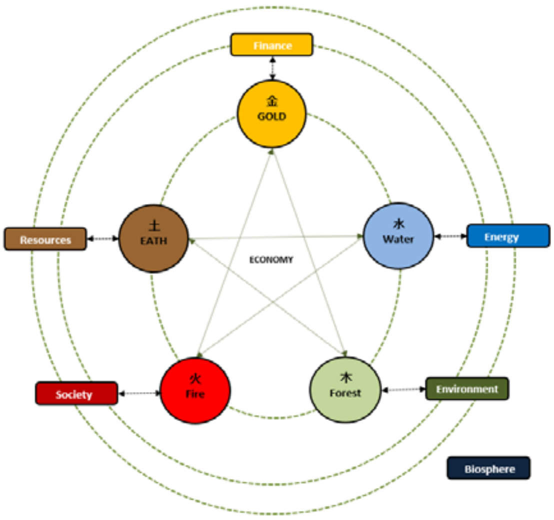

Fig. 1 Structural model of interaction between Economy, Finance, Environment, Energy and Society. Source: Authors' methodology.

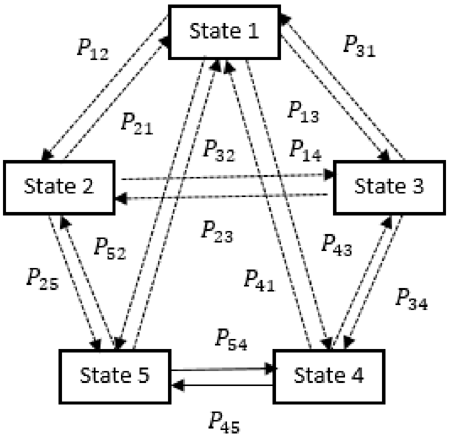

Fig. 2. ***Space-time diagram of the two-component system (Yin Yang 2-component system)***
Source: [3]

Chinese traditional philosophical thought worshipped the idea of harmony expressed in the saying “the unity of heaven and man” (天人合一). Concept of the harmonized interrelation between nature and man was first developed by Dong Zhong Shu (董仲舒), Confucians, Han Dynasty period, at his work "Three strategies of the celestial man" (天人三策) by means of harmony between Nature and man, and thus constructed the base of Chinese Traditional Culture. The traditional thought of the harmonious union between man and natur e emphasizes reasonable unity. On the one hand, to attribute the human behavior to Heaven’s destiny helps to obtain an external theoretical framework. Yin Yang addresses the relationships between the individual compartments and the overall properties of a system by analysing material-energy-information networks. Similar concept and network methods can be applied, however, to all matter-energy-information flow systems in general, because of widespread and significant parallels among system parts and development dynamics concerning all fields. We have constructed the Yin Yang’ flow network. Over 60 years ago, Leontief showed that economic structure could be effectively modelled as an input-output map of goods, services, money, or value circulating within and across a network of business [7]. Markov chain methodology is a bright and fruitful example of the fuzzy mathematician space-time analysis concerning stochastic probability analysis. The same process we can observe concerning traditional Chinese Daoism philosophy. Concerning Yin Yan philosophical theory describe by mathematician way most correctly reflects the views is Markov chain. same way, according to Feynman, a system has not just one history but every possible history [5]. Moreover, the next state of the system depends only on the present situation, not on the previous one. Markov chain – a series of events in which each subsequent event depends on the previous one [8]. Applications of Markov chains can be the best variants of the decision-making concerning economy equilibrium at a whole (see **Fig. 2**). Markov chains are named after the Russian mathematician A.A. Markov (1856-1922), who started the theory of stochastic processes [9,10].

3. Results

We can describe the system changes from unbalancing condition to balance one using the equation:

$$P(X_{n+1} = x | X_1 = x_1, X_2 = x_2, \dots, X_n = x_n) = P(X_{n+1} = x | X_n = x_n)$$

Fig.3,4 it was shown 5-dimension model factors in dynamic in chaotic “not ideal” condition, but it is the way of interaction in

real life and “ideal” one.
In Fig. 3 coordination degree is irregular and asymmetry, at Fig. 4. – in “ideal” state with symmetry excellent coupling in steady state condition. If we need the perfect system, system coordination degree and system balance index seek to 1 as dynamic steady and symmetrical system.
Concerning Author’s space-time Yin Yang system methodology

F- Finance
R- Resources
E- Energy
Env – Environment
S – Society
F R E Env S
5- Dimension model $x_1\ x_2\ x_3\ x_4\ x_5$

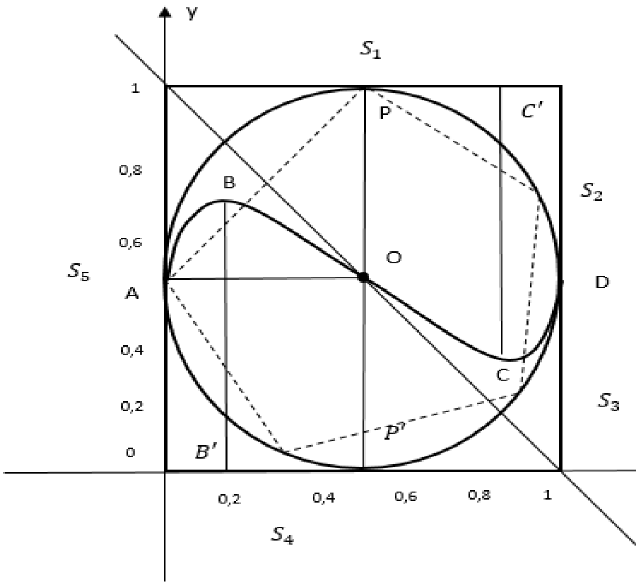

Fig. 3. **“Not- ideal” Yin Yang condition**
Source: Authors’ calculations

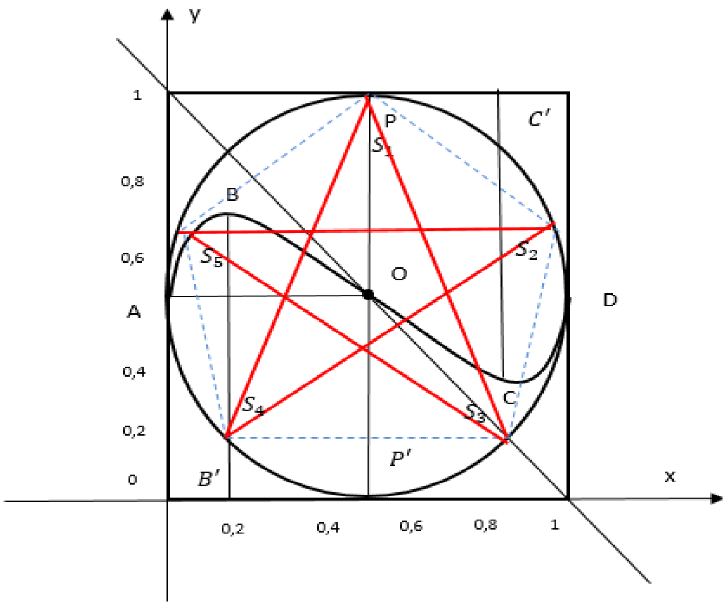

Fig. 4. **Explanation of Yin Yang employing of Markov chain calculations (forecasting calculations) ideal condition.**
Source: Authors’ calculations

By means of formula $= \varphi S'$, we dynamic changed Yin Yang 5 factors system. Yin Yang together strengthens those pathways with positive contributions to increasing ascendency and (2) weaken those with adverce effects (see **Tab. 1**). Biophysical addresses the relationships between the individual compartments and the overall properties of a system by analyzing material–energy–information networks to all matter–energy–information flow systems in general, because of widespread and significant parallels among behavioral patterns and development dynamics in various fields.

Table 1

Matrix of Markov' F R E Env S – 5D model dynamic chanced transferring probability

S_i/S_i+1	F	R	E	Env	S
F	F'F'	F'R'	F'E'	Fen'v'	F'S'
R	R'F'	R'R'	R'E'	Ren'v'	R'S'
E	E'F'	E'R'	E'E'	Een'v'	E'S'
Env	Env'F'	Env'R'	Env'E'	Env'Env'	Env'S'
S	S'F'	S'R'	S'E'	Sen'v'	S'S'

Source:Authors' methodology

Authors' developed 5- factors system balance index on the base of Ying Yang philosophy (see **Fig. 5**)

Fig. 5 can describe every two quant interaction between each other with emphasize strong and weak connections inside.

$$SBI_{Kleiner} = \frac{1}{(\sum_{i=5\neq j=5} ai/aj)-19}$$

Where,

$SBI_{Kleiner}$- System Balance Index,

$I_5 = f(a_1, a_2, \dots a_{5)}$,

a_i, a_j distance between 2 points.

The value of the index of system balance of communications can be interpreted as follows: 0≤SBI≤0,2 - fragile balanced connection, the 0,2≤SBI≤0,5th delicate balance, 0,5≤SBI≤0,7 – average balance, the 0,7≤SBI≤0,9th strong balance, 0,9≤SBI≤1 – stable balance.

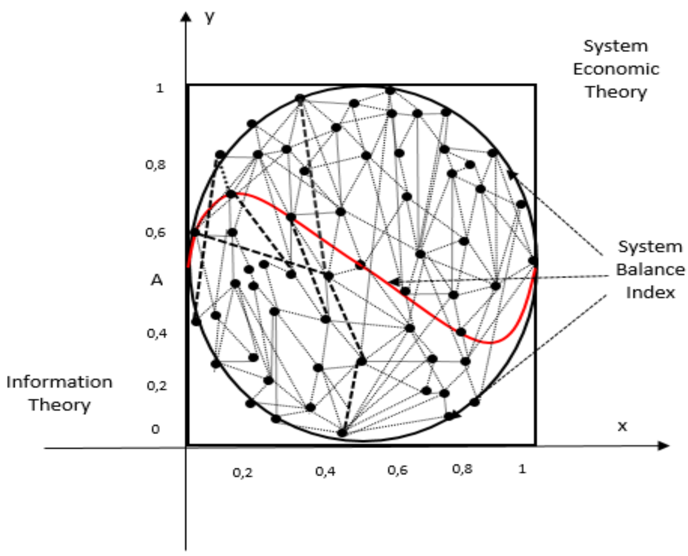

Fig. 4. **Explanation of Yin Yang through a new system economic index.**

Source: Authors' calculations

4. Discussion and conclusion

It is already obvious that Economy is not a "many parts" system. It is very challenging, self-organized, self-changing equilibrium system. The system is not "one condition" to "another condition" system. It is between conditions system. Chinese Traditional Yin Yang Philosophy can reflect the system process, and with the help of system balance analysis can give development to System Economic Theory as a whole, and space-time analysis in particular. It was used algebra and geometry to describe the philosophy and economic system theory based on Chinese traditional Yin Yang Diagram. Besides, as a result, Authors' consider 5-parts System Balance Index based on Chinese Yin Yang Philosophy. Authors emphasize their position that Man and the harmony between Man and Nature are essential conditions for economic development as well as economic development could base on Chinese traditional philosophy points of view. Moreover, it is further research direction for Authors to develop space-time economic analysis tools. We want to go the same way as the theory of the universe (Hawking, 2001) try to explain how System Economic Theory must include all forces – philosophical and economic and predict every observation we can make.

5. Acknowledgements

Authors express great gratitude to the Prof. Zinaida Bragina from Kostroma State University, Doctor Svetlana Razmanova from Gazprom – VNIIGAZ (Ukhta branch) and Prof. Maxim Rybachuk from Central Economics and Mathematics Institute of the RAS for their great support and help.

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JEL O10, O21

STRATEGIC PLANNING AS A METHOD FOR SOLVING THE PROBLEMS OF INTER-LEVEL INTERACTION OF ECONOMIC SYSTEMS

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Abstract. This paper analyzes the retrospective of documents determining the priorities of Russia's socio-economic development in the long and medium term. It is shown that the plans embodied in such materials can be duplicated and not always successfully implemented. It has been established that at present there is no unified program for the socio-economic development of Russia, which would be shared by both the general public and experts. One of the reasons for this is the problem of coordination of strategic goals between levels of economic management, which in a broad sense can be understood as a problem of coordination of economic agents and systems. It is proposed to use the achievements of the system economic theory to solve this problem. A unified program of socio-economic development of the country, developed by the principles of strategic planning, organized on the basis of system economic theory, will ensure inter-zone, inter-period and inter-level coordination of economic systems.

Keywords: coordination of economic agents and systems, system coordination, system economic theory, socio-economic development, strategy, economic policy.

At present, the search for new and revision of existing strategic directions and goals of socio-economic development, allowing to achieve innovative, sustainable and balanced growth of the national economy, is taking place in Russia. Active preparation, discussion, and finalization of documents defining the course of the country's economic policy are being carried out. This process is complicated and is accompanied by errors and lengthy approvals. It is not uncommon in the process of developing documents the persons responsible for the result and departments are being changed or already prepared documents do not find their application. The problem of inter-level coordination of the strategic decisions taken at all levels of the economy is particularly pressed.

For a general assessment of the current situation, we will conduct a retrospective analysis of such documents, having presented them in chronological order according to the dates mentioned in official sources.

The first document in this list is the Concept of the long-term development of Russia until 2020 [1], approved by a resolution of the Government of the Russian Federation on 17 November 2008, and its second version [2], which appeared on 13 March 2012. The need for editing the original document, which was developed by the Ministry of Economic Development of the Russian Federation and other departments, was due to the impossibility of its implementation, caused, in particular, by the global financial and economic crisis of 2008-2009. However, the second document has not been adopted and approved by the Government of the Russian Federation; therefore, formally, the Concept of the long-term development of Russia until 2020 remains valid. It should be noted that both the original version [3] and its edition [4] were criticized.

The next key point is the "May Decrees", representing a series of 11 decrees adopted on 7 May 2012 by President of the Russian Federation V.V. Putin. In these decrees, 218 instructions to the Government of the Russian Federation were formulated, and targets for some socio-economic indicators were set. But until now, the planned values of many of them have not been achieved, in particular, it concerns the increase in the wages of public sector employees. As noted in [5], the wage increase was not supported by the necessary funding, which led to a growth in the load, primarily on regional budgets and became the source of their imbalance. See also [6].

On 1 July 2015 Prime Minister D.A. Medvedev instructed the Minister for Open Government Affairs of the Russian Federation M.A. Abyzov to form a working group for the development of the "Strategy for Socio-Economic Development of Russia until 2030" in connection with the adoption on 28 June 2014 of Federal Law No. 172-FZ "On Strategic Planning in the Russian Federation" [7]. Despite repeated discussions, including 19 February 2016 at the plenary session "Strategy-2030. The image of the future of Russia" of the XIII Krasnoyarsk Economic Forum, the final document was never made public. At the end of 2016, the planned horizon of the strategy was increased until 2035, and the responsible departments were changed. The Ministry of Economic Development of the Russian Federation and the Center for Strategic Research (CSR) became responsible for the development of the strategy. Until today, public consultations on the discussion of key issues of the long-term development of the country in the framework of the development of this document are continued.

On 7 May 2018 a new "May Decree" was issued — Presidential Decree No. 204 "On the national goals and strategic objectives of the Russian Federation for the period until 2024" [8], the essential provision of which is to ensure the growth rate of the Russian economy above the world average and its entry into the top five largest economies in the world by 2024. A similar task was formulated in the context of instruction No. Pr-2346, p. 1 b) of 1 December 2016 on the implementation of the Presidential Address to the Federal Assembly. Even though the country's GDP growth rates went out of the negative zone in 2017-2018, the specified goal is still far from reaching. Thus, in [9], it was shown that without cardinal changes in the cabinet of ministers, the fulfillment of plans for the country's social and economic development for the next six years seems hardly probable. Nevertheless, on 18 May 2018, President of the Russian Federation V.V. Putin signed decrees on the appointment of new deputy prime ministers and ministers of the Government of the Russian Federation. These changes can hardly be called significant, but the structure of the Government of the Russian Federation, one way or another, has been updated. However, it is too early to talk about its effectiveness and readiness for the reforms.

The above documents are designed for a long-term period, herewith only the "May Decrees" of the President of the Russian Federation, adopted on 7 May 2012 and 7 May 2018, are implementable and most significant of them. This fact is reinforced by the "Main areas of activity of the Government of the Russian Federation for the period until 2024" approved on 29 September 2018. At the same time, intense competition between documents defining the priorities of Russia's socio-economic development in the medium term is now taking place.

19 May 2017 Prime Minister D.A. Medvedev presented to the President of the Russian Federation V.V. Putin Plan of the Government for Accelerating the Pace of Economic Growth until 2025, but the document did not receive support from the President and was sent back for the revision without official publication.

30 May 2017 the head of the Stolypin club B.Yu. Titov and the head of the CSR A.L. Kudrin presented to the President of the Russian Federation the programs for the socio-economic development of Russia — Medium-Term Program for the Social-Economic Development of the Russian

Federation until 2025 (the "Growth Strategy" program) [10] and the Strategy for Russia's Socio-Economic Development 2018-2024 respectively. Comparison of the key provisions of these programs is presented in [11]. A critical review of the strategy of the CSR by experts of the Financial University can be found in the article [12]. At this meeting, according to the materials of ITAR-TASS [13], the president brought into focus that the Plan of the Government for Accelerating the Pace of Economic Growth until 2025 is a priority strategic document, and the proposals of expert groups will be studied and, possibly, used in one or another form in the joint program.

It should be noted that "Strategy-2035", developed by the CSR in coordination with the "National Development Strategy for 2018-2024", was claimed to be the leading document, but the options proposed by A.L. Kudrin to the President of the Russian Federation V.V. Putin has not been approved, and its development continues.

There is no doubt that the underlying and fundamental document defining the principles, tasks, and participants of strategic planning in the country is the already mentioned Federal Law No. 172-FZ "On Strategic Planning in the Russian Federation" [7]. However, despite the fact that the law indicates specific documents of strategic planning at the federal, regional and municipal levels, the form of their preparation is determined locally. Moreover, the content of these documents in most cases conflicts with each other. In other words, the problem of coordinating strategic goals between levels of economic management, which in a broad sense can be understood as a problem of coordination of economic agents and systems, manifests itself. It should also be noted that in economic discourse a different division of the economy into levels that differ from the levels of economic management is used.

To solve this problem, we propose to use the achievements of the system economic theory [14, 15], which presents tools to the researcher for structuring socio-economic systems. According to its provisions, on the basis of the space-time characteristics, it is possible to distinguish only four basic types of economic systems: object, environmental, process, and project. By performing their functions and exchanging space and time resources, systems of four basic types are combined into stable configurations (complexes, patterns), called tetrads. Thus, any economic system can be considered as a tetrad, because it includes subsystems of four basic types, presented in varying degrees, and as a part (subsystem) of a higher level tetrad.

This approach, on the one hand, is less expensive in comparison with traditional system analysis, and on the other hand, it provides ample opportunities to ensure the coordination of economic systems [16].

On the basis of a retrospective analysis of strategic documents in the field of the economic policy of the country, it can be concluded that today there is no consolidated position shared by state authorities, academic world, business, industry representatives and citizens, the same as a unified program of Russia's social and economic development. In our opinion, such a document should be developed by the principles of strategic planning, organized on the basis of system economic theory, which will ensure not only inter-zone (spatial), inter-period (temporary), but also inter-level coordination of economic systems. Inter-zone coordination is intended to eliminate imbalances in the territorial development of economic systems, inter-period coordination is to support the continuity of their development, and inter-level coordination to agree upon strategic goals between economic systems of different levels.

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JEL M50

DEVELOPMENT OF THE PROJECT STRUCTURE MODEL BASED ON THE ANALYSIS OF STANDARDS IN THE PROJECT MANAGEMENT FIELD AND THE TEAM ROLES THEORIES

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Abstract. The article is devoted to analysis of the approaches to designing of small working groups (project teams) structures. The work is based on the modern standards in the project management field related to the roles of project participants and their competences. For project team structure building a flexible model based on the criteria of heterogeneity of professional and social skills of the project members was offered.

Keywords: project management, project team, competence, team roles, standard

Introduction

At present elements of project management structures can be found in many organizations. Project structures in the classical sense are distinguished by the fact that they are created on a temporary basis and an important role in such structures is played by horizontal connections between the executors. Among the reasons that contribute to the development of structures of this type are the complexity of information flows within enterprises, active involvement of information technologies in management processes and in main activities, increasing of small groups autonomy in organizations. In nowadays, such autonomy in decision-making is often used as a complementary factor for motivation of employees. Among the areas of activity, which are particularly characterized by the structure of the project type, are: development and implementation of information systems and technologies, consulting, architecture and construction, advertising and marketing, etc.

The ***project team***, as it was observed in [1], is a group of professionals, working together on implementing a set of interrelated tasks aimed at achieving common unique targets in a given time frame.

Project management issues, including the task of selecting and implementing the structure of the project, are the subject of discipline of project management. Project management methods take into account the innovative nature of the project work, high uncertainty, technical and organizational complexity of project activities.

Review of project management standards

In the field of project management international standardized methodologies and national standards have been developed.

Modern global project management is based on three key documents:

1. PMBOK 6th Edition is a framework, a Guide to the project management body of knowledge (PMBOK Guide), which includes the standard, as well as a set of knowledge, traditional and innovative practices of project management.

2. ISO 21500:2012 is the first in the planned by the International Organization for Standardization (ISO) family of project management standards; it is designed to comply with relevant international standards such as ISO 10006-2017, ISO 10007-2017, ISO 31000-2018. The standard provides General guidance on project management processes that are of particular importance and affect the achievement of project results.

3. PRINCE2 is the fifth version of the standard issued by the

British Chambers of Commerce, which is a part of the Efficiency and Reform Group. The standard is divided into two parts: Managing Successful Projects Using PRINCE2 and Directing Successful Projects Using PRINCE2.

IPMA ICB 4.0, a set of the requirements in the field of project management, is also used in project management.

The Russian regulatory framework in the field of project management is only being formed nowadays. Currently, it is represented by the following documents: GOST R (Russian: ГОСТ Р) 54869-2011 Project management. Requirements for project management; GOST R (Russian: ГОСТ Р) 54870-2011 Project management. Project portfolio management requirements; GOST R (Russian: ГОСТ Р) 54871-2011 Project management. Requirements for the management of the program; GOST R (Russian: ГОСТ Р) 53892-2010 Guidelines for assessing the competence of project managers. Areas of competence and criteria for professional compliance; GOST R (Russian: ГОСТ Р) 52807-2007 Management of competence assessment of project managers; the set of standards GOST R (Russian: ГОСТ Р) 56715-2015 Project management; GOST R IEC (Russian: ГОСТ Р МЭК) 61160-2015 Project management. Documentary analysis of the project; GOST (Russian: ГОСТ) ISO 21500-2014 Guide to project management, and a number of others.

Analysis of features of project structures and limitations of standards

The listed international and Russian standards do not always pay enough attention to the issues of project personnel management and project structures development. Among the examples of early methods and standards of project management, which considered the models of project groups, can be noted: the "White Plan" method (USA, 1970s, developed in parallel with the standard MRP – Material Requirements Planning); the standard P2M (Japan); the technique of the Microsoft Corporation – Microsoft Solution Framework, including a description of the model the project team – Microsoft Solution Framework Team Model (USA, 1994) [1, 2, 3]; the theory of team roles developed by Meredith R. Belbin and the related technique for definition of a role structure of a project group [8].

When developing a project structure, its flexibility is becoming a very important requirement, i.e. the ability of a structure to adapt to changes in the external and internal environment. As a rule, the flexibility of the structure is achieved by strengthening the horizontal links and the implementation of the principle of heterogeneity of the project group. It should be noted that project teams are small in most cases (up to 15-20 persons), because weak standardization and unification in project management, following from the very nature of projects, do not allow to make working units large. The participants of the project have a high degree of independence in conducting professional activities [eg., 4, pp. 126-133; 5, 6, 7].

The principle of heterogeneity indicates, first of all, that with relatively small size of project teams, however, highly qualified specialists from different fields of knowledge should be represented in them. Some of the modern standards for describing the skills required by the project participants operate on the concept of "competence" (see Table 1). However, the requirement of heterogeneity also applies to the socio-psychological skills of project participants, including leadership skills. Often there are recommendations for the formation of project teams, which focus on the functions of management ("roles"). In accordance with these approaches, in the list of project participants are included: Project Manager, Project Administrator, Controller, Coordinator, Project Forwarder, etc.

Elements of project structures in the standards: a comparative analysis

Table 1 presents the results of a comparative analysis of the main international standards of project management, taking into account the following features of the classification: 1. The presence of a description of the roles in the project: a) the requirements for competencies for a separate project role are established; b) the recommendations on competencies are given in general, without reference to a specific role. 2. The use of the concept of a "competence" and its interpretation. 3. Details of competences presented in the standard. 4. The structure of the organizational model. 5. The scale of distribution of the standard.

Table 1

Characteristics of the main project management standards

Classification feature	Basic standards (recommendations) in the field of project management			
	PMBOK® 6thEdition Guide	ISO 21500:2012	PRINCE2®	IPMA ICB 4.0
1. A role description in the project	four main roles are highlighted: - project manager; -resource manager; - product manager; - project team	three main roles are highlighted: - project manager; - project management team; - project team	at least four roles	at least three roles
2. Use of the concept of "competence"	skills and capabilities required to perform assigned activities within project constraints	no definition	no definition	применение знаний, навыков и умений с целью достижения желаемых результатов
3. Detailed description of competencies	more than 30 competencies have been identified, recommendations for determining the level of ownership of each of the competencies are given	provides general recommendations on the structure of competences	provides general recommendations on the structure of competences	more than 30 competencies and recommendations for determination of the level of ownership of each of the competencies are given
4. The design of the model	three-level	three-level	linear	four-level
5. The scale of the distribution	national / international standard	international standard	state standard	international requirement

Source:[12, 13]

Table 1 shows that the standards of project management, having a number of differences, adopt a certain amount of knowledge from each other. In the Russian Federation, as a part of the standardization of project activities the national standard GOST R (Russian: ГОСТ Р) 21500:2014 identical to ISO 2500:2012 is used, despite the fact that the international prototype is in the last stage of revision and will soon be replaced by ISO/AWI 21500 "Project, Programme and Portfolio Management – Context and Concepts".

Table. 2 shows those of the Russian standards, which consider the elements of project structures (competence and roles).

From the data in the Table 2 it can be concluded that the three present national standards define the competencies required by the project participants. Thus, only in one of these standards, namely in GOST R IEC 61160-2015 (Russian: ГОСТ Р МЭК 61160-2015), behavioural competence, regarding the Director and the Secretary of the group of analysis of the project, were defined. In the other standards only the professional competences were noted.

The idea of a project structure model

On the basis of the analysis carried out by the authors it was proposed to build the model of a project structure based on the role theory and, in particular, on the theory of M. Belbin's team roles, which has become widespread in the world practice of management [8, 9].

Table 2

Russian standards in the field of project management

Classification feature	The main national standards in the field of project management					
	GOST R 54869-2011	GOST R 54870-2011	GOST R 54871-2011	GOST R 53892-2010	GOST R 52807-2007	GOST R IEC (Russian: ГОСТ Р МЭК) 61160-2015
Number of roles in the project	4	3	4	M*	M*	from 4 and more
Number of competences	-	-	-	7	7	more than 3
«M*» – regarding Project Manager; «-» – competences are not identified (no data)						

Source: GOST R (Russian: ГОСТ Р) 54869-2011, GOST R (Russian: ГОСТ Р) 54870-2011, etc.

In addition, the requirement to provide a heterogeneous structure of the project team, on two grounds – professional and socio-psychological, was taken into account.

The examples of constructions of such models have been presented in the previous works of the authors of the paper [10, 11, 12]. The main features of these models are: an interactive process of construction (the model is built step by step, at each step it is being specified); the evaluation of professional and socio-psychological skills of project participants on the base of the methods of organization of complex examinations, primarily the methods in which the information assessment of A.A. Denisov is used:

$$H_{ij} = -q_{ij}\log(1 - p_{ij}'),$$

where H_{ij} is the assessment of the significance of the *i*-th participant of the project from the point of view of the implementation of the *j*-th role (perform *j*-th function or operation), taking into account the evaluation q_{ij} made by the manager (the head) and self-esteem of the employee p_{ij}' $(0 \le q_{ij} \le 1;$ $0 \le p_{ij}' \le 1)$.

Conclusion

The article presents the results of the analysis of the provisions of project management standards in terms of recommendations for the formation of project teams. The idea of building a model of the project structure based on the theory of group roles is described. The model takes into account the professional and personal characteristics of the project participants; the model based on the information approach of A.A. Denisov is given.

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JEL L-50

DEVELOPMENT PROSPECTS ECONOMICS OF RUSSIAN PORTAL TERRITORIES

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Abstract. Sea ports, being a transport subsystem of the country, at the present stage represent a complex territorial-branch system, which requires a broader approach to their development. In this paper, based on the methodology of systemic economic theory, the insufficiency of the infrastructure approach to the development of Russian ports is substantiated. The purpose of this study is to identify and systematize the development possibilities of the Russian port-industrial complexes as the basis for the development of the economy of the port territories based on the "Strategy for the Development of the Sea Port Infrastructure until 2030". In this study, the analysis of the environmental subsystem of port industrial complexes as an element of the tetrad. In particular, the intellectual component, socio-economic institutions and infrastructure are considered in detail as an element of the environmental subsystem. As a result of the work, the opportunities for the development of the production subsystem of the control panel in Russia are identified. Further research involves the analysis of port industrial complexes in the process, design (innovation) and object subsystems.

Keywords: port-industrial complexes; system economic theory; development strategy.

Introduction

The development of seaports stimulates economic growth, entrepreneurial activity, market competition, the inflow of investments and qualified personnel, and the development of innovative technologies. In the process of globalization of the world economy, ports become regional centers of development: their functions are expanding, becoming more complex, various types of production are located on their territory or close to them, which indicates the development of port industrial complexes (PIC).

The study of the problems of development of the PIC, as a system-forming element of the regional economy, requires the application of a systems approach, and strategic management. The purpose of this study is to identify and systematize the possibilities for the development of Russian PIC, based on the "Strategy for the Development of the Sea Port Infrastructure until 2030".

Methods

The methodological basis of this study is a systemic economic theory (SET), which allows to carry out a fundamental economic analysis in order to predict the economy under turbulence and heterogeneity in an era of large-scale qualitative crises that radically change the situation in the economy, politics and the social sphere.

The Strategy-2030 states that it is an element of a single hierarchical system of strategic planning of the transport industry and the economy as a whole. [1]. This means that this document can be considered not only as a transport strategy, which creates prospects for its application in the development of the economy of coastal territories.

The concept of a four-dimensional coordinate system for analyzing economic systems in a broad sense involves the interaction of key subsystems of a national economy: economic science (environmental subsystem); economic policy (process subsystem); management of the economy (project sub-system); economic practice (object subsystem). Together, these systems constitute a complete complex that implements the full range of functions necessary for the sustainable functioning and development of the economy as a system (a combination of stability and variability, homogeneity and diversity) [2].

Results

The study is devoted to the analysis of the environmental subsystem of PIC: economic science, socio-economic institutions, business climate, infrastructure, Internet [3].

1. Intellectual environment. In Russian economics, there are practically no methodological foundations of design (PIC) and their development strategies as centers of territory development. Consequence - weak development of PPC as mesoeconomic education.

According to the veteran of the industry, the professor of SUMRF. Admiral S.O. Makarova G.V. Poplavsky, the solution of many port problems was achieved through a close connection with the production, with the largest seaports of the country. “Lenmorniiproekt” was formed from a sub-division of the port. As a result of the introduction of economic and mathematical methods in maritime transport, on the initiative of the USSR Ministry of the Sea Fleet (from 1970 to 1986), Gugenko T.B., together with the director of the Central Economics Institute of the Academy of Sciences of the USSR, Academician Fedorenko N.T. the largest ports of the country switched to the developed system of continuous planning of the work of the fleet and port [4].

Specialists of FSUE "Rosmorport", representatives of the transport science, business community took part in the development of the Strategy 2030.

2. Socio-economic institutions. The starting point for the formation of the institutional environment for the new industrialization of the region is the creation of [5]: a) regulatory elements of the state (normative level), b) cognitive - knowledge dissemination institutions about the formed regulatory (legislative) norms c) cooperation: the parties are often needed in institutions to help obtain profit from cooperation, d) the value-personal component: norms of morality and ethics, incl. the role of the personality of the representative of the top management of the region (governor) is a harmonizing element. Consider each element of the institutional environment in more detail.

a) *regulatory elements* of the state (normative level). The development of the transport industry depends on the application and adaptation of the Federal Law:

- On concession agreements "dated 21.07.2005 No. 115-FL,

- “On seaports in the Russian Federation” from 2007 with changes in subsequent years,

- “On Amendments to the Federal Law “On the SEZ ” and certain legislative acts of the Russian Federation” (regarding the creation of the SEPZ) dated 30.10. 2007 № 240-FL,

- Federal Law of 7.11.2011, No. 305 “On introducing amendments to certain legislative acts of the Russian Federation in connection with the implementation of measures of state support for shipbuilding and shipping”.

The Strategy-2030 points to the imperfection of the federal laws “On Seaports” and “On Amending the Federal Law “On the Special Economic Zone in the Russian Federation”, in terms of creating a special economic zone on the territory of seaports, in order to achieve the strategic goals of port development [1].

Legal uncertainty remains in matters of reservation and use of land for the construction and reconstruction of ports, including the establishment of the boundaries of the territories and waters of seaports and the classification of the territories they occupy into the category of land transport [1].

The balanced development of the regulatory framework requires: the development of a list and draft laws that are the basis of the provision of the Strategy-2030, including by-laws; actualization of normative documents in the field of port designing immediately before the start of the implementation of the strategy, which is important for the formation of the PIC.

b) *cognitive elements.* Representatives of the cognitive approach consider the decisive role of knowledge in human behavior. The focus of the theory of the cognitive approach is the processes of human processing of information about everything that surrounds it, on the basis of a system of acquired knowledge.

The main parameters of the development of seaports are formed on the basis of a detailed analysis of the main strategic documents of cargo-forming industries (the Energy Strategy of Russia for the period until 2030, the Strategy for the development of railway transport until 2030, the Long-term program for the development of the coal industry until 2030 Development strategy of the metallurgical industry of Russia up to 2020, Development strategy of the chemical and petrochemical industry of Russia until 2015, etc.), and also the Program for the development of infrastructure and logistical support of grain market of Russia for 2011 - 2020 years.

The managing director of Port Poronaysk LLC believes that the best success is achieved by the one who has the best information, one of the most significant sources of which is the seaport information and analytical magazine Sea Ports, which provides valuable information about companies, trends, and prospects of ports. Articles about the activities of market leaders help to see new opportunities in organizing their own business and contribute to the generation of ideas in improving production and business processes [6].

c) *cooperation*. Until the 90's the interaction between industrial and transport industries was carried out through state associations of the Ministry of Foreign Trade. The abolition of monopoly weakened ties: problems in forecasting cargo flows, analyzing supply and demand [1]. The lack of partnership between the agencies leads to problems in forecasting, to the lack of coordination between industry and maritime transport, which hinders the development of the PIC.

The balanced development of port capacities implies: the development of sea, port and land zones. Solving these issues needs state regulation and a high degree coordinating the actions of not only the structures of the federal government, but also the subjects of the Russian Federation, local governments, businesses, the public [1]. The world practice of the PIC proves the effectiveness of collective participation in management and development.

3. Infrastructure. In order to create the innovation infrastructure of sea ports, the Strategy-2030 identifies the following priorities: innovations in the management and organization of the transport process; strengthening the role of the state in the implementation of innovations, and in the management system; in the field of technological innovations, active implementation of logistic transport-but-technological systems [1].

These provisions create the potential for the formation and development of the port infrastructure of the PPK, but there is not enough information for the development of the industrial subsystem infrastructure.

As a result of the study, the development possibilities of the production subsystem of the control panel in Russia within the framework of the environmental subsystem were determined. Regulatory elements have the potential to form the institutional basis for the development of the production subsystem of the control panel. The main parameters of the development of seaports in the Strategy-2030 are the information base for the development of a strategy for the production subsystem of the PIC, which will solve the problem of combining territorial and sectoral development strategies.

Discussion

Further study of the development of porous-industrial complexes within the framework of systemic economic theory involves the analysis of the process, design (innovation) and object subsystems.

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JEL L 50

ECONOMIC EFFECTS OF REALIZATION OF THE STATE PROGRAMS OF INDUSTRIAL DEVELOPMENT

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Abstract. The relevance of the research topic is determined by the implementation of industrial policy in the Russian Federation within the framework of the program-target approach, the need to develop methods for assessing the effectiveness of state programs for the development of industry, the complex structure of the effects of state programs and, consequently, the complexity of assessing their effectiveness. The purpose of the study is to elaborate a structure of economic effects of the implementation of state programs of industrial development. Research method: mathematical modeling. Research results: The author structures the positive effects of the state programs of industry development. The novelty of the proposed structure is to separate the effects of micro-, meso - and macro-levels, as well as in the developed system of indicators for assessing the effectiveness of the implementation of state programs for the development of industry by subjects and objects of management of structural changes. The author defines the conditions for effective implementation of structural changes in industry, leading to the achievement of economic development goals. The feature of the author's position is to take into account such factors as the quality and consistency of strategic planning documents, the type of distribution of functions in the management of structural changes and others. The author sees the directions of further research in the adaptation of methods for assessing the effectiveness of state programs for individual subjects (types of subjects) of management of structural changes in the industry of the Russian Federation and individual objects (types of objects) of management of structural changes in the framework of the program-target approach to the implementation of industrial policy.

Keywords: state programs, industrial development, economic effects, structural changes

Introduction. The relevance of the research topic is due to the implementation of industrial policy in the Russian Federation within the framework of the program-target approach, the complex structure of the effects of state programs and, consequently, the complexity of assessing their effectiveness. Industrial policy dedicated to the works of A. G. Aganbegyan, M. A. Bendikov, R. S. Greenberg, V. E. Dementyev, G. B. Kleiner [1], R. M. Kachalov, E. B. Lenchuk, O. A. Romanova, O. S. Sukharev [2], A. I. Tatarkin [3] and other authors. Methodological issues of state program management, evaluation of effectiveness and efficiency of state programs revealed in the works by M. A. Bendikov, V. V. Ivanter, S. Y. Glazyev, V. E. Dementiev [4], V. N. Leksin [5], B. N. Porfiryev [6], V. M. Kapitsyn [7], V. V. Karpov [8] A. Y. Lagzdin, K. K. Loginov [9] A. A. Korableva, A. G. Breusova, S. M. Markov [10] and other authors.

The state program of development as an instrument of industrial policy has a complex structure, a large number of tasks, instruments of influence and stimulation, and, as a result, a complex structure of effects. The state program can plan to achieve the effects of production growth, import substitution, development and introduction of innovations, increase the share of production with the use of new materials and technologies, increase productivity, investment, increase the share of manufactured goods and high-tech goods in commodity exports, etc. The instruments of the state program have a different level of availability for enterprises – recipients of state support, a different share of budget expenditures in the total volume of planned and actual expenditures for the solution of certain tasks of the state program, different levels of complexity, resource intensity and achievability of the tasks at the given resources and for the planned period.

The purpose of the study: to elaborate a structure of economic effects of the implementation of state programs of industrial development.

Methods and results of the study. Research method: mathematical modeling. Depending on the objectives of the study, there are different types of structures of positive effects of the state program: a) subject structure (by subjects of economic activity and/or subjects of management, their groups); b) object structure (by objects of management). According to the subject structure, the sum of positive effects of the state development program ($E_{govprogsub}$) consists of the following components:

$$E_{govprogsub} = \sum_{k=1}^{l} E_{enterprise} + \sum_{j=1}^{m} E_{branche} + \sum_{i=1}^{n} E_{reg} + E_{st}, \text{ где} \quad (1)$$

$\sum_{k=1}^{l} E_{enterprise}$ – the amount of positive effects of implementation of the state program for individual enterprises, members of the state program, where k is the number of companies; $\sum_{j=1}^{m} E_{branche}$ - is a sum of positive effects of implementation of the state program for certain sectors, where m is the number of branches (effects that are not included in the sum of effects for individual enterprises); $\sum_{i=1}^{n} E_{reg}$ - sum of positive effects of implementation of the state program for the individual regions, where n is the number of regions (effects that are not included in the sum of effects for individual businesses industries); E_{st} - sum of positive effects of implementation of the state program for the state (effects that are not included in the sum of effects for individual enterprises, industries, regions).

The planned amount of positive effects of the state development program ($E_{govprogob}$) in accordance with the object structure consists of the following components:

$$E_{govprogob} = E_{growth} + E_{inv} + E_{techdev} + E_{efrise} + E_{stabdev} + E_{safe} + + E_{imp} + E_{qol} + + E_{stchange}$$

….(2),

где (E_{growth}) - the effect of increasing the volume of production; (E_{inv}) - the effect of the inflow of private investment; ($E_{techdev}$) - the effect of technical and technological development; (E_{efrise}) - the effect of increasing the efficiency of the economy (industry); ($E_{stabdev}$) - the effect of increasing the sustainability of development; (E_{safe}) – the effect of ensuring the safety of the functioning of the economy, the industrial complex, the life of the population; (E_{imp}) - the effect of import substitution; (E_{qol}) - the effect of improving the quality of life of the population; ($E_{stchange}$) - the effect of other structural changes not included in the above effects.

Efficiency is also proposed to be calculated for individual entities and objects.

On subjects:$Ef_{sub} = \frac{E_{sub}}{C_{sub}}$ (3),

где Ef_{sub} – the effectiveness of the state program for a particular entity;E_{sub} – the positive effect of the implementation of the state program for a particular subject; C_{sub} – expenses of a particular entity for participation in the state program, for example,

a) $Ef_{st} = \frac{E_{st}}{C_{st}}$ (4),

где Ef_{st} – the effectiveness of the state program for the state; E_{st}- the sum of the positive effects of the state program for the state;C_{st} – the state expenses for the implementation of the state program, etc.

On objects of management (separate tasks or groups of tasks of the state program):

$$Ef_{ob} = \frac{E_{ob}}{C_{ob}} \quad (5)$$

где Ef_{ob} – the efficiency of the solution of the separate task (group of tasks) of the state program (in total or for the specific subject);

E_{ob} – the positive effect of solving a separate task (group of tasks) of the state program (collectively or for a particular subject);

C_{ob} – the actual expenses for the solution of the separate task (group of tasks) of the state program (in total or for the specific subject).

For example, the efficiency of solving the problem of increasing production (Ef_{growth}) is calculated as the ratio of the effect of increasing production (absolute growth) (E_{growth}) to the actual cost of solving this problem (C_{growth}):

$$Ef_{growth} = \frac{E_{growth}}{C_{growth}} \qquad (6) \quad \text{и т.д.}$$

Condition for the effective implementation of structural changes (including in the framework of implementation of state programs), leading to the achievement of the objectives of economic development, the study's author believes the formation and functioning of the system including: 1) strategy of socio-economic and industrial development, determine the criteria, principles, directions, objectives and tasks of structural changes at the macro-level and for individual subsystems of the economy; 2) developed and accepted, adequate, systematic, consistent tools: the regulatory framework of structural changes; methodological documents that ensure the effectiveness of the process of management of structural changes; 3) sufficient information base of the process of management of structural changes; 4) sufficient financial resources for the implementation of the planned structural changes; 5) honesty, responsibility, professionalism of the subjects of management of structural changes; 6) monitoring and evaluation of the effectiveness of the subjects of management of structural changes.

The author sees ***the directions of further research*** in the adaptation of the methodology for assessing the effectiveness of state programs for individual subjects (types of subjects) and individual objects (types of objects) of management of structural changes in the industry of the Russian Federation in the framework of the program-target approach to the implementation of industrial policy.

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THE SYNTHETIC CHARACTER OF SYSTEMIC THINKINGAND COGNITIVE PROCESSES

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Abstract. A general approach to problem solving based on the synthetic nature of thought processes is considered. The cognitive approach considers human thought processes as a systemic property of an open self-organizing sociobiological system. There is a transition from what can be called the "century of analysis" to the "century of synthesis". The changes that are taking place are already putting pressure on real decision-making processes in management practices, and people who consider these changes and understand their meaning are better equipped to take advantage of the opportunities presented to them.

Keywords: analytical method, synthesis, holism, imagination, mind, intuition, system thinking, cognitive science

1. The synthetic nature of systemic thinking

The general approach to problem-solving is presented as a cyclical process. To solve the problem, systemic study is carried out, including decomposition, analysis and synthesis, as a result of which the problem is removed. The main creative component in the named process is synthesis. The result of synthesis is a completely new formation, the property of which is not only the external sum of the properties of the components, but also the result of their interpenetration and interaction. Therefore, the true synthesis is not an aggregate, but a creative synthesis. However, analytics and so-called analytical thinking used to be the main cognitive tools for a long time. The essence of the method of analytical thinking, by R. Descartes, was created to the complex phenomenon into parts and understand the behavior of the whole based on the properties of these parts. [1].

Ideas raised by scientists in the first half of the XX century (A. A. Bogdanov, biologists L. fon Bertalanfy and J. Haldane), contributed to the emergence of a new way of thinking – *systemic thinking* based on connectivity, relationships and context.

In accordance with the system views, the essential properties of the living system are the properties of the whole, which does not have any of its parts. New properties arise from interactions and relations between parts.

The belief that in any complex system the behavior of the whole can be fully understood via the properties of its parts was central to the Cartesian worldview. In an analytical, or reductionist, approach, the parts themselves can be analyzed further, only by reducing them to even smaller parts. Western science developed in this way, and at each stage had to deal with a certain level of fundamental components, to analyze that was not possible.

However, the system cannot be understood by analysis. The properties of parts are not their intrinsic properties, but can only be understood in the context of a larger whole and can only be derived from the organization of the whole. Systemic thinking does not focus on the basic elements, but is interested in the basic principles of the organization. It is contextual, which is the opposite of analytical thinking. Analysis means the separation of something in order to understand it; systemic thinking means the placement of something in the broader context of the whole.

In the transition from mechanistic thinking to systemic thinking, the interrelation between the parts and the whole becomes the opposite. But, ultimately - it is shown by quantum physics –there are no parts at all. What we call a part is just a pattern (object, image, construction, repetitive action) in an indivisible web of correlations.

Experiments and studies of recent decades have discovered the dynamic nature of the world of particles. Any particle can be transformed into another; energy can be transformed into particles and conversely. Existing at this stage of cognition models of description of subatomic reality reflects the deep unity and the mobility of matter. They show that the properties of a particle can only be understood through its activity, that is, its interaction with the environment, and that the particles should not be considered as independent units, but as inseparable parts of the whole. The results of studies of all these complex processes and phenomena of the microcosm and their philosophical understanding were carried out by many physicists of the XX century [2-6].

Therefore, the transition from parts to the whole can be seen as a transition from objects to relations. Thinking systemically, we can understand that the objects themselves are networks of correlations, included in the larger network. For systematically thinking man correlations are primary. The boundaries of the discernible patterns are secondary.

However, the new approach to science raises an important question. If everything is connected to everything, how can you hope to understand anything? The discovery of approximate knowledge makes it possible to turn a systematic approach into a science. The new paradigm recognizes that all scientific concepts and theories are limited and approximate. Science can never provide a complete and definitive understanding.

The science of the twentieth century, appeared out of the Cartesian separation, now overcomes its limitations and returns to the idea of unity expressed by the ancient philosophers of Greece and the East. In the first half of the last century the doctrine of integrity – holism (from greek. *holon* - whole) was born. The doctrine was founded by J. Haldane and presented in his work "Philosophical basis of biology" [7]. Holism comes from the integrity of the world as the highest and all encompassing integrity - both qualitatively and organizationally, – integrity, encompassing the area of psychological, biological and external, the most rational physical reality. All these areas represent a simplification and isolation of this encompassing integrity.

In recent decades, the interpenetration of the cultures of the rational West and the intuitive East has been increasing. There is a confirmation of the idea of the need for a *dynamic balance* between *the rational* and *the intuitive*, between the external and the internal, that is, applied to our century – between *technology* and *psychology*.

Paradigm shift requires improving not only our perceptions and thinking, but also the value system itself. Changes in thinking gradually lead to changes in values. These processes can be seen as a shift from self-affirmation to integration. Good and healthy is characterized by dynamic equilibrium; bad or painful is caused by imbalance – overestimation of one tendency and neglect of another. Turning to Western industrial culture, one can see a clear reassessment of self-assertion and underestimation of integration. This dominates both in thinking and in the value system.

The German philosopher I. Kant made a fundamental contribution to the theory of knowledge, to the development of its analytical and synthetic component. He established that fundamental scientific solutions lie in the field of reflexive analysis of the concept-predicate relation. Reflection can be seen not on the diode, but on more complexly organized social groups, united by significant joint activities; for example, a corporation, the stock market and others. Space and time are understood as the most important elements of such reflection. They create conditions for experience.

Kant singled out three *cognitive* (active) abilities: 1) *the imagination,* 2) *the reason* and 3) *the mind*; and one *perceiving* (passive) ability – *the sensual intuition*. Thus, the active part of the mind Kant associated with intelligence, and passive, receptive part of the mind he called intuition [8].

The most important value of imagination is that it allows the subject to present the result of the activity before it starts, thereby orienting him in the process of this activity. The imagination acts in unity with thinking during the activity. The inclusion of imagination or thinking in the process of activity is determined by the degree of uncertainty of the problem situation, the completeness or lack of information in the source data of the problem. If the initial data are known, the course of solving the problem is subject mainly to the laws of thinking; if these data are difficult to analyze, the mechanisms of imagination. The value of imagination is that it allows you to make a decision in the absence of the necessary completeness of knowledge necessary to perform the task. However, in this case, the ways of solving the problem are often not accurate enough, not strict and cause the limitation of imagination.

The processes of imagination have *analytical and synthetic character*, as well as the processes of thinking, memory, perception. The main trend of imagination is the transformation of memory representations, providing, ultimately, the creation of a deliberately new, previously non-arisen situation; reflection of reality in new, unusual, unexpected combinations and connections. *The synthesis of representations* in the processes of imagination is carried out in different forms: agglutination - connection of qualities, properties, parts of objects that are not connected in reality; hyperbolization - increase or decrease of objects; sharpening – emphasis of the attributes; schematization – smoothing of the differences and identification of similarities; typification – selection of significant, repeated in homogeneous phenomena.

The reason and the mind in the philosophical and psychological tradition are two types of logical thinking. Reason, being one of the moments of the movement of thought to the truth, operates within the existing knowledge of these experiences, arranging them according to the established rules. Reason provides material for the mind through the formation of concepts and judgments through reasoning.

The mind gives knowledge of a deeper and more generalized nature. It has the ability to analyze and summarize both the data of sensory experience and its own forms, thoughts and to develop concepts reflecting the dialectics of the objective world. Going beyond the limits of available knowledge and the generation of new concepts is the main difference between mind and reason. The mind is constructive, reflective, focused on social goals of the highest level. The desire to understand the world through the mind and to transform it according to mind is called *rationalism*. Along with sensual intuition, the mind is the basis of our knowledge.

The intuition is knowledge that occurs without comprehension of the ways and conditions of its receipt, whereby the subject has it as a result of "direct discretion". It is considered as a necessary, internally determined by the nature of creativity moment of going beyond the existing behavior stereotypes and, in particular, a logical program to find a solution to the problem.

A key provision of the I. Kant: *reason can give nothing to the intuition, the feeling of anything can't think. Only through their "union" (synthesis) can one come to knowledge.* It brings you closer to the understanding of the "paradoxical" relations between the reason and intuition and has much in common with the above-mentioned conceptions of philosophers on the necessity of dynamic balance between the *rational* and the *intuitive*.

According to Kant, *analytical (or explanatory)* judgments are judgments, the predicate of which is already contained in the subject in advance. *Synthetic (or expanding)* are judgments that *add* to the concept of the subject a predicate, which is not yet implied in the knowledge of the subject. Here lies the answer to the central question of "Criticism of pure reason": How are a priori synthetic judgments possible? Synthetic means: adding (philosophy adds or expands previous knowledge); productive (philosophy develops knowledge of the "beyond").

Habitual causal thinking does not work when you have to deal with systems, because it tends to see everywhere the action of simple, localized in space and time cause-effect correlations, rather than combinations of mutually influencing factors. In systems, cause and effect can be far separated in space and time. The consequence can appear only after a few days, weeks and even years, and we need to act now. If we are unable to establish links between causes and effects, it will be difficult to learn from experience and make intelligent decisions. But logical analysis can also be misleading, and obvious solutions can make a situation worse than it was, and getting out of it can turn out to be somewhat counterintuitive.

It is obvious that each area of human knowledge in its development goes from analytical and descriptive methods to synthesis and integration. Trends in the transition to synthesis and systemic thinking can be observed in business. Humanity is in a state of transition from one era of thinking and activity to another – from what can be called the "century of analysis" to the "century of synthesis". The changes are already putting enormous pressure on the real decision-making processes in business, and people who consider these changes and understand their meaning are better equipped to take advantage of the opportunities presented to them [9].

2. Mechanisms of cognitive processes

The development of computer technologies and advances in neurophysiology and artificial intelligence research have provided new opportunities and allowed to clarify and refine the formulation of some fundamental philosophical problems and made it possible to implement some simple functions of the human brain on the computer.

However, the purpose of research in these areas and the development of intelligent systems are not to replace the human brain with a computer, but to create an effective symbiosis between a human and a computer equipped with appropriate intellectual modules, models and methods. This approach is based on the fact that when faced with complex systems, the brain exhibits abilities far superior to the most complex methods implemented on computers.

Despite the success of artificial intelligence, as well as neurophysiology, psychology and other Sciences, there is a reason to believe that some of the abilities of the human brain will never be fully understood. The most valuable properties of the human brain are intuition, insight, ability to global reach, possession of metaphor.

However complex systems have often properties that cannot be intuitively understood and globally evaluated. These properties often push people to wrong ideas. In this respect, the brain is not very strong and limited in its capabilities, and detailed analysis is exactly the area where the computer surpasses it. This property of the computer allows it to play an important role as an amplifier of intuition. Using a computer as a guarantor and an amplifier of intuition with the support of management decisions and solving system problems is one of its two most important applications. Another is its use in research related to the world cognition and knowledge about man. In this case, it is used for experiments with systems modeled on it.

Cognitive psychology. At the end of the 50-ies of the last century, scientists are increasingly interested in cognitive topics - attention, memory, pattern recognition, problems of language and thinking; however, these processes were discussed at a new level. The beginning of a new approach can be found in the works of the psycholinguist J. Miller, his apprentice W. Neisser, and J. Bruner, who are the founders of cognitive psychology as a scientific direction [10-12]. The authors used the term "cognitive psychology" to contrast behaviorism, aiming to engage not only the study of behavior, but also mental processes and proof of the decisive role of knowledge in human behavior.

The theory of cognitive dissonance explains the impact on human behavior of the system of cognitive elements that can cause a negative incentive state in a situation where a person simultaneously has two psychologically contradictory knowledge about one object. The state of dissonance is experienced as discomfort, which is sought to get rid of either by changing one of the elements of dissonant knowledge, or by introducing a new element. L. Festinger defined dissonance as a consequence of insufficient justification of choice [13]. In an effort to strengthen the justification of the act, a person either changes his behavior, or changes his attitude to the objects with which the act is associated, or devalues the value of the act for himself and the others.

Cognitive science. Simultaneously with the development of cognitive psychology began to develop the science of cognitive processes and thinking – cognitive science (from the Latin cognition - knowledge, cogitation - thinking) [14]. It studies the laws of the processes of perception, cognition, understanding, transformation, representation, thinking, reflection and learning, and models the principles of organization and operation of natural and artificial intelligent systems, based on analytical, synthetic and synergetic approaches. Cognitive science unites a whole family of disciplines with a single problem and similar methodological principles.

3. Systemic cognitive thinking

Human cognitive processes are analyzed both in their connections and interactions with each other and with other areas of the human real world. Based on the awareness of the importance of the above-discussed synthetic nature of thinking, systemic mechanisms of cognitive processes and principles of synergetic thinking, we can say that the cognitive approach considers the cognitive processes of man as a systemic property of an open self-organizing sociobiological system.

The current wave of the cognitive revolution is different from the one considered by G. Miller in article [15]. It is more related to cognitive approaches to understanding and understanding the importance of not only rational human activity, social groups and computer systems, but also to explaining its emotional manifestations and intuition. The development of cognitive science is on the way to more and more deepening in such "irrational" areas as intuition and creativity.

Researchers and people from the field of practical management are faced with the need to describe and comprehend the rapid processes of finding solutions; separate meaningful results from chaotic, often meaningless initial information; unpredictability of the course of development through critical states; observation and description of the processes of ordering at the macro level through the disorder at the micro level. Today we can speak about the dynamic development and implementation of management practices the system of cognitive-synergetic approach [16].

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JEL D83

REFLECTIONS ON THE APPLICATION OF SYSTEMS THINKING TO MANAGEMENT PRACTICE

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Abstract. This paper contextualizes the ongoing development of Soft Systems Methodology (SSM) through its practical application and learning through use. Based on this learning process SSM has evolved from its roots in "hard" systems engineering in the late 1960s to become an organized process of enquiry, utilizing systems thinking and models to help structure dialogue about possible improvements in situations regarded as problematic. SSM has proved to be useful in a wide range of practical applications in public and private sector and some illustrative examples are provided.

Keywords: Soft Systems Methodology; SSM; learning process; "hard" systems engineering; systems thinking; practical applications.

Soft Systems Methodology (SSM) in context

As a long time "practitioner" of systems thinking I will share observations and lessons based on its practical use in a variety of problem situations over a period spanning nearly 40 years. This paper doesn't deliver new theory, but I hope it provokes your interest and encourages you to further explore the use of SSM in practice.

An important question for academics is whether management theories can be developed without any practical experience of doing management. The relationship between management theory and management practice should be seen as groundless: practice informing theory just as theory can inform practice. No Management Science can be developed without testing and learning from practice. As systems thinkers we can choose to frame our interventions in real world and content from a description in the 1990s or 2000 or now. Given the groundless relationship between theory and practice one should expect SSM to continue to evolve. It is therefore important to start this paper with some context about its evolution so far.

This paper is written from a particular perspective.
problems as opportunities to learn from practice; and we can use that learning to test, challenge and improve theory. In effect every real-world application of systems thinking is an opportunity to learn. This can be viewed as action research and it is from this perspective that I offer some reflections on real-world practice in applying systems thinking.

Although there are many references to Soft Systems Methodology in secondary literature, evidence such as Sue Holwell's research shows that SSM is often misunderstood. This is at least in part because the methodology has continued to develop and has evolve through application and learning over time: hence a description of SSM in the 1980s would have different emphasis

Soft Systems Methodology developed through the work of Professor Peter Checkland as opposed to his colleagues in the newly formed Department of Systems Engineering at Lancaster University in the UK. As a group with considerable practical experience in industry, they started in 1969 with a research programme intended to apply systems thinking to real-world problems in organizations that were receptive to the idea of allowing a team of systems thinkers to come along and help them understand how to do things better in some way. The researchers soon discovered, as would-be-engineers-of-a-better-world, that their initially "hard" centred systems methods, rooted in Systems Analysis and Systems Engineering, when applied to the vagaries of "rich 'management' problem situations", sometimes "fell apart in their hands" according to Checkland. For example, the Anglo-French Concorde project which began way back in the 1950s wasn't simply an engineering challenge to design and manufacture a radically new supersonic passenger aeroplane; Concorde was developed in an emotionally charged transnational political environment in which there were many changing, views of what the emblematic project could or should achieve. The original project spanned two decades before it entered service and costs rose from the original estimate of £70M to £1.3B! Clearly there were problems but agreement about a simple definition of "the problem to be solved" and a "solution to engineer" was anything but straightforward.

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Over the first three years of Lancaster's research programme much was learned from practice about the apparent limits of "hard" systems methods in "soft" problematic situations which were always "messy" and often "wicked" in nature. This practice-based learning provided the foundations for what later became known as Soft Systems Methodology. In 1972 Checkland's paper "Towards a systems-based methodology for real-world problem solving" described a set of ideas based on practice that helped to develop the appreciation of some critical differences between "hard" systems approaches and the emerging "soft" methodology. Whereas the "hard" systems thinker might view the world as systemic, literally seeking to engineer systems within that world; the "soft" systems thinker saw the world as complex and confusing but one where systems concepts could be used to frame, explore and learn about the real-world in ways that could lead to action for improvements (figure 1).This differentiation is important for practitioners to understand as it can help inform their choices about how best to deal with different kinds of problems and situations including the possibility of using some combination of soft and hard approaches.

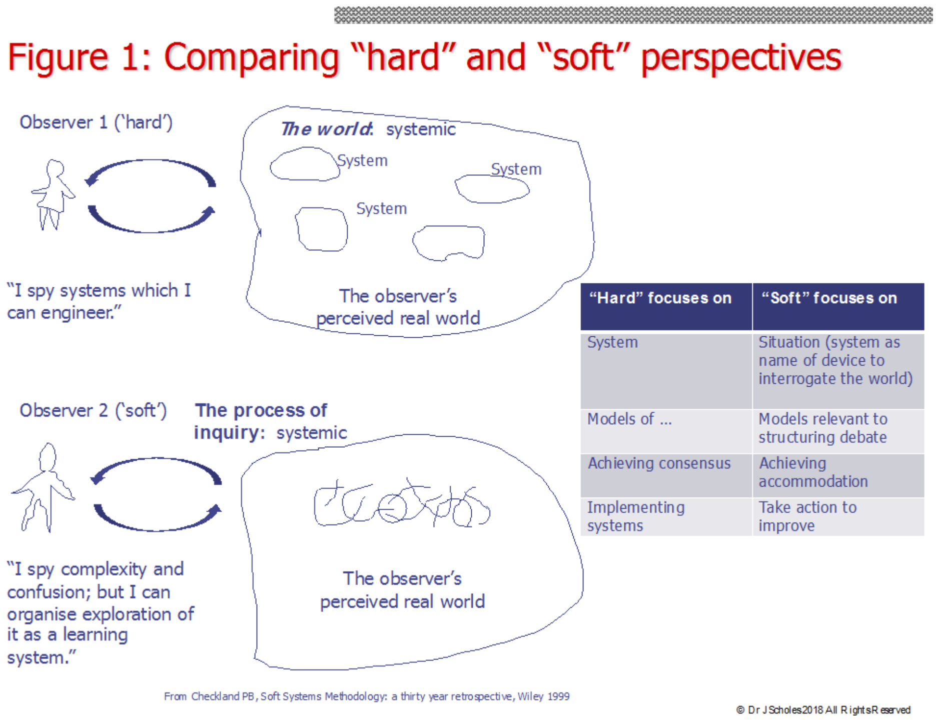

Fig. 1 **Comparing "hard" and "soft" perspectives**

Source:

Just as "hard" and "soft" can be problematic labels, so is the word "system". Some of the difficulty arises because of imprecision in language. In English the word "System" is in common usage but can actually mean many different things to different people. Some "systems" are indeed very tangible; designed and engineered as "hard". For example, the technology used to write this "paper" is delivered courtesy of the efforts of those who designed and engineered the technology I have used (even though at the time of writing no paper has actually been used in the process!). But the concept of "system" can also be a very useful construct to help systems thinkers better understand things that aren't and can't be human engineered (for example, the solar "system"). In such cases, the value of systems thinking is at a conceptual level and we can choose to use this repertoire of systems ideas to help us better understand whatever we have chosen to study; ranging from the human body to the world we live in and all forms of human activity "systems" in between. This differentiation between things that we can design and operate as systems and those things that we can choose to view using systems ideas is crucially important in considering how and when to intervene in real world problem situations.

The SSM process

In describing the SSM process rather than as a sequential series of steps that must be followed I'm seeking to give some sense of how SSM has evolved over time, based on its practical application; and to differentiate clearly between method as a systematic procedure or technique which may be used for dealing with particular problem types in a particular way to achieve a predictable outcome; and methodology as an organized set of principles based on systems thinking used to guide a process of enquiry and the outcomes it may achieve. This essential distinction is something I learned when I first became involved with Lancaster's ongoing research programme in 1981, initially as a client and would-be-problem-solver working with the Peter Checkland and the Lancaster team using SSM.

Between the early 1970s and the 1980s SSM had been developed through practical application of systems ideas, to situations perceived as problematic, in a variety of organizational contexts. The body of experience accumulated through this action research programme contributed to more precise definition of Soft Systems Methodology. Unsurprisingly, given its roots in Systems Engineering, SSM was characterized as a simple 7 stage model with some important constituent parts such as "rich pictures", models of human activity "systems" and so forth. This level of description was important in capturing and sharing the essence of what had emerged from the research up to that point. This sharing of SSM and the lessons on which it had been built generated considerable interest amongst systems thinkers and, when adopted and replicated, proved to be a convenient and often insightful way of conducting projects leading to real-world improvements; and for capturing lessons from such interventions . Such is the succinct beauty and simplicity of this description of SSM that many have taken it to be a prescriptive "method" rather than "methodology" and seem to see it as ***the*** definition of SSM rather than a description of its emerging form at a point in time. This 7-stage model and its constituents remains powerful and useful for some purposes but SSM has continued to develop beyond it. As mentioned earlier, this is a point not always appreciated in the secondary literature.

So, let's consider the SSM process and what that means. Entering real-world organizations as systems thinkers and would-be-problem-solvers we encounter busy people engaged in activities we might assume to be purposeful. But what we often find as consultants and "outsiders" is that there is only a limited agreement at the most basic level about objectives and actions; and, even then, there may or may not be the organizational capabilities needed to deliver on those objectives. As a brief and simplified illustration consider, for example, how the SSM process might be used in seeking improvements within the UK prison "system" (figure 2). In the UK many people would see prisons as a system to punish criminals; others see prisons primarily as a system to protect society; those more liberal in outlook might see prisons as a system to re-educate offenders; and the more cynical might feel that prisons have actually become universities of crime (though not necessarily by design!). Each of these perspectives could be modelled as a conceptual "human activity system" and each model would be very different. The value is not that these models represent designed systems to be implemented, it is that they can be used to facilitate dialogue amongst stakeholders with different perspectives in order to find improvements that can be made in practice. They are of course conceptual models rather than designs of a real-world system.

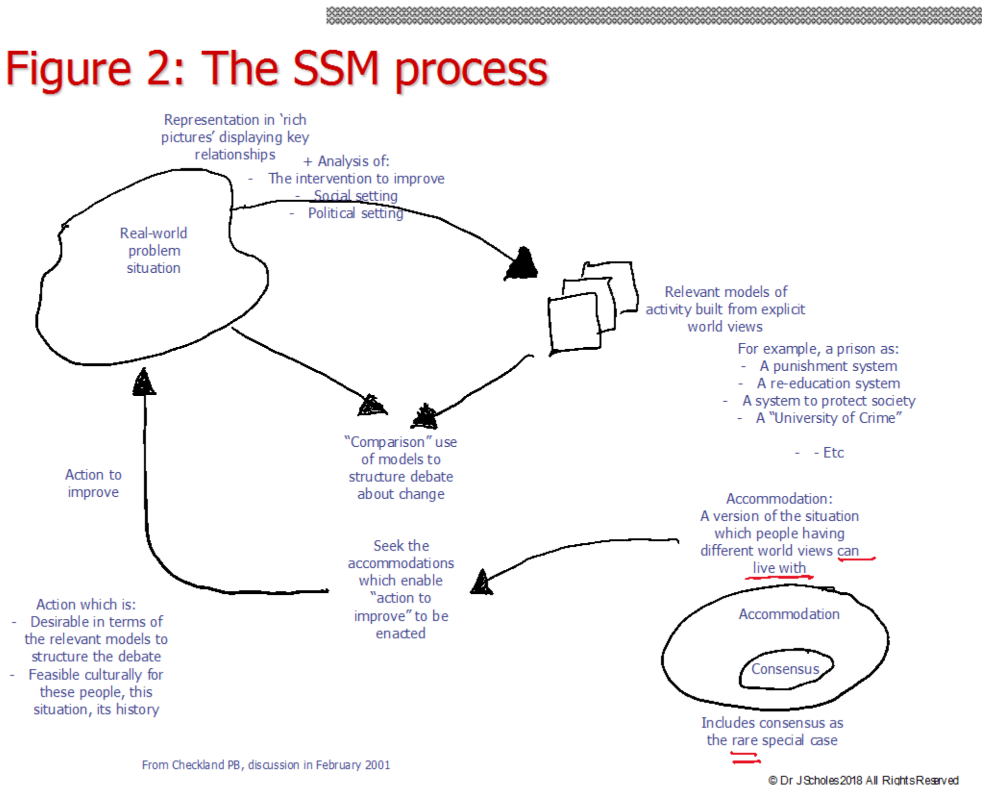

Fig. 2 **The SSM process**

Though very much simplified, this illustrative example encapsulates the kind of dilemma often encountered when studying activities and choices in any large organization or project. People aren't automatons and always have their own unstated beliefs and opinions about what's and how's in the workplace. When human beings are involved in any kind of enterprise their daily efforts rarely, if ever, add up to proceeding en masse as directed by some grand design or plan. The conceptual model of a "human activity system" can be an important contribution to help structure a debate about change in the world; but it is not a designed "system" to be implemented in the real-world. Unlike, say, a fully automated production line.

So, SSM can be described as an organized process of enquiry which leads to a choice of purposeful action. Conceptual models of human activity systems that are relevant to developing understanding and potential action, and which represent specific points of view, provide a basis for comparison with what actually happens in the real-world which in turn helps in structuring a dialogue about possible actions to improve the situation regarded as problematic. And every application of SSM creates an opportunity to contribute to its ongoing development.

An illustrative application of SSM in a commercial enterprise

As a consultant I've had opportunity to work with large companies in a broad range of industry sectors and geographies. Common, problematic, themes across these client organizations have included issues of leadership, strategy, growth and organizational change. A recent example was in a Branded Petcare company facing increasing pressure on margins and slowing volume growth in its large European business. The newly appointed Head of the European business sought consulting support and I led a small team that used SSM to help design and implement an initiative bringing together over 60 managers from HQ functions and country operations across Europe in a process of strategy "co-creation". For just over 4 months the managers worked together on the project through a series of facilitated workshops to develop a shared understanding of the challenges facing the business; identify growth options; agree strategic direction; and then implement country-specific plans. The initiative helped managers re-shape their business by enabling them to step outside of the day to day flux of maintaining business as usual and take a fresh look at the potential for beneficial changes to the overall business model. Figure 3 illustrates the notion of simply using SSM to "do" the project compared with using SSM in order to make sense of a problematic situation, learning and adapting as necessary in order to move towards an agreed beneficial outcome as in this case.

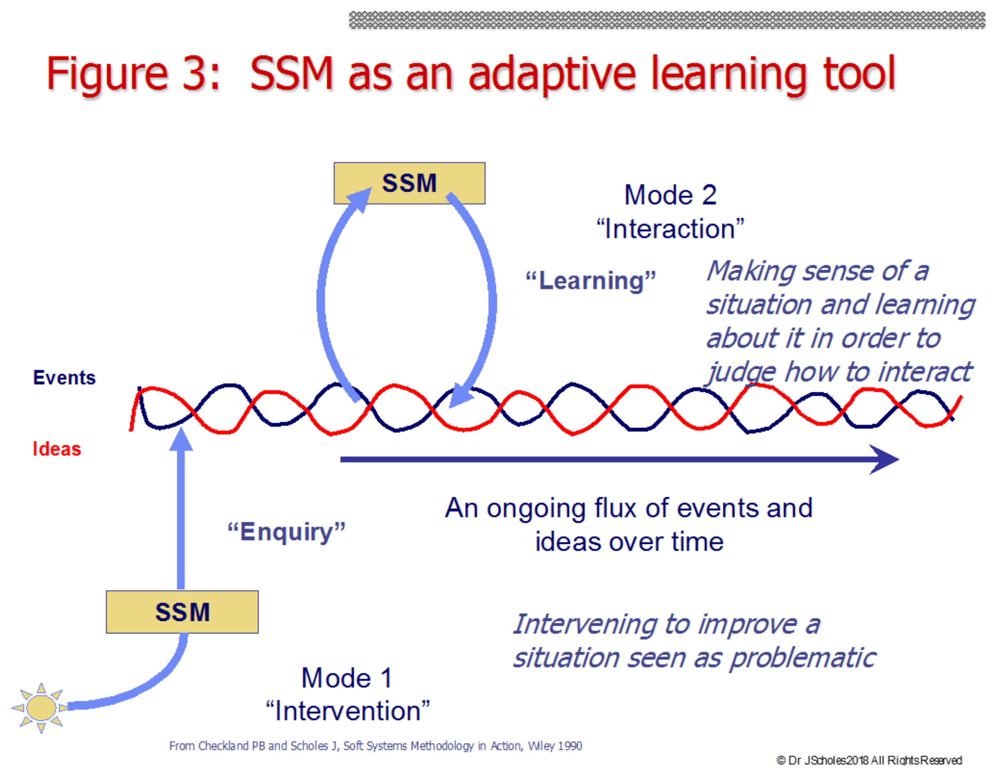

Fig. 3 **SSM as an adaptive learning tool**

For example, they looked afresh at the relationship between owners and their pets and this helped them to "re-define" their concept of the business in a way that was significantly different from their previous model and from their competitors. This approach to strategy co-creation across a disparate business was developed using Soft Systems Methodology (SSM) as a diagnostic, design and learning tool at three distinct levels: the overall project initiative; within and between the workshops that were at the core of the project design; and as a tool to support dialogue between the participants and the Executive Leadership Team that had responsibility for resource allocation decisions to support implementation of the strategy that they collectively created. The outcome of their efforts resulted in significant improvement in sales growth and profits and based on the success achieved in Europe, their approach was adopted worldwide.

Conclusion

Soft Systems Methodology can help systems thinkers dealing with difficult-to-define, messy, sometimes "wicked", problem situations in the real world. SSM can support such practitioners at several levels, for example: getting beyond overly simplistic definitions of "the problem" which, in reality, are only based on individual assertions, and which even if "solved" would be unlikely to achieve any meaningful improvement; helping to build a shared appreciation and constructive dialogue amongst stakeholders using models of human activity systems to better understand the overall context of the problem situation; and helping to make explicit the different worldviews or Weltanschauungen that inform existing assumptions about the nature of the "problem" and possibilities for improvement.

Soft Systems Methodology continues to be developed through application in real-world problem situations and lessons learned through use. Recognising this, a challenge for would-be practitioners is perhaps to appreciate that a once and for all "final" description of SSM will always be elusive. Rather than agonize on this it is better to engage in using the methodology as is, recognizing that it is an ongoing process founded on a set of principles which will continue to evolve through practice and learning.

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JEL D83

GROUP MODELLING AS A TOOL FOR ORGANIZING COLLABORATIVE ACTIVITY OF A GROUP OF STAKEHOLDERS

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Abstract

Purpose. The presented brief overview of methods of collaborative modelling is aimed at demonstrating the advantages of its application in the management of socio-economic systems as well as filling the shortage of publications on this topic in the native scientific and business spheres. The involvement of stakeholders in the management of the socio-economic system is considered as a positive process. However, a very complicated aggregate of communication and coordination problems caused by differences in aims, values, experience and knowledge occurs in the process of organization of collaborative activity of the stakeholders. Collaborative modelling is viewed as a powerful tool which allows the stakeholders to expand their knowledge and understanding of the system and build up communication processes.

Methods. On the basis of the analysis of publications in which theoretical and methodological approaches to working out methods of collaborative modelling were reflected as well as practical experience of their application, an attempt has been made to identify the main problems of application and put forward perspectives of further development.

Perspectives. The experience of applying some methods of collaborative modeling in different areas has allowed to identify some tasks for further research: the development of methods in terms of raising their effectiveness without affecting the quality of the produced models, ways of forming and the optimal size of a groups of stakeholders, approaches to evaluation of the designed models from the point of view of the participants.

Keywords: systems modelling, collaborative modelling, group modelling, conceptual modelling.

Introduction

In the modern world organizations come across such complicated problems and tasks that no one possesses information, knowledge or experience for solving them. Due to this the role of collaborative managerial activity is growing and the group of shareholders is becoming the subject of management. During collaborative activities of the group arises a number of complicated communicative, coordinating and positions negotiating tasks as differences in purposes, values, organizational culture, functional experience, knowledge, managing styles sufficiently influence the productivity and results of the group work. On the one hand, the effectiveness of collaborative work depends on the social relations between the stakeholders, their ability to communicate and exchange information and knowledge. On the other hand, there exists an obvious necessity of special tools for organizing and supporting group processes and interaction. Methods of collaborative modelling are considered to be the above mentioned tools. During recent decades certain progress in their design and development has been achieved and some experience in their practical application has been gained.

Collaborative modelling as part of applied scientific research had been developing within recent decades whereas the practice of building group models refers back to the second half of 1970-ies, when system analysts in the area of system dynamics started to engage clients for the modelling process. Since that time there have been worked out several approaches to involve stakeholders to modelling in the framework of different schools. Different groups of researchers were simultaneously working out and applying methodologies based on the same basic principles but aimed at different parts of the process.

Types of collaborative modelling

Collaborative modelling is defined as "the joint creation of a shared graphical representation of a system" [1, p.249]. An indispensable part of the collaborative modelling process is the exchange of opinions between the participants. From this aspect the model is considered as a way to identify, reflect and present different points of view, judgments and assumptions of the group members. For creating a common image of a system as opposed to the individual one it is necessary to form shared understanding of the elements and their interrelation in the model. The shared understanding can be defined as "the overlap of understanding and concepts among group members" [2, p.36]. For collaborative modelling shared understanding is seen as "the extent to which specific knowledge among group members of concepts representing system elements and their relations overlaps" [1, p.249]. For creating overlap of knowledge the participants not only need to exchange information about the elements of the model and their interrelation but also to form a shared meaning of these elements and their interrelation. The formation of shared meaning is usually viewed from the point of view of sensemaking, understood as "the ongoing retrospective development of plausible images that rationalize what people are doing" [3, p.409]. Sensemaking normally requires some development of shared meaning of concepts, terms and notions and presupposes forming of common understanding of the context in which the model is designed from the point of view of all stakeholders.

For organizing the processes of interaction in the group of stakeholders as well as for creating shared understanding and a system model there has been developed a number of methods and tools for collaborative modeling.

Problem Structuring Methods, **PSMs** cover a wide spectrum of methods and tools worked out mainly in the UK for overcoming situations characterized by complexity, vagueness and controversion [4]. In this case the models are viewed as tools for learning [5] at the stage of strategic decision making and problem solving. Among the most successful and considerably widespread methodologies there could be highlighted the Soft Systems Methodology (SSM), Strategic Choice Approach (SCA), Strategic Options Development and Analysis (SODA).

Group Model Building was created in the Netherlands and then widely used by Decision Techtronics Group (DTG) (Albany, New York) [6] mainly in the sphere of business applications. This direction uses the models of system dynamics and allows to expand the conceptual model up to the simulation model for studying different strategic options. Modelling is considered as a process of forming mutual understanding, defining terms and notions and experience exchange.

Mediated Modelling (MM) is a trade mark which was introduced by M. van den Belt [7] and is usually using the models of system dynamics. As could be seen from its name, MM is mainly focused on the conflict processing tasks through mediation and working out mutually accepted points of view.

Companion Modelling (CM) is a brand introduced in the middle of 1990-ies by the researchers from CIRAD (France).The method represents a combination of agent based models and role-playing games and is based on three basic principles: creating the model by the stakeholders, transparency of the process and the adaptability of the process. The model is being transformed alongside with changing the understanding of problems in the process of research.

Enterprise Analysis. Modelling analysis at Arizona University includes both working out programming tools and designing methods of supporting collaborative activities. Models are mainly based on the IDEF0 standard [8]. As a rule the initial model is created at a collaborative working session of stakeholders. Then the group is subdivided into subgroups for detailed work on those parts of the model which match the expertise of certain subgroups.

Apart from the above mentioned directions comes across a term “participatory modelling” which is referred to as a general term with no connectionto any of the particular directions. In some recent publications, however, collaborative modelling is viewed as one of the multiple component parts of the participatory modelling, with the differentiation being made depending on the level of involvement of the stakeholders [9]. Thus, a high level of involvement is typical for collaborative modelling (e.g. at making collaborative decisions, designing.) Opposed to that, participatory modelling is done for a wider spectrum and could involve much lower levels of involvement: from discussion to consultations and information exchange.

Collaborative modelling is usually used for supporting the decision making processes and working out strategies and is aimed at 1) spreading knowledge and forming the shared understanding of the system and its dynamics in various conditions; (2) identifying and justifying consequences of the solution of the problem under consideration.

The following ways of involvement of the stakeholders could be identified there: passive involvement or participation which is aimed at informing people; eliciting of information, data for researchers and system analysts; participation in the process of supporting collaborative decision making; interactive participation when stakeholders are using diagnostic and analytical methods and tools; self-organization during which some participation process learning turns into decisions made directly by stakeholders [10-11].

A collaborative model has got a double identity. On the one hand, at some stages of the collaborative modeling process the model is viewed by the group of stakeholders as a micro-world, a supposedly realistic image of the object under research [12]. At other stages of the modeling process the model serves as a socially constructed artifact aimed at assisting management teams to form shared understanding The latter type of a model is the closest to the representation of the models in PSMs as transitional objects, referred to as a basis for social interaction (communication, negotiations, discussions) [13-14].

DISCUSSION AND CONCLUSIONS

It’s common knowledge that active participation of the stakeholders in the modeling processes allows to create better quality models of complicated systems. However the participation of stakeholders in collaborative modeling causes a number of problems. For solving all the problems it is necessary to get a deeper understanding of different techniques and methods of collaborative modeling.

The achieved results of applied use of different methods of collaborative modeling allow to pick up a number of interesting possibilities for further research. Collaborative modeling is very time-consuming and requires a lot of expenses. The above facts require working out and developing some ways of raising the collaborative modeling methods effectiveness without damaging the quality of the model which is being created.

Involving stakeholders who possess different knowledge and experience booster the creation of more comprehensive and accurate models, but at the same time it makes it more likely that the conflict between the parties arises due to different points of view and knowledge. As a rule, in small groups the effectiveness of modeling and parties involvement is higher, and it is easier to form shared understanding.

Another important direction is the choice of the starting point for the modeling task. The use of a preliminary model created by an expert or an analyst outside the group process might accelerate the process and identify critical topics for discussion. However, it might also cause rejection from the participants’ side and a refusal to continue the process.

A possible solution of this problem could be found in the parallel process of creation of submodels in subgroups followed by the collaborative group work to get the created submodels integrated and converged. At this point strict syntactic rules are needed to achieve common understanding.

It looks like the results of collaborative modeling activities are only restrictedly studied.The majority of articles cover the quality and complexity of the created models from the experts' points of view. The development of approaches to the evaluation of the models constructed by the participants is one of the most promising and complex tasks of further research.

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JEL D87

ON THE PERSPECTIVES OF «UNION OF ECONOMICS WITH BRAIN SCIENCE»

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Abstract. The modern economy is characterized by a high level of uncertainty. Under these conditions, the use of complex mathematical algorithms for enterprise management is problematic. Therefore, it is proposed to use control algorithms that are based on the simulation of the logic of the human brain. This idea was prompted by the Nobel laureate R. Schiller. On the other hand, this is even more necessary because of the current state of economic science, which mainly represents the mainstream trends. This conclusion is confirmed by the themes of the works that were awarded with the Nobel prize in Economics for the last 50 years. The part of conceptual component of these works was significantly reduced in recent years. For comparison, K. Marx's teaching, set out in his work «Capital», was chosen as an example of a conceptual approach. In order to correct this asymmetry, it is necessary to direct the vector of economic science in the direction of conceptual research. This difficult task requires more active use of computer algorithms and programs. As a result, there is a need to develop algorithms for the brain functioning model in terms of generating new knowledge and management decisions under conditions of strong uncertainty, i.e. cognitive methods and technologies of a new type.

Keywords: cognitive technology; thinking; truth; knowledge; information; brain.

The modern economy is on the way of intensive innovative development and this cannot but affect the need to develop new methods of management. This need is determined by the high systemic complexity of the economy due to the impact on the economic system of various kinds of uncertainty factors.

These factors have a very diverse nature: global economic crises, political decisions, legislative acts of the government, incompetence of managers, the level of competition, uneven development by region, industry, high rate of renewal and expansion of the range and volume of production, natural disasters, etc.

To date, a very significant Arsenal of mathematical methods and models for solving control problems under uncertainty has accumulated.

These tasks can be divided into two large groups.

In the first group, the problem of reducing uncertainty is posed and solved directly through the identification of uncertainty parameters. And then the problem of minimizing the risks in the presence of these parameters is solved.

The second group is related to the development of management methods applicable to any significant and unpredictable uncertainties. These methods should be equally successful in dealing with any uncertainties. They can be realized only on the basis of imitation of thought processes and those laws and principles which exist in a human brain. The brain is not only a flexible management tool, but it is also the only generator of new knowledge (NZ).

In the context of modern scientific and technological progress, the role of NP increases as the main factor in the development and modernization of the economy. Knowledge is considered as a resource for solving and maintaining management tasks. In this regard, modern concepts of economic management are purposefully focused on the use of algorithms for generating NC in a new quality – in algorithms for the formation of management decisions. They should manage the development, absorption, creation, use and diffusion of innovation.

It follows that the process of generating management decisions is inseparable from the processes of human thinking that generate, form and use this knowledge. Here exactly belongs the main logical link of the proposed new approach to the management of economic, on the basis of which the application of cognitive methods and technologies (CMT) is justified.

A key feature of such CMTs is that they use not so much the knowledge itself as such a property of knowledge as truth. Thus it turns out that the truth governs the economy.

However, the importance of cognitive technologies is not limited to this aspect. The proposed approach to the creation of CMT on this basis also has such a unique ability to harmonize the fractal principle of financial and economic indicators of managed economic objects. And this property is generally beyond consideration in the existing concepts of management systems of innovative development. When using CMT based on the logic of human thinking, it «chooses» a special mode, characterized by the presence in the control decisions of - as it turned out - fractal structure.

This CMT algorithm provides two essential properties:

1) in accordance with the fractal structure, financial and economic indicators of the managed innovation economic system (prices, asset structure, borrowed funds, wages, revenue, etc.) are formed.);

2) fractal structure tends to spread to managed economic systems of any level, regardless of industry and scale of activity (enterprise, industry, state, transnational Corporation, stock and financial markets, etc.).

The need for this type of CMT is long overdue. As the Nobel laureate Professor R. Schiller rightly noted [1], «... Another equally important thing is the urgent need to combine the economy with the brain science. People are now studying how the structure of the brain and mechanisms of its activity affect economic activity. In the future, their discoveries should be applied in the sphere of economic policy».

Therefore, the search for traces and consequences of the processes of direct «unification of the economy with the science of the brain» should be recognized as an extremely promising direction.

In principle, this production is not new. This kind of research has been conducted for a long time and its results are published periodically. But true to form. in all known works, which examine the impact of mental abilities of the brain on the economy, the brain is considered as a super-powerful multifunctional computer, which is configured to receive huge flows of information from the outside and effective and universal processing [2]. And it is in this that the limitations of most of the works are manifested.

Brain activity is not limited to the perception of knowledge and information from the outside, their processing and generation of new knowledge and information. It is the brain in an effort to maximize the truth of knowledge about the studied objects that has the above unique additional ability to structure new knowledge on the basis of such a worldview essence as truth. This property is little studied by modern science and therefore it is even more beyond consideration in the existing concepts of innovation management.

The economic system in this case is presented in the form of some structure evolving in the conditions of market competition. Here, many, including the most important and significant processes are determined directly by the peculiarities of the logic of the brain functioning. It is no exaggeration to say that the patterns of behavior that are present in economic processes – is an integral result of both the action of economic laws and the parameters of thinking of the totality of all people involved in these processes.

There is another circumstance that requires the study of CMT.

Abstract review of publications in the field of economic achievements of recent years showed that economic science is gradually losing its generalizing essence and is becoming more like a set of techniques. And it is correct, but partially. Due to this transformation, the detailed studies, their depth and diversification are acquired. The growth of depth and detail in economic research is accompanied by the loss of qualitative universal generalization and integration of all aspects of economic processes into a single coherent theory.

At the same time, economic theories of such an integrating generalizing approach exist, and K. Marx's teaching set out in his main work – Capital, can serve as an outstanding example here. Let us consider in more detail the difference between «Capital» and modern trends and concepts.

Marxism, as a doctrine, has the famous «three sources and three components»: English political economy, French philosophy and German dialectics. This creates a serious methodological and philosophical Foundation for the whole theory of Marxism. The modern mainstream does not have such a Foundation. This gave Marxism the highest level of credibility that modern economic concepts lack,

Let us consider from this perspective the works, which authors were awarded with the Nobel prize in Economics. The list of those is available on the Internet [3].

It is known that the Nobel prize in Economics, since 1969 to the present time, were awarded to 78 laureates. These examples are quite representative in order to identify the familiar trend in the dynamics of the winners ' topics. This trend is the transition from major theoretical problems of a global nature to more private works, but nevertheless less significant theoretically. This does not detract from their correctness, relevance and necessity, but their generalizing level is much lower.

This trend was noted by the Nobel prize winner in 1973 V. Leontiev: «... the continuation of the activities of the Nobel Committee is problematic. I think that even now his attention is gradually shifting from theoretical economists to institutional economists. And now there is a problem, because in concrete economic researches it is possible, at least, to speak about some hierarchy, and also large steps forward, breakthroughs whereas in institutional school I really do not see any large breakthroughs» [4].

We see that in these works, in particular, system-wide principles and approaches have been removed or replaced. In this regard, it would be methodically correct to return these principles to the practice of research.

Thus, there is a need for the «scientific economic pendulum» to swing in the other direction, i.e. to direct all the power of CMT towards the development of the «lagging» theoretical generalizing component. In other words, use CMT to generate new theoretical knowledge.

And there is confidence that in this direction we should look for a way to «combine the economy with the brain science».

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UDC 519.86(043.2)
JEL C6

EMOTIONS IN DECISION-MAKING WITHIN SIMULATION MODELING

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Abstract. Emotional agent behavior simulation in general, and decision-making of the emotional agent simulation, in particular, is linked to rapprochement of science of psychology and computer modeling. Psychological theories form the foundation for computational models. The main assumption is that the emotional agent thinks more effectively. The majority of results are problem-oriented and don't turn the researcher back to the emotion theory used as the basis.
Emotion-based model for decision-making in an emergency situation is considered in the Netlogo software.

Keywords: emotion, simulation, decision making

Introduction. The paper considers the emotional agent as an autonomous agent of agent-based modeling (a type of simulation modeling), that is provided with one emotion/emotions. Simulating behavior of an emotional agent in general and modeling a decision-making process of an emotional agent in particular are closely related to the current state of psychology and computer simulation being interconnected. On the one hand, findings of the research with an emotional agent where computational models are based on various psychological theories are specific and more credible. The main assumption is that an emotional agent thinks more effectively. On the other hand, all the results are problem-oriented and at this point they do not refer to the emotion theory that is used as a basis here. Some models are focused on cause factors of an emotion with the collection of information and expression of the emotion itself (Bickmore & Picard, 2005; Breazeal, 2003; Fong, Nourbakhsh, & Dautenhahn, 2003; Hudlicka, 2003; Paiva, 2000), others pay attention to measuring the effects of introducing these agents into specific areas, such as games and training (Graesser et al, 2005; Rickel & Johnson, 1997, Elliott, Rickel, &Lester, 1999). Few computational models address simulation of effects of emotions, emotional influence on cognition (Broekens, Kosters, & Verbeek, 2007; Canamero, 2000; Gadanho, 2003; Hudlicka, 2005; Marinier III, Laird, &Lewis, 2009; Velasquez, 1998), uniting emotional states of a thinking agent (Coddington & Luck, 2003; Meyer, 2006; Steunebrink et al, 2008) and models of emotions studying interaction between a simple agent and its environment (Canamero, 2000; Leinstein, 2005; Velasquez, 1998). Poor feedback to psychology, absence of citations of leading psychological publications to simulation modeling of emotions generate a hypothesis of the more complex and yet not studied relation. The key to this relation involves the understanding that computational modeling of an emotional agent is not enough, but it is necessary. Simulation modeling is a good method of study: it not only shows the relation between objects, but also states a probable explanation of the reason for this relation.

A theoretical framework of the concept of emotions. Affect (as a response to stimulus) refers to the main core of an emotion, mood or emotional attitude towards people and things. An emotion, mood and emotional attitude differ from each other, but they are interconnected and influence each other. An emotion is related to facial expression, feeling, cognition, physiological change and alertness. It refers to a short, but intensive episode that has some cause. A mood stands for calm presence of affect at moderate levels and is not attached to any cause. Emotional attitude refers to the way how a person usually feels towards something or someone. Emotions are studied at various levels, such as the social, psychological, biological and physiological ones. They are defined by the constituents that form them and by the key factors. For instance, P. Ekman introduced well-known emotions, the basic ones of which are fear, anger, happiness, etc. Russell suggests that emotions should be described using two continuous factors – pleasure and arousal. Majority of researchers believe that there are two common emotional factors that are useful in describing a mood, emotion and/or attitude: valence and arousal. They also support the idea that an emotion is a result of evaluating a situation from the personal perspective. This ‘simple’ definition goes hand in hand with the ‘complex’ one based on a phenomenological structure and relation to neurobiological mechanisms. Describing phenomenological content includes the following: emotional associations; describing pleasure and intensity of arousal within an emotional period; dominance ratio between people or social context of an emotion; evaluation, including cause events, contributing goal, novelty and matching standards; judgmental details between various forms of an emotion.

Scope of simulation modeling. The first type of models may be considered as models of neurobiological mechanisms intended to study neural correlates of emotional experience. Such computational models may be used for modeling biologically possible neural networks, involved in an emotion. This type is based on biological and physiological constituents of an emotion. However, it is difficult to relate the findings to the phenomenological content of an emotion. The conceptual gap between physiological and neurological theories of emotions (the ones that are best suited for computational modeling) and the phenomenological description of an emotion is too large. The second approach describes content and experience of an emotion, but it cannot produce new predictions, as the mechanisms responsible for the content and the flow are not modeled. For example, one may simulate phenomenological content of an emotion using a network of sites, which are likely to be interconnected. Each site may include description of emotional content, and the edges define possible transitions. As a result, this network defines the flow of experiencing an emotion. Phenomenological content of an emotion may be predicted by the third type of simulation that consists of the mechanisms defined within a language, which is put between neural processes and phenomenology. All the models are based on the theory explaining collection of emotional information (such as evaluative theories). They also interpret findings of predictions in terms of phenomenological description of emotional experience with the possibility of verification within psychological experiments. The approach discussed above is implemented in the research of an emotional agent’s behavior in cases of emergency.

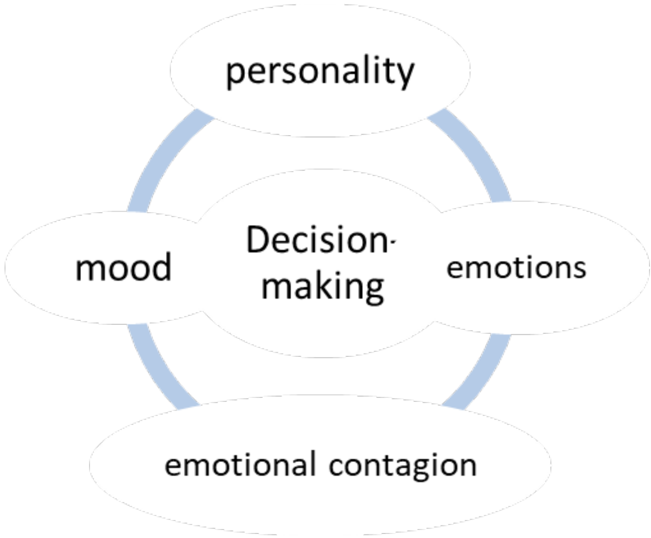

Fig. 1 **Emotional aspects of decision-making process**

Simulating emotional state transition. Emotional contagion is a strong stimulus for triggering a definite mood in a group of people in various situations. This mechanism can be both conscientious and unintentional. However, there are a great number of aspects still unstudied. The model of emotional contagion that takes into account automated process is known as *Primitive Emotional Contagion*. Each transmitter agent may influence emotionally a receiver of information. Emotional contagion implies the cause process of emotional contagion in groups: people constantly influence the others and are influenced by the others even intentionally.

Fundamental works by Hatfield [2] define emotional contagion as a tendency to automatic mimicry and synchronous expressions, vocalization, postures and movements following those of other people and leading to emotional convergence. Personal emotional experience is subject to influence, from one instant to another through activation and feedback. Barsade [3] studied two factors influencing the process of emotional contagion: emotional valence (positive and negative) and the energy of expressing this emotion. He hypothesizes that unpleasant emotions are more likely to lead to emotional contagion than the pleasant ones, and that emotional valence expressed with more energy results in more emotional cover. However, the findings show that people who possess less energy and experience unpleasant moods (depression, grief) are less subject to influence.

Emotions and decision-making. The fact of changes in behavior under the influence of emotions has introduced new ideas and decisions into decision support systems. Attempts to improve controllability and manageability in multi-agent systems make researchers introduce social function of emotions and subsequent interaction with social norms as leverage for team activity and cooperation. Simulating emergencies rests on the influence of emotions on crowd behavior. According to unemotional behavior, all agents in dangerous and extraordinary situations follow a specifically developed plan. Nevertheless, in real life, emotions prevail over the 'set' behavior. Thus, during evacuation, agents start feeling panic, lack direction, during street riots – experience fear or, vice versa, too much excitement. Such emotions may change perception and communication with other agents.

The model of civil violence in the course of direct confrontation based on simulation of participants' behavior. Each object is simulated as an autonomous agent making decisions, having a state defined by the variables of the state and behavior. The procedure assigned to the group of agents regulates the agent's behavior. Environment, neighboring agents, state and behavior of the agent generate a new state that is reviewed at each time step. Modeling is based on the model, developed by J. Epstein [6] for two types of agents who are members of different ethnic or social and economic groups. Most part of agents is situated in a two-dimensional lattice, one agent per each lattice site. The lattice is not fully 'populated' (its maximal level of occupation is less than 80 percent), vacant spots are necessary for agents to move. NetLogo Rebellion model is used as a starting point [7,8]. The ability to reproduce 'emergent behavior' that is hard to simulate analytically with stochastic nature of parameters, defines dynamics of the confrontation model. Epstein's civil violence model includes two types of agents: civilians (population with two states – active and neutral) and policemen ('cops') – forces of central authorities, whose purpose is to arrest active rebels. Civilians possess attributes of political discontent and risk aversion with values in the interval from (0,1). If risk aversion equals zero, a civilian is neutral towards risk. Before joining rebels, civilians estimate probability of being arrested: by means of matching the quantity of policemen to the number of active civilians within his/her own sight. The rule defining the agents' movement order: move in a randomly chosen direction within one's own sight. Civilians differ in a number of characteristics: endured privations, risk aversion, situational probability of arrest, limited rationality, presence of local interactions.

The paper studies the possibility of considering an emotional state based on the results of subjective evaluation and on adding one more feature to the agent 'civilians'. An emotional state of an agent depends on evaluating the 'pleasantness' of the event in relation to goals (love, hate), on evaluating approval of an agent's actions in regard to behavior standards (satisfaction, pity, hope, belief, disappointment, joy, sadness, etc.), and on evaluating sympathy towards the attitude of an agent (pride, admiration, shame, reproach) [5]. The state of an agent may be switched at every time step. Suppose

$$Em(i) = \left\{ \begin{matrix} joy(i, F(\varphi), int), distress(i, \neg F(\varphi), int), \\ relief\ (i, \neg F(\neg\varphi), int), \\ anger(i, j, F(\neg\varphi), int \end{matrix} \right\}$$

is a multitude of emotions, where, for instance, $joy(i, F(\varphi), int)$ means that agent *i* feels joy from achieving goal *F(φ)* at work, for example, from liquidating a policeman agent. Every emotion is associated with intensity *int* assigned in dependence to various situations in terms of the potential and threshold. Emotions have a short duration period, but they do not vanish instantly, having a delay period. The delay function may be defined differently. This paper uses the delay function introduced by Pickard in the form of the inverse exponential function: $Int(q, t, b) = \frac{q_i}{e^{-b \bullet t}}$, where q – initial intensity, t – time, b – constant for simulating different types of behavior. The logics of complicating the model lays in reviewing the procedures of agents' behavior: stating the 'rules of movement', agents' behavior: transition from the neutral state to the active one, calculation of delay probability. The main purpose is to test existing tendencies of understanding the decision-making process in cases of emergency.

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JEL: C02, C15, C5, C6

APPLYING EVOLUTIONARY-SIMULATION METHODOLOGY ISSUES IN MODELING OF LONG-TERM ECONOMIC DEVELOPMENT

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Abstract. The global economic crisis of 2008 has had a paralyzing effect on the world economic growth. It has reinforced research on the geopolitical and socio-economic forecasting. The new methodologies of long-term socio-economic simulating and forecasting have been proposed over the last ten years. However, the complexity of estimated model parameters has always been against them being used for analytical modelling. Simple and at the same time so efficient tool for analytical modelling is the use of The Evolutionary-Simulation Methodology (ESM), developed by Russian scientists – G.V.Ross and V.E.Lichtenstein. The approach suggested by the authors of the article makes it possible to apply world dynamics modelling with ESM.

Keywords: The Evolutionary-Simulation Methodology, Model-ling and Forecasting World Dynamics, Long-term Economic Development, The global economic crisis.

Over the past twenty years, we can see new pickup of activity in the field of mathematic modeling and forecasting of global and regional dynamics. This intensification relates to both global crisis (Asian financial crisis in 1997, the dot com bubble in 2000, The Global Financial Crisis of 2007) and to ecological, energy and demographic challenges. The objectives of the forecasting are ecology, demography, economics, scientific-and-technological advance and quality of life. The key parameters of the forecasting are the population size, the available resources, the level of technology. Typical forecast indicators are the Gross Domestic Product (GDP), population and labor force, capital investment, labor productivity and others. The forecast horizon can reach 30 – 50 years.

In the research [7] was identified the following leading direction of long-term forecasting. *The extrapolation method*. The method examines trends of the last period trends, and then extrapolates it to the future. Its field of application is short- and medium-term forecasting. *The expert evaluation method.* It is based on evaluations of experts in specific subject. Its field of application is short-, medium- and long-term forecasting. The Delphi and Foresight methods are applied to reach fully agreement of the expert community. *The integral macro forecasting* methodology is based on synthesis of Nikolai Kondratieff's theory and Wassily Leontief's Input-Output Analysis. The methodology was designed by Yuri Yakovets [3]. *The scenario method.* It is applied in long-term forecasting with a lack of appropriate data. Three scenarios are considered: optimistic, pessimistic and most likely. *Mathematical modelling.* In addition to produce the forecast it allows to decide the planning problem – development management according to the scenario obtained in the forecasting. The complex models are being developed by R&D teams or consulting centers (see, for example, the PwC report “The World in 2050. The Acceleration Shift of Global Power: Challenges and Opportunities”, [8] and the Goldman Sachs report “Dreaming with BRICs: The Path to 2050”, [9]). Economy of the U.S. has often been chosen as reference economy for comparison. The method relies on Solow's neoclassical model of long-term economic growth, which is based on a Cobb-Douglas production function:

$$Y(t) = A(t)K^{\alpha}(t)L^{1-\alpha}(t)$$

where $Y(t)$ – the current volume of the GDP; $K(t)$ – the current volume of the physical capital; $L(t)$ – the total employed in entire economy (the labor capital); $A(t)$ – the technological advances (the level of technological development).

According to the research [7] the new dynamic macro models are designed to address the combined effects of the equilibrium long-term growth and cyclical fluctuations round it, specified by supply-demand balance.

When making the forecasting calculations of economic growth and development it is generally considered as *the total factor productivity* (*TFP*) (TFP is named as "technological progress" by Solow). The growth of TFP leads to better standards of living and quality of life of the population. So-called R&D model is the most effective and promising model among existing models for TFP calculating. The improved R&D model was presented by Akaev et al. [1, 2, 5]. This model is taking into account the allowance per one R&D worker and skills of the labour force in addition to number of R&D workers, and number of workers in the economy as a whole.

In the situation of the lack of information there is a need to use special techniques of evaluation of expected GDP value and, first of all, analytical modelling method.

The advantage of this approach is the provision of brief research results and it is sufficiently flexible at a minimum of expenses. It is possible to change the factor composition, contents of the model, and the use of any evaluation techniques.

The main problem of applying analytical modelling method is that the forecast GDP values (the plan) estimated based on the model (as numerical characteristic in modelling model of economic growth) can have unacceptably high error, sometimes exceeding the evaluation itself. That is because the value of model's factors can be evaluated only approximately (using expert opinions), the factor error of estimation has been an exponential increase during the required plan calculation in accordance with formulas of the optimization model.

The Evolutionary-Simulation Methodology (ESM) allows to reduce uncertainty by one or two degrees at the expense of optimization.

It changes the whole situation and makes a theoretical economics an effective tool of business practice.

Let's consider an example of estimating of the general model for exponential growth (the Anchishkin model [5])

$$Y = Y_0 e^{q_0 t},$$

where Y_0 – the start value of GDP, q – growth indicator, t – time.

The evolutionary-simulation model of output of GDP on the base of the general model for exponential growth contains:

$$\bar{f} = q;$$

$$\bar{p} = Y_0, t;$$

$$Fa = IM_0(\bar{f}, \bar{p}) = Y_0 e^{qt};$$

$$R_1 = IM_1(PL, Fa, \bar{f}, \bar{p}) = PL - Fa;$$

$$R_2 = IM_2(PL, Fa, \bar{f}, \bar{p}) = Fa - PL;$$

where q – factor – a random values which are defined by interval values.

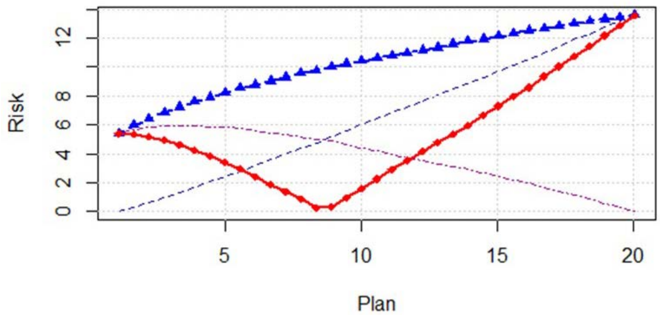
Y_0, t - indicators – conditionally constant values;

IM_0 – the simulation model that calculating of GDP output value.

IM_1 и IM_2 – the simulation models for costs calculations (the overstate plan costs and the understate plan costs are equivalent in proposed model).

Let's calculate equilibrium output value of the production by using the "Equilibrium" software in the R environment [4]. Load a package and define the evolutionary-simulation model. The model includes: *q*-factor; *Y*, *t* indicators; the overstating/understating calculation functions UZav и UZan; the overstating/understating cost calculation functions IZav и IZan:

```
library(esm)
model.Anchishkin <- setClass("Anchishkin",prototype = prototype(
    factors = list (#Случайные величины
      q=esm.factor(min=0.1, max=3, name="Показатель роста", dimension = "ед.")),
    indicators = list(#Условно постоянные величины
      Y=esm.indicator(value=1, name="Начальный объем выпуска национальной
продукции", dimension = "млрд.$"),
      t=esm.indicator(value=1, name="Время", dimension = "год")),
    UZav = function (df){ df["Y"]*exp(df["q"]*df["t"])},
    UZan = function (df){ df["Y"]*exp(df["q"]*df["t"])},
    IZav = function (df){ (df["PL"]-df["Fa1"])},
    IZan = function (df){ (df["Fa2"]-df["PL"])},
    name = "Anchishkin"),contains ="Model")
```




```
Model: Anchishkin(Anchishkin)
RESULTS OF OPTIMIZATION CALCULATION
 --- PLAN
                                     value
Optimum                             8.3595
Reliability for overstating         0.3014
Reliability for underestimation     0.3014
Overstating/Underreporting          2.3462

--- Co-distribution of factors and indicators
                                                        value
Fa1                                                     8.356
Fa2                                                     8.356
Показатель роста, ед.                                   2.123
Начальный объем выпуска национальной продукции, млрд.$  1
Время, Год                                              1
```

Fig. 1 **Graph and equilibrium values of risks**

The result of calculation of equilibrium value of production output and a risk chart (see figure 1) presents the planning production value ($8.3595 billion) which is attained minimum difference between overstating and understating risks.

The evolutionary-simulation model has reduced uncertainty to the range from $6 billion up to $13 billion (the interval in which difference of risks is less of both values).

The further use of the ESM could include scenario analysis of the impact to GDP of the value changes of the various factors and indicators (and their combinations).

The combination of ESM with dynamic macro model allows not only to get the forecast but also to consider the various risks of scenarios of socio-economic development for solving the development management problem.

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JEL C18

SYSTEM PHENOMENOLOGICAL MODELS IN ECONOMICS AS AN INSTRUMENT OF DECISION-MAKING

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Abstract. The purpose of the article is provided with creating a new decision-making method for the conditions of modern economy. For solving this problem, we offer to use the method of phenomenological models. The result of using this method is a model of managed economic system and its' external environment. This model is based on the positions of two theories. The first one is a system management, the second is provided with various styles of management. When the economic system is structured, we make its' phenomenological model which connects the indicators of resources' streams in the system and the parameters of changes created by a manager. In discussion, on the base of this model we account the preferable meanings of the parameters.

Keywords: organizational management; economic system; system management; management functions; decision-making; phenomenological modeling

Formation of an institutional economy requires new methods of management decisions making in economic systems at all levels (from the state management of national economy to individual enterprises and organizations). Nowadays in Russia at all levels of economy so-called "manual" management dominates. It means that for each specific problem a manager creates a decision based on his own subjective attitudes. But in the conditions of institutional economy, management should be institutional too [8]. Of course, it does not imply the complete elimination of subjective factors from management process. It is impossible, because every manager (unlike, for example, an engineer at the factory) leads the social system, where the central element is a human with intelligence and consciousness. But nevertheless, it is important to reduce the share of subjectivity in the decision-making process, since without it, Russian economy is doomed to further stagnation.

The present work is devoted to the new method of decision-making. This method considers the most valuable ideas formulated within individual managerial theories.

The most important among them are four theories:

- general theory of managing large complex systems (AA Bogdanov, N. Wiener, K. Shannon, S. Bir) [1];
- theory of behavioral economics (A. Tversky, D. Kahneman) [7];
- system management (J. Kornai, GB Kleiner) [9];
- theory of stylistic variability in organizational management (I. Adizes, GB Kleiner, I. Drohobytsky) [2, 6].

An analysis of modern approaches to understanding organizational management shows that in spite of all differences their common feature is that the basis of management is information. At the heart of each act of development, adoption and implementation of the management decision is the analysis by the manager of the initial information about the managed economic system (hereinafter - the ES) and its external environment and the synthesis of new information. In the framework of the general theory of the control of large systems, the law of information-order is formulated, according to which an increase in the amount of information in the system leads to an increase in the measure of its orderliness and a decrease in entropy. The decrease in the entropy of the system is accompanied by a change in the links of its elements with each other and with the external environment, and this leads to changes in the processes of exchange of material, energy and information resources between them. Hence the basic hypothesis is derived that every act of making, making and implementing a solution is a change in the resource exchange between elements within a managed system and with elements of its external environment.

On this hypothesis, two basic principles of this work are based, which introduce new into the process of studying and practical realization of organizational management of ES in comparison with existing approaches.

According to the first principle, the process of development, adoption and implementation of a decision in organizational management considers the changes that are taking place in it, not only in the managed ES, but in the entire economic system, including the ES and its external environment brevity, this concept is referred to simply as an "economic supersystem").

According to the second principle, the functioning of the economic supersystem is considered as a set of resource-exchange processes between its elements, the management decision as an act of changing these processes in the supersystem as a whole (and not only in the managed ES). The proposed principle provides a basis for assessing the correctness of the solution being developed, considering how the associated changes in the processes of return and the acquisition of resources of the managed ES correspond to similar indicators of other elements of the economic tax system of which it is a part.

On the basis of the stated principles of the author's research, the following results are obtained.

1. The approach to structuring of an economic supersystem in which the solution is developed and realization is offered. The idea of changing the resource exchange between the elements of the economic supersystem as the main result of the management decision was introduced to streamline the process of its development. To do this you must order firstly the elements of economic sustainability themselves, and secondly, the resource-exchange processes between them. And this must be done from the position of their connection with the outcome of the decision.

Based on the approach to the structuring of economic systems, developed within the framework of system management. He proposes to divide them into subsystems of 4 types depending on the space-time constraints. The approach assumes adaptation to the conditions of a specific task, on which the choice of criteria for space-time limitation depends.

For the economic supersystem, considered in this paper, the central element is the change in resource exchange resulting from the decision. Other elements should be grouped according to the space-time relations with it. But these connections cannot always be precisely defined. The basic premise of the study is the consideration of management as an information process. Therefore, it is proposed to consider the links of changing the resource exchange not with the elements themselves, but with the characteristics of the perception of information about them by the manager who develops the solution. The pendent economy distinguishes two characteristics of the perception of information: the degree of impact on the outcome of the solution (short-range interaction - directly, or long-range - indirectly) and representativeness (only for the current solution or for other similar solutions). These characteristics of information on the elements of economic super-systems correspond to the characteristics of physical space-time limitation, by which they can be grouped into four types of supersystems.

The second result is the classification of resource-exchange processes of the economic supersystem and the indicators characterizing it. In the first approach, the resource-exchange processes are divided into the primary transfer of resources (costs) and the response of receiving resources (winnings). This division is supplemented by representations of the theory of stylistic variability of management, according to which the main characteristics of ES are the ability to transmit and receive resources in the short-term and long-term perspective, these characteristics are associated with 4 basic managerial functions. It turns out the classification of 4 types of resource-exchange processes associated with these functions.

Resource-exchange processes of each of the 4 species are grouped, depending on the belonging of the elements of the economic supersystem connected to them to one of the 4 subsystems. As a result, the functioning of economic sustainability is considered as a set of 16 integrated resource-exchange processes.

This functioning continues until the moment of elaboration, adoption and implementation of the decision. The act of implementing the solution becomes a new element of the economic supersystem. The new element implements the same 4 resource-exchange processes as the existing subsystems. The indicators of resource exchange of the new element are quantitative characteristics of the changes implemented by the manager in the economic supersystem in the course of implementing the solution. Further they are called the sought-for indicators of resource exchange changes. These indicators should be calculated by the manager in the process of developing the solution.

The links between the indicators of resource exchange in subsystems and the sought-for indicators of resource exchange change show the transition of the economic system from one state to another in the process of developing, adopting and implementing a solution. Before the beginning of this process, the supersystem is characterized by a set of indicators of exchange with the designation (before the solution). Then the manager implements changes in the resource exchange, characterized by indicators with an index of changes. After the implementation of the solution, the indicators of resource exchange acquire new values.

Formally, the change in the indices of resource-exchange processes is represented in the form of a model where the expression of each of the sought indices of the change in resource exchange through 3 others transforms the description of exchange processes into a mathematical system of equations with four unknowns.

To solve the problem of developing a solution in the form it is proposed to use the toolkit of phenomenological modeling. Its result is a phenomenological model, the construction of which does not attempt to reveal the general laws governing the development of the modeled object, but only to generalize the phenomena associated with it for forecasting and changing its development on a short-term time interval [10]. The orientation of phenomenological modeling on forecasting and changing the development of modeled objects in the short term determines the choice of this type of modeling as the basis for the toolkit for developing operational solutions in the organizational management of the ES. A detailed description of the proposed methods is contained in the author's papers [3, 4, 5], where the general conclusion is drawn that phenomenological modeling is organically included in the general scheme for supporting decisions in organizational management

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УДК 007.3:004.942
JEL C65

MODEL OF FACET AND HIERARCHICAL PYRAMIDAL SYSTEM OF SUPPORT OF MANAGEMENT OF INFORMATION SPACE OF CORPORATION

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Abstract. Essentially new direction of modeling description of digital environment allows creating problems formalization of main components of modeling digital-economic component state corporations having in advance not predetermined structure of management. The main difference is ambiguity directions of movements of trade and economic relations, lack codifiers and qualifiers defining the potential economic, social, controlling, and monitoring relations. In these conditions classical representation forms of government does not allow to present completeness of information exchange fully. The model of system of support management digital environment of corporation allowing systematizing processes, to submit stream data in a uniform format is presented in the article.

Keywords: corporations, support of management, modeling, multisets, processes.

Introduction

Since 90th historically developed commodity-money relations are directly connected to the uniform digital environment. The economic development of interstate level connected to import and export of goods and services since the first stages used artificial substitutes of the national currencies allowing carrying out transactions without additional converting. There were as a result uniform digital platforms of coordination of information streams at the organization of transactions of any level. Further two main directions of development of the organizations entering the international market were defined: the corporations having real interstate objects and independent digital platforms of the world digital environment in a basis. The second type for the last ten years was widely adopted thanks to introduction of digital currency and also transformation mechanisms in national and back. Nevertheless, the first type is more important and interesting from the point of view of modeling as it has more difficult instruments of management and also play more important role in the world market.

As a result, there appeared the need of management of such corporations with no geographical, social and state binding behind, i.e. corporations of common digital space. The existing practice has shown that many organizations in these conditions use the actual lack of uniform sets of rules, the settled regulatory base, the unified mechanisms control and auditing structures, etc., capable to coordinate and control commodity and economic procedures of information exchange of both the natural and digital environment in the uniform environment of the economic relations. As a result this problem doesn't allow government institutions to gain natural internal income from turns of subordinates of the digitized organizations.

Process of modeling and formalization of the main processes and objects is an essential solution of the problem to solve. In work the example of process of formalization of the unified model of organizational processes of the information environment of corporations of different level and a profile including elements of control of the digital-economic relations is given.

At the first stage the model of formalization of the main processes of execution of transactions in the digital environment at expansion of sales market outside the Russian Federation is developed. Mechanisms are used to corporation of mining type that has allowed to improve efficiency of sales and also to organize export to neighboring countries with the smallest delays at the intermediate stages [1].

At the second stage the realized model received extension towards oil and gas branch. In case of accidents on large objects (for example, on the trunk pipeline) there was a problem of assessment of consequences of cross-border level. At the same time the mechanism allowing to define the unified system of payment of the stakeholders promoting further elimination of a problem and also prediction of costs of emergency recovery operations before complete elimination of consequences was necessary [2].

As a result, the received model including two systems of organizational management (pyramidal and matrix and hierarchical) has got formalization with use of algebraic submission of the theory of multisets on the main processes [3]. Use of facet model of data in the set restrictions became the following stage of the description of possible relations of not having accurately predetermined communications [4].

Modeling of processes of the digital-economic relations

The developed generalizing model of formalization of information streams of the relations represents synthesis of three main models of support of management (fig. 1) [5]:

- pyramidal, allowing to consider levels of management corporation of different level including tools of the carried-out tasks;
- hierarchical, the straight lines and the return target trees of the main performers of tasks allowing to form at different stages of life cycle;
- facet (matrix), allowing to introduce mechanisms of the digital relations without modification of the key main that promotes no violation of the settled commodity-money relations processes.

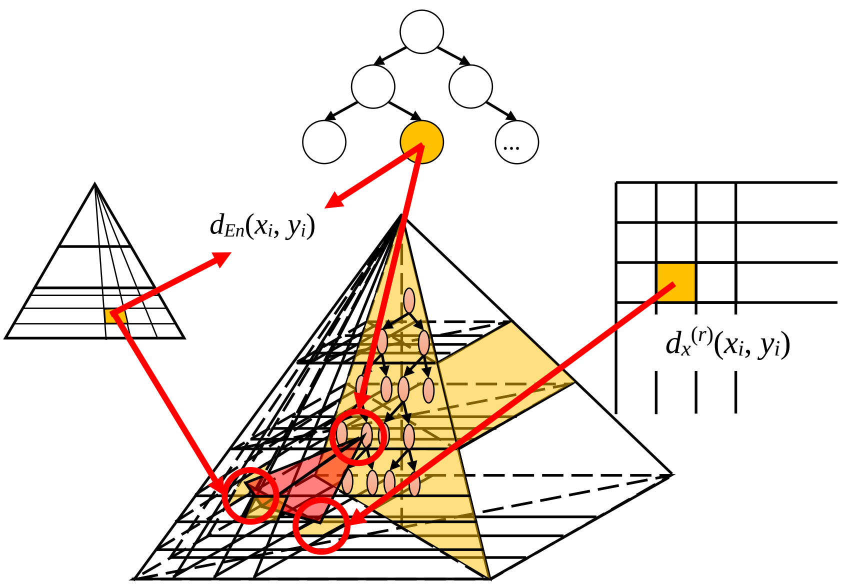

Fig. 1 **A general view of developed model**

As the systematizing model the mechanism of formalization I3-technology is used. Three independent variables (control objects of the commodity-money relations of a real and digital medium of dEn(xi, yi) and also participants of process of dx(r)(xi, yi)) are synthesized as the initial arguments of the general scenario rule of inequality of a triangle in an Euclidean space of En (according to Cauchy-Bunyakovsky's theorem) created directly on places:

(1) $$d_{En}(x_i,y_i)=\sqrt{\sum_i[(x_i-z_i)+(z_i-y_i)]^2}\leq\sqrt{\sum_i(x_i-z_i)^2}+\sqrt{\sum_i(z_i-y_i)^2}=d_{En}(x_i,z_i)+d_{En}(z_i,y_i).$$

(2) $$d_x^{(r)}(x_i,y_i)=\frac{d_x(x_i,y_i)}{d_x(x_i,y_i)+d_x(x_i,r_i)+d_x(r_i,y_i)}.$$

The alternative option of the monetary relation on *x* and/or *y* is chosen. By synthesis in two planes the vector is formed (*x*, *y*), the coefficient of *i* shows a serial combination for the chosen cell of a hierarchical tree of *z*. Compliance is defined by the choice of the player – the participant of process. As a result we receive a figure similar to a triangle which according to pyramidal system has to satisfy to inequality (1). Communication between two cash flows and an object over which operation is made is as a result received.

At the following stage the scenario on the basis of which the received operation can be executed has to be defined. By formation of hierarchical association (unary, binary – for simple operations and n-unary for participants, compound with a set) the line of base of associations is filled, the call of the corresponding scenario of the faset of base of rules is made (2). The received pyramidal system from three interconnected triangles also has to correspond to inequality (1). As a result, the received rule with the use of associations base receives the reference to a cell of the uniform base of rules of the corporation allowing executing the constructed rule with attraction of necessary resources (fig. 2).

At the final stage the coordinator of rules forms the application in a temporary zone, builds the return target tree of estimated result and the additional line of the field of a trend.

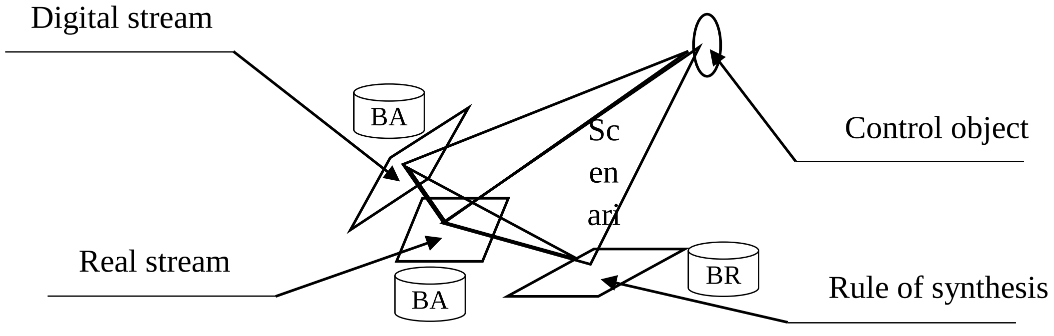

Fig. 1 **Graphical representation of process of use of the I³ mechanism**

Conclusion

At the moment, thanks to long-term practices and also practical experience in area of examinations of scenario development of business processes, the model allowing systematizing necessary for synthesis of the digital-economic relations with real processes of uniform commodity-money system is developed. The state corporations most relevant in the field in connection with new spirits of the times are obliged to conduct both interstate system, and in advance uncertain external, within flexible partner network. In these conditions, the offered model allows, without interfering with the main processes, to modify (to add, change, delete) a field of activity that allows to develop according to requirements of the competition.

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JEL C51

THE EFFECT OF EXPECED EVENTS ON THE RESULTS OF THE FORECASTS IN ECONOMIC AND MATHEMATICAL MODELS

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Abstract. The influence of the past on the current values of economic variables and parameters of econometric models is taken into account by introducing lag variables in the model. The influence of future random events in econometrics is taken into account in the models of adaptive and rational expectations, partial adjustment, which are also reduced to models with lag variables. Econometric models with lag variables are widely used to predict the dynamics of economic processes. The influence of past values of economic variables on their current and future States is explained both by the inertia of economic processes themselves and by the inertia of thinking of economic entities. At the same time, expectations of future changes in the economic situation cannot but affect the results of forecasting. Past and future are equal in their influence on economic processes. Expectations of future changes are also reflected in the statistics, which serve as the basis for the construction of econometric forecast models. Assuming that the expectations of future changes in the economic situation will remain the same as they were when sampling the statistical data used for the specification of the econometric model, the so-called f-lag variables are introduced, which, unlike lag variables, are one or more time intervals ahead of the current variables. Taking these expectations into account on the basis of introduction of f-lag (future values) variables in the model, as shown by the results of econometric modeling on several examples, significantly improve the statistical significance of the model and reduce the prediction error.

Keywords: econometric models, expectations, forecasting, f-lag variables

Forecasting the dynamics of economic processes is an important component of such science as econometrics. The importance of this task distinguishes econometrics among many Sciences, as it tries to look into the future and overcome uncertainty and chance, which are the fundamental properties of our world. However, despite the huge number of studies in this area, the use of increasingly complex mathematical models, big data and supercomputers, the methodological foundations of econometrics in recent decades have not undergone any significant changes. It is still based on classical (frequency) probability and mathematical statistics based on data from the past.

According to the classical definition, the probability of an event is equal to the ratio of the number of favorable outcomes to the total number of possible outcomes. However, in an economy it is impossible to determine the ratio of the number of favorable events that contribute to the emergence of any economic event, for example, an increase in the value of a financial instrument, to the total number of events. Therefore, the classical notion of probability of occurrence of economic events, so to speak, are not always applicable to the substantiation of economic-mathematical models. There are other concepts of probability than frequency, such as the subjective probability of Bayes, which is fully consistent with economic concepts. Nevertheless, it is the classical definition of probability that is mainly used in econometric modeling.

This fact, along with others, lead a number of researchers to the conclusion that econometrics without changing the basic paradigm, in principle, cannot solve the above problem. The most prominent and visionary economists have long criticized econometrics. The great American economist Keynes, well-known economists Warswick, Hendry, V.

Leontiev, representatives of the Austrian school of Economics criticized econometrics [1-4].

In his book "the Black Swan" N. N. Taleb [5] writes "Then I looked at all the scientific work and the dissertation which has managed to unearth. None of them has conclusive evidence that economists (as a community) are able to make predictions; and if they are sometimes able to, their predictions are only slightly better than random — serious decisions cannot be made on their basis."

However “if the stars are lit, it means that someone needs it", that is, despite all the difficulties and the lack of accurate knowledge, econometrics is in demand and has many useful achievements, as well as in something similar to it the science of meteorology. If we agree with Friedman's statement [6] that realism is not an end in itself in the economic model, the utility of the model is determined only by the degree of compliance of its conclusions with real observations. However, it cannot be denied that any economic process is subject to random events, so that simulation results always contain uncertainty and error.

Terminology and definitions of probability of occurrence of a random event, adopted in the theory of frequency probability, can be used in other, more adequate theories of probability of random events, including in the socio-economic sphere, but they need to give a different explanation and interpretation.

Various random events can also be combined into separate groups, such as expected random events and so-called "black swans".

The influence of "black swans", that is practically unpredictable future random events, on the results of mathematical modeling of economic processes, is not actually considered in economic theory and practice [5].

If we do not take into account the impact of natural random events on economic processes, perhaps with the exception of climate, the subjective probabilities of random events associated with human activity can be estimated within acceptable limits. This, in particular, is the basis of insurance activities. In this regard, a large role belongs to the expected random events, which from the point of view of economic entities can happen with one or another probability within certain limits. By anticipating changes in the economic situation in the light of their perceptions of the future, people are turning these expectations into a powerful factor influencing the course of events. Sometimes it comes to the fact that a different event occurs only because it is expected by the actors operating in the economy.

Some studies have identified three types of expectations: static, adaptive, and rational. The first are used mainly in Keynesian concepts, the second – in monetarist, the third – in neoclassical concepts [7,8,].

Static expectations mean that in the future economic actors are guided by the same parameters of the market that take place in the present.

Adaptive expectations correspond to the assumptions of economic entities about future changes in the parameters of the economic situation while maintaining its overall configuration, that is, the absence of its qualitative changes. Economic agents only adjust their behavior. Rational expectations assume that economic agents form their plans and build their behavior based on the analysis of all available information at the moment. Rational economic actors not only take into account the mistakes of past experience, but also look to the future. This allows them to anticipate future changes fairly accurately in the absence of unexpected shocks. For example, entities, when making their forecasts about the future price level in stock or commodity markets, do so in the same way as the market determines the actual prices.

Decisions about purchases or sales are made based on expectations of prices in the future, and these prices, in turn, depend on current decisions about purchases or sales. The situation is not so obvious when it comes to commodity markets, where supply is highly dependent on production and demand is dependent on consumption. But in the financial market the role of expectations is almost obvious.

Econometric models that meet these expectations are called partial adjustment, adaptive and rational expectations models. These models assume that the future values of the variables are linearly related to the past and present values of the variables. Ultimately, these models are reduced to models of autoregression with lag variables [9].

Taking into account the impact of possible future expected events on the explained characteristics of socio-economic processes is an actual direction of the study. The problem of accounting and evaluation of the probability of occurrence of a random event in the insurance business is particularly relevant.

In physical experiments it is possible not to take into account influence of future expected events, but in models of economic processes it leads to incorrect conclusions. Suppose that economic agents expect a stable economic situation in the future that is no different from the present. That is, we consider the situation with static expectations.

As an example, consider the event "buying shares in the financial market". The price of a share at which an investor wants or can buy it changes under the influence of events external or internal to it. These events can occur now, be in the past or relate to the future. For example, an investor makes a decision based on a mental and then a formal model. Then these assumptions about the future situation affect the characteristics of the model. Since everything is interconnected in the world, the events of the past, present and future form a graphical probabilistic model. As an example, such a graphical network model, which presents the characteristics of the share price-Y (endogenous variable) and the events affecting it – Xi(explaining variables) is shown in Fig. 1.

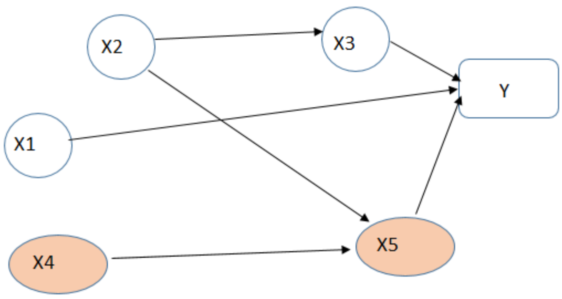

Fig. 1. **Multiple events and their cause-and-effect relationships**.

Here:X1, X2, X3 – events that have already occurred; X3, X4 – events that are likely to occur; Y-the resulting event (endogenous variable).

In the above diagram, past and future events are completely equal in terms of their impact on the explained variable. This, by the way, was understood by Einstein, who said that "for us, convinced physicists, the difference between the past, the present and the future is no more than an illusion, although it is very stable" [10].

In this example, we can obtain only probabilistic estimates of the simulation results, which, in turn, depend on the probabilistic characteristics of samples of past events and the probabilities of future (expected) events. Statistical data on past events (changes in factors X1, X2, X3) are samples on the basis of which the model parameters are estimated in classical econometrics (for example, using the least squares method).

Forecasting of the future on the basis of classical econometric models is based on statistical processing of data of past observations of values of economic variables and the assumption that the state of economic space does not change fundamentally. Currently, however, comes the understanding that the future influences the present-day realities and take economic and political decisions. This means that the assumption of a person or society about the future began to predetermine their current behavior. This point is key, because in this case not only the past determines the present, but also the future affects the present. Thus, in the econometric model in its generalized form there should be both variables related to the past and variables related to the future. We will call such variables f-lag [11,12]. The use of f-lag variables suggests that expectations of the future imply a slight deviation from the past and this affects the present.

To confirm the hypothesis about the influence of the expected future random events, as an example, consider a time series describing monthly milk production in England for the period from January 1962 to may 1975, Changes of volume of milk production are random events. The corresponding graph is shown in Fig. 2.

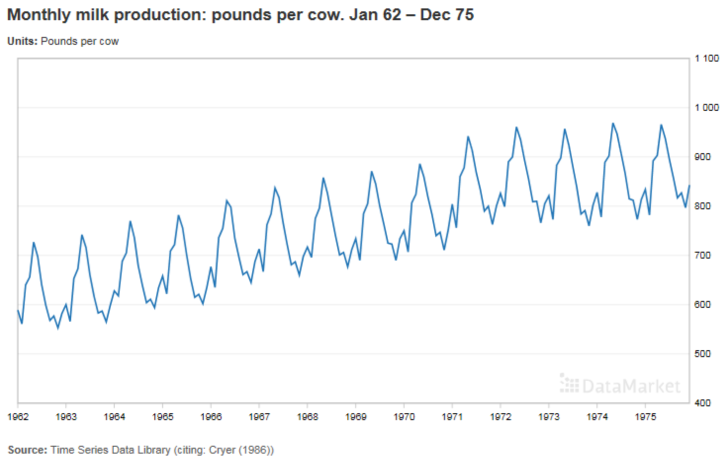

Fig. 2. **Dynamics of milk production**

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Source: Time Series Data Library (citing Cryer (1986))

We evaluate the quality of three econometric models describing this process:

1-linear: Yt = a0 + a1*t +et, excluding lag and f-lag variables

2-lag: Yt = a0 + a1*t + a2*Yt-1 with lag variable,

3-with the inclusion of the f-lag variable in the model

Yt = a0 + a1*t + a2*Yt-1 + a3* Yt+1

The latter model includes, in addition to the lag variable Yt-1, the variable Yt+1, which we call f-lag [12,13].

When evaluating the parameters of these models using the Regression function from the Excel data Analysis package, the following results are obtained (Table. 1).

Table 1.

Parameter estimates of the three models

№ mod-els	Coeffi-cients	The Num-ber of Fisher	Standart error	t-statistics
1.	611,68 1,69	306	60,7	t_1=64,9; t =17,5
2.	173,01 0,459 0,721	395	42,4	t_1=5,1; t_2=3,9 t_3= 13,2;
3.	8,83 -0,26 0,08 0,50	499	32,1	t_1=-0,3; t_2=3,9; t_3= 11,1; t_4= 11,2

From the data presented in the table, it is obvious that the best model is one that takes into account both lag and f-lag variables, both of which are actually equal: they have almost the same coefficients and student fractions. Similar studies have been carried out with other time series, in particular with the time series shown in Fig. 3 and Fig.4.

Fig.3. **Dynamics of the rate of change of the money supply.** Source: Time Series Data Library (citing:Cryer (1986))

Table 2.

The model parameters with and without f-a lag variable

Without f-lag variable		With f-lag variable	
Multiple R^2	0,975	Multiple R^2	0,987
Standard error	0,173	Standard error	0,129
Observations	101	Observations	100

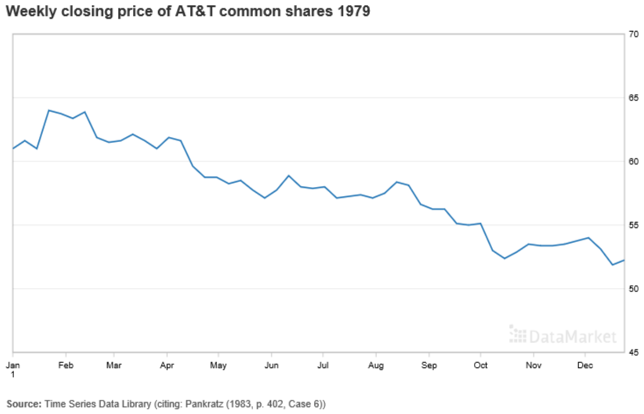

Fig. 4.

Dynamics of the closing price of the stock AT & T.

Source: Time Series Data Library (citing: Cryer (1986).

Table 3.

The model parameters with and without f-a lag variable

Without f-lag variable		With f-lag variable	
Multiple R^2	0,938	Multiple R^2	0,984
Standard error	0,86	Standard error	0,63
Observations	51	Observations	50

Summary. The presented results of comparison of time series models without f-lag variables and with them suggest that the use of f-lag variables in time series in some cases contributes to improving the quality of forecasting (standard error decreases). This fact also confirms the assumption that the economic and mathematical model takes into account the expectations of the future and improves its realism and quality.
Naturally, the assumption of the close identity of the past and the future, necessary

to justify the use of the f-lag variable in the model, is a rather serious simplification of reality, but, nevertheless, in some cases it is useful.

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JEL

TESTING STATISTICAL HYPOTHESES WITH THE USE OF VISUALIZATION TOOLS IN R STUDIO

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Abstract. The research is devoted to the development and justification of visualization tools for decision-making criteria in the problems of testing statistical hypotheses for a given distribution law (in particular, the normality test). A General simulation approach to the graphical construction of the non-critical area zone in the programming language R, suitable for the implementation of any criteria (Kolmogorov-Smirnov, Pearson, etc.) is considered. The text of the article contains working scripts on R and graphic illustrations obtained with their help.

Keywords: visualization in R, tests of statistical hypotheses, the criteria of normality

Introduction

Statistical hypothesis testing is an integral part of data analysis. Despite the huge number of existing methods, this task always requires new approaches corresponding to the modern development of computer technology and related technologies. The use of different criteria when testing statistical hypotheses can be made much more comfortable for the user. The paper describes the construction of a graphical model that visualizes the analysis of the compliance of the sample with the given distribution law. The solution of this problem in the language of statistical analysis R in the environment of RStudio is given. In the standard approach, focusing only on the value of P-value in relation to the selected significance level, we do not take into account the second kind of error. Having a graphical representation of the behavior of such samples, it is possible to conclude more reasonably whether the value of the P-value obtained corresponds to the assumption of the validity of zero or deviations in the distribution, indeed, take place.

1. Visualization of the decision reliability corridor

At present, the R language has not yet been sufficiently disseminated, although it is one of the most modern means of obtaining the results of statistical studies. All cited in the work of the codes in R language is universal and can be run from any computer on which you installed the R language and an excellent interface shell RStudio. How to do this is detailed in [1].

To illustrate the proposed method, the library "nortest", which allows to check the normality of the distribution according to the Kolmogorov-Smirnov criterion (K-C) in the Liliefors modification [2], [3], according to the variational series data. This criterion and distribution can be replaced by any other procedure in the form of the corresponding language.

Let's generate a random sample of volume 1000 from the normal distribution N\left(4;1\right) by means of R language , this sample will be investigated. Apply the K-C test (see figure 1).

Note that in the lower left window of RStudio (it is called console) there is a report on the verification of the hypothesis about the correspondence of our sample to the normal distribution, the value P-value = 0.3082 is obtained.

Our goal is to visualize how the studied variation series Y corresponds to typical samples of the same volume from the assumed normal distribution according to the null hypothesis. In practice, we do not know in advance the parameters of the distribution of Y, therefore, we will use the method of moments to estimate them.

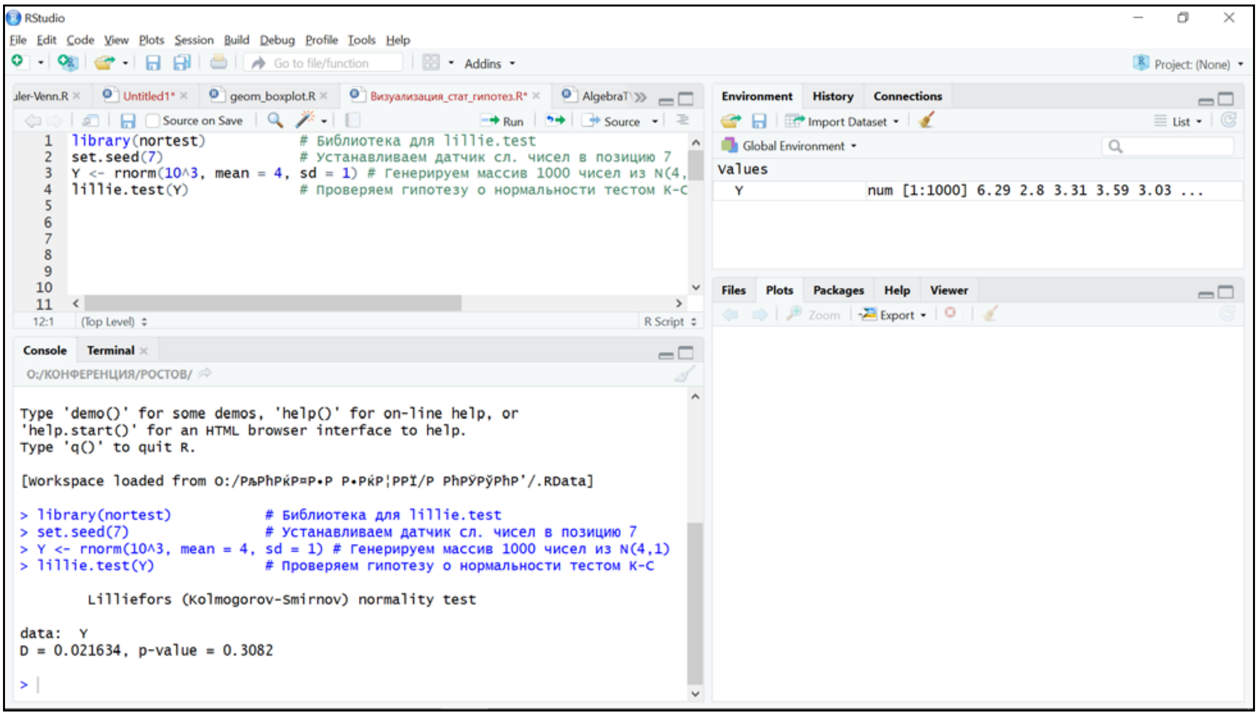

Fig. 1Rstudio working window with the result of the application Kolmogorov-Smirnov criterion for the generated sample

We construct a probability density curve of the normal distribution with the estimated parameters N\left(mean\left(Y\right),\ sd\left(Y\right)\right), which implements the null hypothesis on the interval [\min\below I{Y};\ max \below I{Y}] . In the header of the chart, we specify the calculated value of P-value, rounded to 4 characters, together with the specified level of significance Alpha = 0.05:

```
Alpha <- 0.05
t <- seq(min(Y), max(Y), length = 1000)
plot(t, dnorm(t, mean(Y), sd(Y)), type = "l", lwd = 2,
ylim = c(0, max(dnorm(t, mean(Y), sd(Y))) + 0.1),
main = paste("Alpha = ", Alpha, "; P-value = ", round(lillie.test(Y)$p.value, 4)))
abline(v = round(min(Y)) : round(max(Y)), h = seq(0, max(dnorm(t, mean(Y), sd(Y))) + 0.1, 0.1),
lty = 2, col = "gray60")
```

Next, generate 1000 samples from N\left(mean\left(Y\right),\ sd\left(Y\right)\right)\ of the same size as the sample under study: length (Y). For each of them we will check the condition: is there any reason to reject the null hypothesis at a given level of significance. For those samples for which P-value is not less than Alpha, we will gray the graph of the empirical distribution density function on the previous figure.

Taken together, the curves selected from the thousand graphically form a corridor of specified reliability (1-Alpha), the hit of which illustrates the propensity to fulfill the criterion of K-C.

The following code builds a visual reliability corridor in the previous figure, naturally temporarily overwriting the theoretical density function (see figure 2):

```
for (i in 1:10^3) {
 X <- rnorm(length(Y), mean(Y), sd(Y))
 if (lillie.test(X)$p.value >= Alpha) {
  lines(density(X), lwd = 1, col = "gray80", type = "l")
 }
}
```

Now we draw on this graph the empirical function of the density of the studied variation series Y (solid line), as well as the theoretical probability density for the null hypothesis (dotted line) (see figure 2):

```
lines(t, dnorm(t, mean(Y), sd(Y)), type = "l", lwd = 1, pch = 19, col = "black", lty = "33")
lines(density(Y), lwd = 2, col = "gray30", type = "l")
```

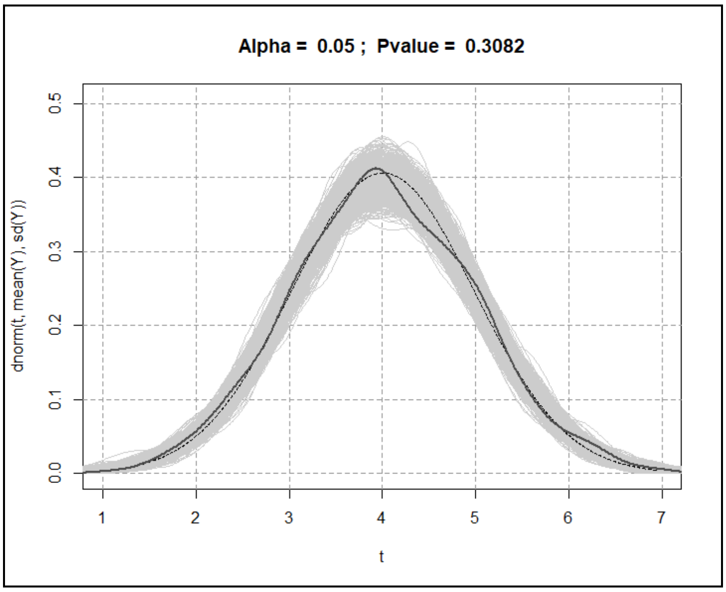

Рис. 2 Getting the empirical probability density in the confidence corridor

Advanced analysis of the null hypothesis deviation

The resulting figure is quite consistent with our ideas of a good agreement of observations of the null hypothesis. Here both P-value exceeds the significance level and the curve is in the obtained corridor.

Now the variational series under study do not correspond to the null hypothesis: we generate 300 random values from the student distribution: Y \ ~ \ t\left (3.8\right). After writing such a procedure on R and plotting graphs similar to those obtained above, we get the picture shown in Fig.3.

In figure 3, it can be noted that a small deviation of the empirical curve from the confidence corridor of probability density is clearly seen in the graph and is consistent with the value of P-value, which, though insignificant, but still becomes less important for this case, which leads to a deviation of the null hypothesis about the normality of the distribution

Note that such a visual analysis is meaningful only if simultaneously with it the quantity of material matching the selected level of significance with the exact value of the p-value parameter. Advisedly we haven't chosen the row that dramatically differs from the general one, as in this case both diagram and P-value become too obvious.

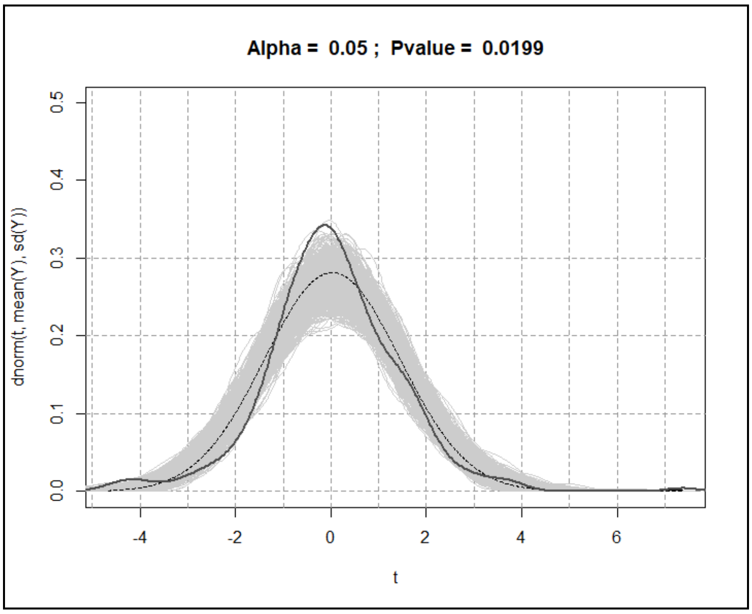

Рис. 3 Deviation of the empirical probability density from the confidence corridor of the null hypothesis

Conclusion

The proposed approach can be easily transferred to another case, any statistical criterion can be used to verify the compliance of the studied variational series with any given distribution. The researcher who knows the basics of the R-language has the opportunity to solve their own issu.

In addition, the graphical construction of these corridors reliability for the selected criteria carry a different, perhaps informal, information about compliance. Here there is a not explained by the integral property of the "relationship" theoretical and IP-follow the density given in the graphic sensations.

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JEL D81

TO THE QUESTION ABOUT THE ABILITY OF SYNTHESIZING THE CRITERION OF WALD-SAVAGE

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Abstract. Abstract. In games with nature, as an optimality principle in adverse economic conditions, the edge-not pessimistic Wald payoff-criterion and the Savage risk-criterion are often used. In this paper, we introduce a linear convolution of these criteria, called the Wald-Savage synthetic criterion with a payoff-indicator $\alpha \in [0.1]$ expressing the quantitative ratio of the decision-maker to the payoffs. This criterion makes it possible to assess the optimality from the synthetic (joint) position of payoffs and risks. The conditions for the existence and uniqueness of the value of the payoff-indicator are found at which the Wald-Savage criterion has the property of synthesis consisting in the existence of a strategy optimal by the Wald-Savage criterion but not optimal for any of the constituent criteria.

Keywords: game with nature; the Wald criterion; the Savage criterion; the synthetic Wald-Savage criterion; payoff-indicator; synthesizing.

As you know, decision-making is the most important component of any management.

In the analysis of the task of making financial-economic decisions useful is the use of a model "Game with nature" [1, pp. 12-59], in which the principles of optimality of strategies by different criteria. Some of them are - the *payoffs-criteria* to determine optimality from the point of view of payoffs, abstracting from risk (for example, criteria of Wald [2; 1, pp. 273-308], maxymax [1, p. 349-362], etc.). Other – *risk-criteria,* on the contrary, characterize the optimality from the point of view of risks, without taking into account the obvious payoffs (for example, Savage criteria [3; 1, pp. 308-349], minimin [1, pp. 362-376], etc.). Widely used *combined* criteria, is composed of two payoff-criteria or two risk-criteria. In each such pair, one of the criteria is extremely pessimistic, and the other is extremely optimistic (for example, the Hurwicz payoff-criterion [4; 5; 1, pp.479 - 558] and the Hurwicz risk-criterion [1, pp. 534-558]).

In our opinion, deserves attention the use of paired *synthetic* criteria, composed of the payoff-criteria and risk-criteria because they provide an opportunity to assess the optimality of the strategies with synthetic (joint) the point of view of payoffs and gambling risks. A general approach to the design of such criteria is proposed in [1], and in [6] and [7] a synthetic Wald-Savage criterion was introduced. For its description let us briefly recall the necessary definitions.

Let in the game with nature $S^p = \{A_1, A_2, ..., A_m\}$ [1], $m \geq 2$ - a set of alternative pure strategies of the player A; $\Pi_1, \Pi_2, ..., \Pi_n$, $n \geq 2$, - states of nature Π; real numbers a_{ij}, $i \in I = \{1, 2, ..., m\}$, $j \in J = \{1, 2, ..., n\}$, - the payoffs of the player A in a game situation (A_i, Π_j), when a player A selects the strategy A_i, and the nature is in a state of Π_j; $\beta_j = \max\{a_{ij} : i \in I\}$, $j \in J$, - an indicator of

[1] In the designation S^p, the letter "p"-the first letter of the *pure*, indicates that the strategies A_1, A_2,…, A_m considered in this article are *pure*, and not mixed, i.e. are chosen by player *A* in a *certain* way without admixtures of chance and uncertainty.

the favorability of the state of Π_j;

$r_{ij} = \beta_j - a_{ij}$, $i \in I, j \in J$ - the risk of not receiving the player A when choosing the strategy A_i of the greatest win in the state of nature Π_j of the payoff β_j [1, pp. 18-25; 8, pp. 9-61].

According to the Wald criterion [2; 1, pp. 273-308; 8, pp. 73-94; 9, pp. 330-347]; $W_i = \min\{a_{ij} : j \in J\}$- the indicator of the effectiveness of the strategy A_i, $i \in I$; $W_{S^p} = \max\{W_i : i \in I\}$; -the price of the game in the set S^p; strategy A_k- optimal if $W_k = W_{S^p}$; $\left(S^p\right)^{O(W)}$ - the set of strategies that is optimal in the set S^p.

According to the criterion of Savage [3; 1, pp. 308-349; 8, pp. 95-120; 9, pp. 348-370]: $Sav_i = \max\{r_{ij} : j \in J\}$ - the inefficiency of the strategy A_i, $i \in I$; $Sav_{S^p} = = \min\{Sav_i : i \in I\}$ - the price of the game in the set S^p; the strategy A_k is optimal if $Sav_k = Sav_{S^p}$; $\left(S^p\right)^{O(Sav)}$; - a set of strategies optimal in the set S^p .

Wald-Savage criterion with a payoff-indicator $\alpha \in [0,1]$ is determined by the following components:

$$(WSav)_i(\alpha) = \alpha W_i - (1-\alpha)Sav_i \quad (1)$$

- an indicator of the effectiveness of the strategy $A_i, i \in I$; the price of the game is determined by the formula

$$(WSav)_{S^p}(\alpha) = \max\{(WSav)_i(\alpha) : i \in I\}; \quad (2)$$

strategy A_k we call optimal if $(WSav)_k(\alpha) = (WSav)_{S^p}(\alpha)$; $\left(S^p\right)^{O((WSav)(\alpha))}$ - set of strategies optimal in the set S^p.

Payoff-indicator $\alpha \in [0,1]$ and risk-indicator $(1-\alpha) \in [0,1]$ are quantitative indicators of the degree of preference given to the player A accordingly, the gains and risks.

From (1) it is obvious that the graphs of the strategies efficiency indicators according to the Wald-Savage criterion as linear functions of the argument α are m segments. From (2) we conclude that the graph of the price of the game is the upper envelope of these segments, which is a broken line, the number of links l which does not exceed m.

Definition 1. We will say that in this game with the nature of the Wald-Savage criterion with a fixed value of the payoff-indicator $\alpha \in (0,1)$ *it has the property of synthesizing if there is an optimal strategy for this criterion, which is not optimal either by Wald's criterion or by Savage's criterion.*

In the article the necessary and sufficient conditions for the existence and uniqueness of the value of the win-indicator, in which the Wald-Savage criterion has the property of synthesizing, are found.

To formulate the corresponding theorems, we define the following sets of optimal strategies and the prices of the game in these sets: $((S^p)^{O(W)})^{O(Sav)}$ - a set of strategies that are optimal according to the criterion of Savage in the set $(S^p)^{O(W)}$; $Sav_{(S^p)^{O(W)}} = \min\{Sav_i : A_i \in (S^p)^{O(W)}\}$ - the price of the game by Savage criterion in the set $(S^p)^{O(W)}$; $((S^p)^{O(Sav)})^{O(W)}$ - a set of strategies that are optimal according to the criterion of Wald in set $(S^p)^{O(Sav)}$; $W_{(S^p)^{O(Sav)}} = \max\{W_i : A_i \in (S^p)^{O(Sav)}\}$ - the price of the game according to the criterion of Wald in the set $(S^p)^{O(Sav)}$.

Definition 2. We will say that playing with nature satisfies the condition $\sigma_{(WSav)}$, if for each strategy $A_i \notin (S^p)^{O(W)} \cup (S^p)^{O(Sav)}$ the following inequality holds

$$\begin{aligned}(Sav_{(S^p)^{O(w)}} - Sav_{S^p})W_i - \\ -(W_{S^p} - W_{(S^p)^{O(Sav)}})Sav_i \le \\ \le W_{(S^p)^{O(Sav)}} Sav_{(S^p)^{O(W)}} - W_{S^p} Sav_{S^p} \quad (3)\end{aligned}$$

and there is a strategy $A_k \notin \notin (S^p)^{O(W)} \bigcup (S^p)^{O(Sav)}$, for which inequality (3) becomes equality. Let

$$\alpha_{(WSav)} = \frac{Sav_{(S^p)^{O(W)}} - Sav_{S^p}}{(Sav_{(S^p)^{O(W)}} - Sav_{S^p}) + (W_{S^p} - W_{(S^p)^{O(Sav)}})},$$

$$\delta_{(WSav)} = \frac{W_{(S^p)^{O(Sav)}} \cdot Sav_{(S^p)^{O(W)}} - W_{S^p} \cdot Sav_{S^p}}{(Sav_{(S^p)^{O(W)}} - Sav_{S^p}) + (W_{S^p} - W_{(S^p)^{O(Sav)}})}$$

and

$S^p_{\alpha_{(WSav)}} = \{A_i : (WSav)_i(\alpha_{(WSav)}) = \delta_{(WSav)}\}$- a set of strategies, the efficiency of which according to the Wald-Savage criterion at the payoff-indicator $\alpha_{(WSav)}$ equal $\delta_{(WSav)}$.

The following two theorems are valid provided that in the game with nature there is no strategy that is optimal at the same time by Wald's criterion and Savage's criterion, and there is a strategy that is not optimal neither by Wald's criterion nor by Savage's criterion.

Theorem 1 (necessary conditions).

If there is a single value of the payoff-indicator, in which the Wald-Savage criterion has the property of synthesizing, the following statements are true;

a) *the number* l *of links in the broken line representing the price chart of the game according to the Wald-Savage criterion is 2*;

b) *the only value of the payoff-indicator, in which the Wald-Savage criterion has the property of synthesizing, is* $\alpha_{(WSav)}$;

c) *a set of strategies that are optimal according to the criterion of Wald-Savage, has the following structure:*

$$(S^p)^{O((WSav)(\alpha))} =$$

$= (S^p)^{O(Sav)}$, *when* $\alpha = 0$;

$= ((S^p)^{O(Sav)})^{O(W)}$, *when* $0 < \alpha < \alpha_{(WSav)}$;

$= ((S^p)^{O(Sav)})^{O(W)} \bigcup ((S^p)^{O(W)})^{O(Sav)} \bigcup S^p_{\alpha_{(WSav)}}$, *when* $\alpha = \alpha_{(WSav)}$;

$= ((S^p)^{O(W)})^{O(Sav)}$, *when* $\alpha_{(WSav)} < \alpha < 1$;

$= (S^p)^{O(W)}$, *npu* $\alpha = 1$; (4)

d) *the condition* $\sigma_{(WSav)}$ *is satisfied.*

Theorem 2 (sufficient conditions).

From each of the following two conditions a) *let the set* $S^p_{\alpha_{(WSav)}}$ *not empty and set* $(S^p)^{O((WSav)(\alpha))}$ *strategies that are optimal according to the criterion of Wald-Savage, has the structure* (4);

b) *the condition* $\sigma_{(WSav)}$ *is satisfied, it follows that* $\alpha_{(WSav)}$ *is the only value of the payoff-indicator, when which Wald-Savage criterion has the property of synthesizing.*

It follows from theorems 1 and 2 that the condition $\sigma_{(WSav)}$ it is necessary and sufficient for the existence and uniqueness of the value of the payoff-indicator, in which the Wald-Savage criterion has the property of synthesizing.

The presence of a set of values of the payoff-indicator, in which there are synthesized strategies, leads to uncertainty in the choice of the payoff-indicator. The obtained results exclude a specified uncertainty, giving rise to another possible uncertainty in the choice of strategy from among the several synthetic strategies that might exist in this case only the value of the prize increased.

The obtained results are applicable to the analysis of any problem of financial and economic decision-making in the conditions of uncertainty, allowing the use of the "Game with nature" model with a synthetic criterion of Wald-Savage optimality.

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JEL G32

GAME-THEORETIC MODELS FOR SOLVING PROBLEMS OF OPTIMIZING THE CAPITAL STRUCTURE OF THE COMPANY

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Management company “Capital”

Abstract. The influence of equity and debt capital shares on the company's profit is considered. Using the methods WACC was established game-theoretic model that reflects the status of the capital of the company "LUKOIL".

Keywords: capital, asset, profit, model, game theory.

Each company, from a huge number existing today has the specifics of work. Any organization implements an individual policy in dealing with financial issues.

Of course, any owner or Manager sets the task to maximize the profit of the enterprise in which he operates. There are many ways to increase the benefit. To get a positive result, it is necessary to take into account a huge number of properties inherent in this particular enterprise at a particular time and forecasts made by professional analysts for the future state of the company. In addition, we should not forget about the impact on the company's activities of external objective circumstances.

One of the most influential factors that increase profits or prevent this is the distribution of capital [1].

The need to optimize the capital structure is determined by many features, including: the strategy and objectives of the company; the division of the workflow into certain stages; optimization of the financial structure; the duration of the production cycle; the production program; the size of the enterprise.

Take into account all these properties is difficult. Therefore, the goal – to optimize the capital structure of the company - is becoming very relevant today.

With the help of mathematical methods, we find the share of equity and debt capital, which are most effective for maximizing profits. All calculations will be carried out on the example of PJSC "LUKOIL", which is one of the leading holding companies in Russia in the oil and gas industry.

In order to obtain the optimal distribution of capital, it is assumed to solve the following problems:

1. Consider in detail the financial components of capital and their impact on the overall condition of the company.
2. For PJSC LUKOIL to apply mathematical methods, namely, game theory, to identify the best option for capital allocation, while taking into account not only internal factors, but also the state of the market as a whole.
3. Test the created models and identify the most accurate of them.
4. Compare the results and verify the feasibility of their practical application.
5. To draw conclusions and determine the best ratio of equity and debt capital shares for PJSC LUKOIL to date.

After the research, the indicator of the target capital structure is formed. The boundary values of the maximum profitable and minimum risky capital structure allow to find a certain set of options from which it is possible to choose specific values for a certain period.

In determining the effective distribution of equity and debt capital experts cannot know exactly what the situation will be in the market tomorrow. Especially if the company's policy for the coming years is determined. There are a large number of external factors that affect the company's revenues. It is difficult to say how they will change in the future, you can only make a forecast with some accuracy that will never reach 100%. Hence, the process of capital structure optimization occurs under uncertainty [2].

The science involved in the search for optimal solutions in such conditions is the theory of games. In this case, we will use this section as a game with nature, which simulates the behavior of the active participant in the situation (player) in an objective reality (nature).

The model will include a player in the face of the owners and managers of the company, who make decisions consciously and try to achieve maximum profit. In addition, there is a certain set of factors that depend not on the decision of any particular person, but on the overall situation. Therefore, as nature take the situation in the market. It does not represent a conscious player, does not seek to counteract anyone and the result of actions to optimize the capital of a particular company is unimportant.

The mathematical model of the game with nature is the matrix of wins (losses) of the player in different States of nature.

In any market conditions, the financial Manager of the organization has a goal to increase the value of the company or its net profit. But, unfortunately, when changing the dynamics of the company's profit, it is impossible to estimate the number of investments spent to obtain this profit. To avoid such difficulties, it is necessary to apply the amount of cash flow of the company, because it allows you to adjust the value of net profit with the level of investment [3].

Thus, to determine the value of any company based on its cash flows and cost of capital, it is necessary to use the discounted cash flow model. According to this method, the value of an organization is inversely proportional to its capital. Therefore, trying to increase the value of the firm, the financial Manager should seek to reduce the value of capital. The cost of capital (WACC) is the weighted average cost of equity and debt capital [4]:

$$WACC = D_{ск} * R_{ск} + D_{зк} * R_{зк} * (1 - T)$$

Fig. 1 **Capital value**

Therefore, it is possible to reduce the cost of capital (WACC) either by reducing the amount of equity and debt capital, or by changing the ratio of equity to debt.

Thus, the purpose of constructing a game-theoretic model is to find the optimal capital structure depending on the situation on the stock market.

We define the main components of the model of the game with nature. To do this, we formalize the options for the actions of the financial Manager of the enterprise in the process of capital allocation and the possible state of Affairs in the stock market in the future.

In our case, the company makes a decision on the composition of the capital, that is, distributes its own and borrowed funds as a percentage. This means that each of the values of D_sk and D_zk can be in the range from 0% to 100%, and their sum is always equal to 100% (make up the entire capital). As possible strategies of the active player AI, consider any value of D_sk from the specified area, which can be considered as belonging to one of, for example, i=11 intervals (to get a more accurate result, you can put i=100).

Set up a table with indicators D_ск and D_зк. We get 11 values from the interval [0%;100%] that are not close to each other. All further calculations for obtaining other values from the considered interval are fully automated, since restarting this function, we obtain several sets of values. This will allow you to check the results and make a conclusion in General and find the most optimal solution for several sets of shares of own and borrowed funds. We obtain several tables with different input data of the following format:

Table 1

The set of strategies of the company

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
Dск	87%	69%	87%	39%	9%	90%	63%	62%	42%	95%	57%
Dзк	13%	31%	13%	61%	91%	10%	37%	38%	58%	5%	43%

As a nature, we take the values of monthly returns from the MICEX index, which is the main indicator of the stock market of our country. Find its monthly quotes from January 2015 to December 2017 and calculate the yield. As possible States of nature PJ take the value of return MICEX. Divide the available statistics into j=12 parts and find the average value for each of them. They are quite scattered and generally reflect the different States of the exchange (line r MICEX).

The table of nature States for different variants of distribution of shares of own and borrowed funds will take the following form:

Table 2

State of the stock market

	П1	П2	П3	П4	П5	П6	П7	П8	П9	П10	П11	П12
r ММВБ	5,07%	0,58%	-0,23%	2,32%	2,02%	0,35%	1,50%	4,04%	-3,74%	-2,00%	3,33%	0,52%
CAPM	5,56%	-0,06%	3,27%	5,81%	7,13%	4,20%	6,12%	5,20%	-6,08%	7,80%	6,01%	4,62%

As a win for some company, we will consider the amount inversely proportional to the weighted average cost of capital [3]. Then the gain of the organization when choosing its strategy A_i at the state of the stock market N_j denote as a_ij=1 / (1+WACC_ij), where WACC_ij – is the weighted average cost of capital, provided that the capital structure of the strategy A_i and the yield of the MICEX index corresponding to the state of nature P_j.

The weighted average cost of capital and return on equity are functionally dependent on the capital structure. It is on this theory that the CAPM model is based, which we will use in calculating the values of the payment matrix.

So, we will get several payment matrixes of winnings for LUKOIL for 2015-2017 of the following type, each of which will have the following form:

Table 3

Payoff matrix

	П1	П2	П3	П4	П5	П6	П7	П8	П9	П10	П11	П12
A1	10,40%	21,20%	13,13%	10,18%	9,11%	11,87%	9,90%	10,75%	-192,63%	8,65%	10,00%	11,38%
A2	7,23%	10,05%	8,16%	7,14%	6,70%	7,76%	7,03%	7,36%	17,25%	6,50%	7,07%	7,59%
A3	10,40%	21,20%	13,13%	10,18%	9,11%	11,87%	9,90%	10,75%	-192,63%	8,65%	10,00%	11,38%
A4	4,79%	5,35%	5,01%	4,77%	4,66%	4,92%	4,74%	4,82%	6,12%	4,60%	4,75%	4,88%
A5	3,58%	3,65%	3,61%	3,58%	3,57%	3,60%	3,58%	3,59%	3,72%	3,56%	3,58%	3,59%
A6	11,22%	26,01%	14,61%	10,96%	9,69%	13,02%	10,62%	11,65%	-63,61%	9,15%	10,74%	12,41%
A7	6,56%	8,55%	7,25%	6,50%	6,16%	6,95%	6,41%	6,66%	12,65%	6,01%	6,44%	6,83%
A8	6,46%	8,34%	7,12%	6,40%	6,08%	6,84%	6,32%	6,56%	12,11%	5,93%	6,35%	6,72%
A9	4,96%	5,62%	5,21%	4,93%	4,80%	5,10%	4,90%	5,00%	6,55%	4,74%	4,91%	5,06%
A10	12,93%	41,82%	17,99%	12,55%	10,84%	15,53%	12,09%	13,53%	-30,06%	10,14%	12,26%	14,62%
A11	6,01%	7,44%	6,52%	5,96%	5,70%	6,30%	5,89%	6,08%	9,99%	5,58%	5,92%	6,21%

WACC is the total cost of capital calculated as the sum of the return on equity and debt weighted by their share in the distribution of funds. This means that a_ij wins show how much the cost of capital will decrease (which will bring the greatest profit to the organization), if managers choose the share values corresponding to the a_i strategy. In this case, the MICEX index at this point in time will take some value No.

Based on these values, we can find the best strategies and make some recommendations for the distribution of funds in equity and debt capital in the future. For this purpose, various performance criteria can be used depending on the interests of the active player – the management of the company in question.

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JEL C1, C15, C4, C5, C53

DISPERSION OF THE CAPACITY METHOD FROM THE POSITION IN THE DISTRIBUTORS CHAIN

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Abstract. The rare events analysis is an actual problem. The capacity method in trading is capable of recovering the original regularities of rare sales with great accuracy. However, when distancing from the end consumer in the chain of distributors, the accuracy decreases. In the previous study, when modeling the consumption process, it was noted that the precision falls, but falls not significantly. In the current study, the reason for the falls in precision was explained and it was shown that the error grows as a decreasing geometric progression. Also, the variance and the standard deviation are determined for the error. It is shown that the dispersion and the mean square deviation grows even more slowly than the geometrically decreasing progression. Numerical error values are obtained depending on the position in the chain of distributors.

Keywords: capacity method, accuracy, error, sequence of distributors, intermediaries

Rare events, which are represented not as a time series, but as a set of data about the time of an event and the magnitude of this event, for example, data on rare sales, are well analyzed using a capacity method [1, 2], which restores the dependence of the products consumption rate with time or any other dependence that leads to the event occurrence.

For distributors, that working directly with end-users, the error of restoring the initial dependence is only 1-3%. Knowing the speed with which the product is spent, you can easily predict the moment when the buyer will need the next purchase and use it for your own purposes to optimize profit or expenses.

However, while distancing from end-users, when intermediaries appear in the distributors chain, the precision falls. According to the previous study [3, 4], as a result of the simulation, the precision falls was as follows, as shown in the Table 1.

A detailed analysis of the consumption process and restoration of the initial dependence showed that the error arises from the fact that there is a discrepancy ΔQ between the observed and consumed output over the period of time between purchases. This happens due to the fact that part of the purchases related to the previous period of time, and also because you have to use insurance stocks, see Fig. №1,

$$\Delta Q_S = \sum_j \left(S_{k+1}^j - S_k^j\right)$$
$$\Delta Q_{SS} = SS_{k+1}^{\text{II}} - SS_k^{\text{II}}$$
$$\Delta Q = \Delta Q_S - \Delta Q_{SS}$$
$$S_k^j \in (0; y^j_{\text{предш}.k}]$$
$$SS_k^{II} \in (0; \max_j y^j_{\text{предш}.k}]$$

where the value of $y^j_{\text{предш}.k}$ indicates the volume of the previous (inclusive) purchase of the buyer j with respect to the time t_k^{II}.

Table 1

Precision falls, depending on the position in the distributor chain

	1 intermediary	2 intermediaries	3 intermediaries
The average value of the relative deviation for 20 runs, %	4,2889	5,6544	6,0386
The root of the sample variance of the relative deviation for 20 runs, %	1,0284	1,3967	1,2145

Source: The results of the simulation were obtained by the author

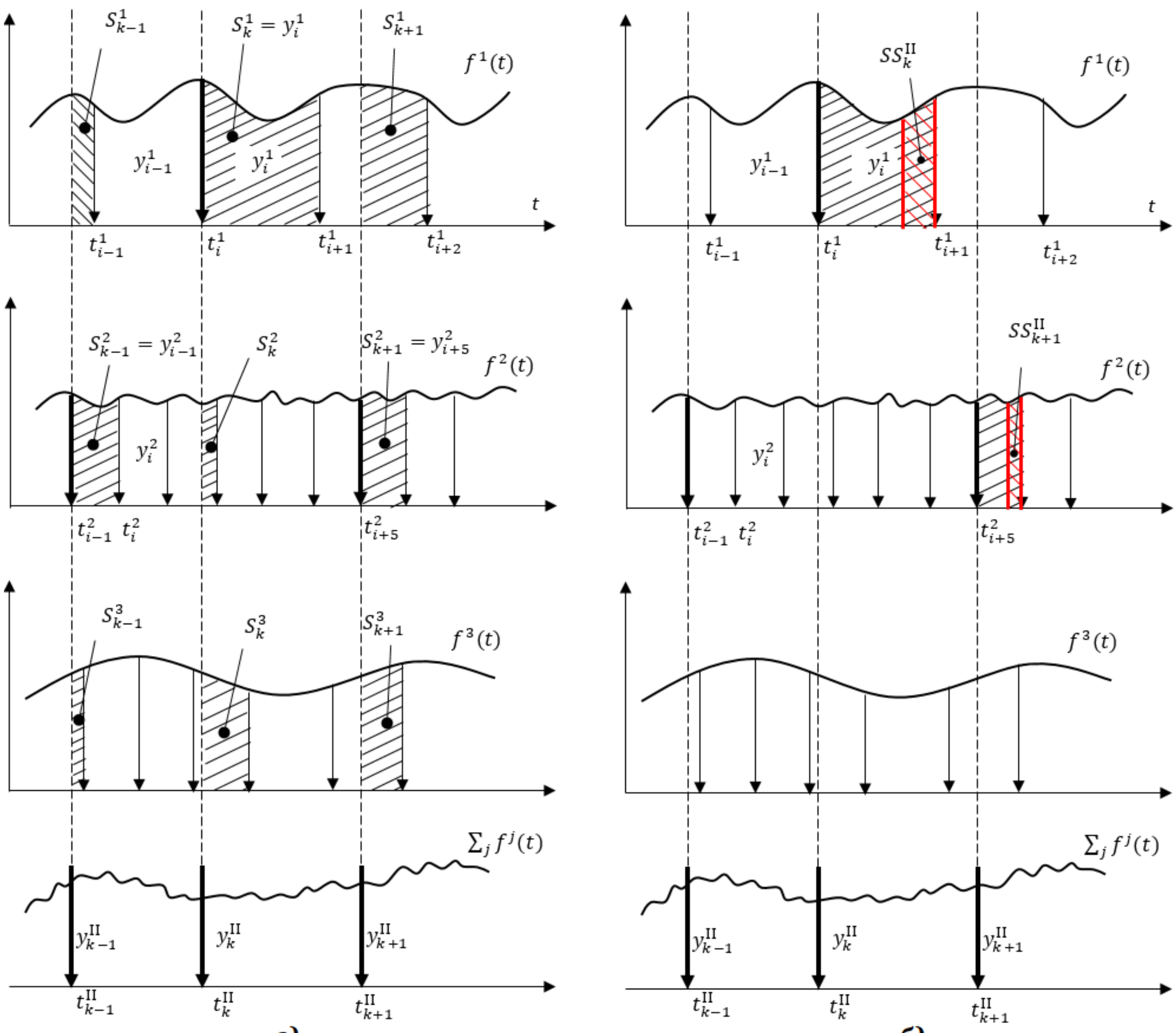

Fig. 1 **The discrepancy between the observed and consumed output: a) part of the purchase related to previous period; b) use of insurance stocks**

Source: obtained by the author

If a second level of intermediaries is added, the magnitude of the discrepancy will include inconsistencies from smaller intermediate distributors.

$$\Delta Q^{II}_S = \Sigma_r\left(S^{r,\mathrm{II}}_{L+1} - S^{r,\mathrm{II}}_L\right) + \Sigma_r\Sigma_j\left(S^{r,j}_{L+1} - S^{r,j}_L\right)$$
$$\Delta Q^{II}_{SS} = SS^{\mathrm{III}}_{L+1} - SS^{\mathrm{III}}_L + \Sigma_r\left(SS^{r,\mathrm{II}}_{L+1} - SS^{r,\mathrm{II}}_L\right)$$

For three levels of intermediaries, the magnitude of the discrepancy will also include inconsistencies from new levels.

The stock of products of the top distributors is always several times larger than the stock of products of smaller distributors. If we consider the idealized case, when the distributors have the same number n of child distributors, as well as the stocks of the upper distributors is always enough for P purchases of child distributors, then the magnitude of the discrepancy may be expressed as follows:

$$\Delta Q^{III}_S = n \cdot P^2 \cdot dS + n^2 \cdot P \cdot dS + n^3 \cdot dS$$
$$\Delta Q^{III}_{SS} = P^2 \cdot dSS + n \cdot P \cdot dSS + n^2 \cdot dSS$$

where

$$dS = S^j_{k+1} - S^j_k, dSS^{\mathrm{II}} = SS^{\mathrm{II}}_{k+1} - SS^{\mathrm{II}}_k.$$

A general discrepancy then will be

$$\Delta Q^{III} = \Delta Q^{III}_S - \Delta Q^{III}_{SS} =$$
$$= (n \cdot dS - dSS)(P^2 + nP + n^2)$$

The relative error can be obtained if the magnitude of the discrepancy is divided by the amount of the purchase taking place at a given position in the distributors chain.

$$\frac{\Delta Q^{III}}{y^{IV}} = \frac{(n \cdot dS - dSS)}{P \cdot y_i^j}\left(1 + \frac{n}{P} + \left(\frac{n}{P}\right)^2\right)$$

If we continue this sequence further, we obtain a relative error for N levels of intermediaries.

$$\frac{\Delta Q^{[N]}}{y^{[N+1]}} = \frac{(n \cdot dS - dSS)}{P \cdot y_i^j}\left(1 + \frac{n}{P} + \right.$$
$$\left. + \left(\frac{n}{P}\right)^2 + \dots + \left(\frac{n}{P}\right)^{N-1}\right)$$

The expression in parentheses is a geometrically decreasing progression, on the condition that the value $\left(\frac{n}{P}\right)$ is less than 1, which is usually satisfied, since n shows the number of customers, and P shows how many purchases the distributor's stock satisfy.

There are reasons to assume that the value of S_k^j is distributed uniformly over the interval $\left(0; y^j_{\text{предш}.k}\right]$, and SS_k^{II} is independent of it along the interval $\left(0; \max_j y^j_{\text{предш}.k}\right]$ (in the idealized case for the same interval $\left(0; y^j_{\text{предш}.k}\right]$).

Now we can calculate the variance for the relative error. At the first level, there are $2(n+1)$ random variables involved (2 values per dS and dSS). On the second, $2(n^2+n)$, and on the third $2(n^3+n^2)$ random variables.

Since the ratio of the random variable $S_k^j \in \left(0; y^j_{\text{предш}.k}\right]$ to $y^j_{\text{предш}.k}$ gives a base uniform random variable from 0 to 1 with a variance of 1/12, we obtain an expression for the variance:

$$D\left[\frac{\Delta Q^{[N]}}{y^{[N+1]}}\right] = \frac{2(n+1)}{12P^2} + \frac{2(n^2+n)}{12P^4}$$
$$+ \frac{2(n^3+n^2)}{12P^6} + \dots + \frac{2(n+1)n^{N-1}}{12P^{2N}} =$$
$$= \frac{n+1}{6P^2}\left(1 + \frac{n^1}{P^2} + \frac{n^2}{(P^2)^2} + \dots + \frac{n^{N-1}}{(P^2)^{N-1}}\right)$$

The expression in parentheses is again the sum of a geometrically decreasing progression, which decreases even faster. The sum of the first N terms is $\frac{1-q^N}{1-q}$, where $q = n/P^2$ is the denominator of the progression.

$$D\left[\frac{\Delta Q^{[N]}}{y^{[N+1]}}\right] = \frac{(n+1)\left(1 - \left(\frac{n}{P^2}\right)^N\right)}{6P^2\left(1 - \frac{n}{P^2}\right)}$$

The mean square deviation is obtained as the root of the variance:

$$\sigma\left[\frac{\Delta Q_S}{y^{[N+1]}}\right] = \sqrt{\frac{(n+1)\left(1 - \left(\frac{n}{P^2}\right)^N\right)}{6P^2\left(1 - \frac{n}{P^2}\right)}}$$

In conclusion, lets represent a table in which the variance and the mean square deviation of the relative discrepancy between the observed and consumed output are obtained for the time between two purchases from the distance from the end-users under idealized conditions, Table 2.

As can be seen from the table, the position in the distributor chain practically does not affect the precision with which the original pattern, that leading to the occurrence of purchases (rare events), will be restored.

Table 2

Dispersion and standard deviation of relative error when moving away from the end user

N	$n=3, P=10$		$n=3, P=4$		$n=20, P=20$	
	D	σ, %	D	σ, %	D	σ, %
1	0,006666667	8.164966	0,041666667	20.412415	0,00875	9.3541435
2	0,006866667	8.286535	0,049479167	22.243910	0,0091875	9.5851448
3	0,006872667	8.290155	0,05094401	22.570780	0,009209375	9.5965489
4	0,006872847	8.290263	0,051218669	22.631542	0,009210469	9.5971187
5	0,006872852	8.290267	0,051270167	22.642917	0,009210523	9.5971472

Source: obtained by the author

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JEL: 336.762

THE MODEL OF THE STOCK MARKET AND THE TYPES OF RESONANCE EFFECTS ON ITS INDICATORS

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Abstract. In this paper, the stock market model is considered as an oscillatory system with eigen frequencies determined on The basis of the Elliott wave principle, which can be included in various types of resonant interaction with the outside world. An example of stochastic resonance of RTS index under the influence of information "white noise" is given.

Keywords: stock market, Elliott wave principle, stochastic resonance, resonance phenomenon

Against the background of globalization and increasing competition of the economies of the world's growing risks and increasing instability in the global economic space. Virtual financial capital, stock and currency markets, whose behavior depends on information signals coming from the outside or originating inside them, have an increasing impact on the economy. These information signals are the final link in the chain of events of the outside world and changes in the mass consciousness of financial market participants (Fig. 1).

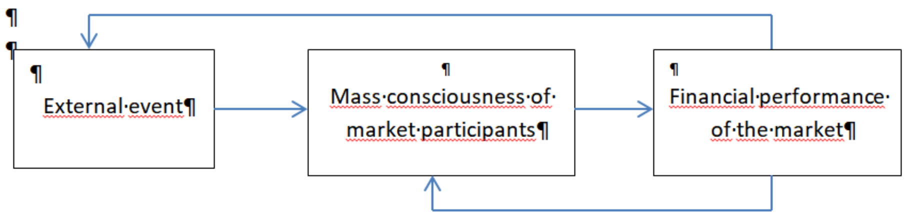

Fig. 1. Scheme of interaction of events of the outside world, mass consciousness of market participants and financial indicators

An example of the impact of natural factors on the stock markets is the relationship of the moon cycles and financial results of market participants. According to a study by Macquarie Securities specialists [1], stock markets, in fact, are hypersensitive barometers, responsive to the invisible influence of the moon cycles on the psychological state of people. Macquarie cites two academic studies in which it was found that net profit in the stock market with the moon rising almost twice higher than similar indicators in the period of the full moon. In addition to this example, there are also many other cyclic processes in nature, the cumulative effect of which can not be ignored in the analysis of the dynamics of financial markets, for example, cyclical processes in the economy [2].

Cyclical changes in the mass consciousness of market participants lead, according to R. Elliott [3, 4], to the wave nature of market movements. Elliot considered his concept of the securities market as part of a much larger whole - namely, the universal law of nature that governs all spheres of human life.

Close to the views of Eliot can be considered and Tesla ideas about the nature of the interaction of processes in nature, which he considered wave, and as a universal mechanism of their interaction called resonance [5]. Tesla believed resonance to be the key to understanding and managing any system, natural or man-made. Each system, in his opinion, has a certain "natural oscillation frequency". Such frequencies can be several; they are a kind of "passport", "identity card" of any system. Any systems can interact, being tuned, on each other.

Considering the stock market as a large

system, we will also assume that it has a set of natural oscillation frequencies or wavelengths, between which there are unambiguous matches. R. Elliot in his book "the Law of nature: the secret of the universe" wrote that the frequencies of these waves correspond to the Fibonacci numbers. All market cycles consist of two types of waves: driving and corrective. The first are signed with numbers from 1 to 5, and the second are marked with Latin letters A, B, C, see table. 1.

Table 1. The ratio of the wavelengths.

Elliott wave	**The ratio of the lengths of waves according to Fibonacci**
1	Reference wave of any length
2	0.382, 0.5 or 0,618 the wavelength 1
3	1.618 or 2.618 the wavelength 1
4	0.382 or 0.5 the wavelength 1
5	0.382, 0.5 or 0.618 the wavelength 1 (or equal to a wavelength of 2)
A	0.382, 0.5 or 0.618 the wavelength 1 (or equal to a wavelength of 5)
B	0.382 or 0.5 the wavelength A
C	1.618, 0.618 or 0.5 the wavelength A

Table 1 shows the ratio of these wavelengths to the reference wavelength, which is selected on the basis of the simulation method in such a way as to best smooth the initial time series, which is the dynamics of the price of a financial instrument (Fig. 2). The time series is presented in the form of Fourier series expansion:

$$m(t) = a_0 + a_{01}t + \sum_{i=1}^{r}(a_i \cos\omega_i t + b_i \sin\omega_i t)$$

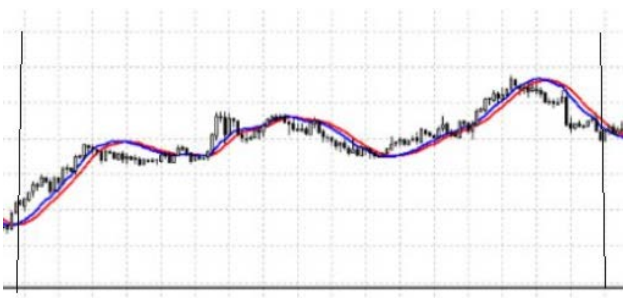

Fig. 2. Charts of the financial instrument price (initial and smoothed with the help of harmonics)

Thus, it seems appropriate to present the dynamics of financial market indicators as a result of the influence of stochastic oscillatory processes on the system with its own frequency characteristics corresponding to the Fibonacci numbers.

The most important consequence of the wave nature of the dynamics of financial market indicators is the possibility of such interaction of waves of different nature affecting them, which has the most effective impact on their change based on resonance. Detection of resonance phenomena in the financial markets, understanding their nature, will allow to predict the dynamics of financial indicators and, using various mechanisms of influence on the financial markets, to avoid the onset of the crisis.

The financial market is a nonlinear oscillatory system. However, with small amplitudes of fluctuations of financial indicators (with small deviations from the equilibrium position), financial markets can be considered linear, fluctuations in them are described by linear differential equations, which allows using the General theory of fluctuations. If it is impossible to consider the financial market as a linear system (large deviations from the equilibrium position), the system's own oscillations will no longer be harmonic, and their frequencies will depend on the amplitude of the oscillations. The dynamics of financial indicators should be described by nonlinear equations. For nonlinear systems, unlike linear systems, the principle of superposition is violated, according to which the resulting effect of a complex process of action is the sum of the effects caused by each action separately, provided that the latter do not affect each other.

In such a nonlinear system the resonance will be characterized in that during the buildup of financial indicator external force (impact on financial market participants) the difference between the frequency of the driving and the financial market (□ - □0) will change as the frequency □0 will depend on the amplitude of oscillation.

An example of a nonlinear oscillatory system are self-oscillating systems, which belong to the group of nonlinear oscillatory systems. They compensate for dissipative losses due to the inflow of energy from an external constant source. In this case, the system itself regulates the supply of energy to the system, feeding it at the right time and in the right amount. The presence of market regulators allows us to consider the stock market as a self-oscillating system.

The impact of regulators on the market with a certain frequency, close to the natural frequency of the market, allow to ensure its stable equilibrium operation. The advantage of using resonance phenomena is their efficiency and large oscillation amplitude. The disadvantage is the instability of the system, associated with the necessity with a high degree of accuracy to maintain the resonance condition (-□□p), since any deviation of the frequency of the external effects of resonant frequencies in the narrow resonance curve sharply change the amplitude of the oscillations in the system.

We will consider the financial market as a linear distributed oscillatory system, which behaves as a set of independent harmonic oscillators. In linear distributed systems, there is an infinite but countable set of normal oscillations (Eigen frequencies of oscillators). Considering the stock market as a single oscillatory system, and interacting with it an external system consisting of market participants, which are affected by economic and natural factors, we get related systems. Vibrations arising in coupled systems are called coupled oscillations.

Fluctuations in one system due to the presence of the connection cause fluctuations in the other, i.e. there is a transition of energy from one system to another. With external excitation of the system, normal oscillations largely determine its resonance properties. Resonance can occur only when the frequency of the harmonic external action is close to one of the natural frequencies of the system, or to their linear combination, if the external action changes the parameters of the system (parametric resonance). In the linear approximation, the natural oscillations of these systems are a set of normal oscillations (modes). If the response of the system is the total response of all degrees of freedom, then the resonance curve will be the superposition of the resonance curves of individual normal oscillations and can be complex.

Thus, in a system with two degrees of freedom, due to the fact that the natural oscillations can occur with two different frequencies, the resonance occurs when the frequency of the harmonic external action coincides with both one and the other normal frequency of the system. The selection of the parameters of normal fluctuations can create a resonant curve of any shape that can be used when choosing a mechanism of influence on the stock market.

One of the mechanisms of influence on the oscillatory system (stock market) is stochastic resonance [6]. Stochastic resonance is a phenomenon of amplification of a periodic signal under the action of white noise of a certain power, inherent in many nonlinear systems, which are under the external influence of both chaotic and weak periodic action. The phenomenon of stochastic resonance is due to the nature of white noise, the spectral components of which are evenly distributed over the entire range of frequencies involved. In this case, the frequencies coinciding with the frequency of the weak periodic signal cause a resonance effect (amplify the periodic signal). Amplification of other components of white noise does not occur.

The role of stochastic resonance in the dynamics of financial markets has not been studied, although, on the basis of General considerations, it may be responsible for a significant contribution to the change of its parameters, including "bubbles" and crisis phenomena.

The hypothesis of stochastic resonance was tested in [8] as an explanation of changes in monthly levels of the RTS index. Logarithmic returns of Brent oil prices, the time period from may 2003 to may 2007 are used as an information signal, as can be seen from the table. 2 the RTS index is weakly correlated with the logarithmic returns of Brent oil prices, which suggests that the latter can be taken as a sub-threshold signal.

Table 2. Values of correlation coefficients between logarithmic returns of Brent prices, as well as logarithmic returns of RTS index and "modified differences" of RTS index for the analyzed period

The period	ρ (yields RTSI and Brent)	ρ ("modified difference" and RTSI yield Brent)**ρ**
May 2003-March 2007	0,1924	-0,0936
May 2003-March 2005	0,0519	-0,1387
April 2005-May 2007	0,2319	0,1818

The periodic component of the information signal was selected using the Statistica package (Fig. 3). The corresponding circular frequency ω=1,8325.

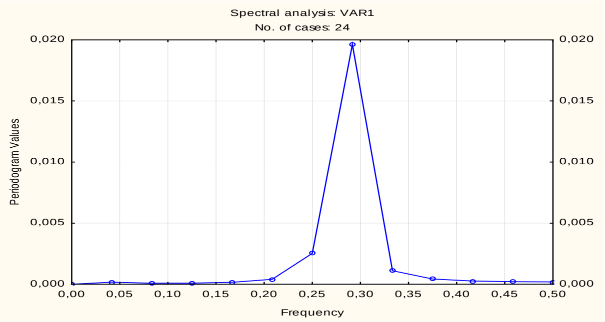

Fig. 3. The frequency characteristic of the signal

Deviations of the real subthreshold information signal (logarithmic yield of oil prices) from its periodic component. it is a Gaussian noise. Based on historical data, the noise intensity D=0.0072 was obtained. The method of simulation was used to search for the optimal value of the noise intensity. It was found that the maximum signal-to-noise ratio is reached at Dopt=0.1311. In addition, an increase in the noise intensity can transfer the system from one stable equilibrium position to another, which suggests the presence of stochastic resonance.

Summary.

1. The stock market model in the form of a set of oscillatory processes with the distribution of natural frequencies corresponding to the distribution of Fibonacci numbers adequately reflects the dynamics of its financial characteristics.

2. The presence of various types of resonant impact on the stock market, including parametric and stochastic, sets the task of identifying effective mechanisms to maintain its financial stability and efficiency of investments in financial instruments.

3. Simulation modeling has shown that when the amplitude of the harmonic of the information signal increases at some level, there is a sharp increase in the level (amplitude) of the corresponding harmonic of the financial indicator, which implies the presence of stochastic resonance.

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УДК 519.25
JEL C32,C53,C58,C81

BUILDINGS ELECTRICITY CONSUMPTION MODELING USING ARTIFICIAL INTELLIGENCE SYSTEMS

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Abstract.
Intelligent technologies of energy saving and energy efficiency are a modern large-scale global trend in the development business. The demand for smart buildings is growing not only in the world, but also in Russia, especially in the market of construction and operation of large shop-ping, entertainment and business centers. In this paper the gradient boosting algorithm is used to simulate energy consumption. On its base the method of modeling the daily energy consumption profile is proposed and a numerical algorithm is developed. Data on the energy consumption of 380 commercial buildings were used to assess its efficiency. The computer experiments showed that the use of the gradient boosting model improved the prediction accuracy in more than 80 percent of cases compared to the куп algorithms..

Keywords: smart buildings, artificial intelligence systems, gradient boosting, neural nets.

1. Introduction

The development of intelligent networks in manufacturing, finance and services creates new opportunities for the development and application of effective methods of machine learning and data analysis. Smart technologies for collecting, recording and monitoring data on energy consumption create a huge amount of data of different nature. These data can be used for optimal network management, improving the accuracy of the forecasting load, detection of abnormal effects of power supply (peak load conditions), the formation of flexible price tariffs for different groups of consumers [1, 2, 3]. One of the most important issues in this area is to predict the power load consumption as accurately as possible. Consumption has rather complicated stochastic structure which is difficult for modeling and prediction. Nevertheless, when different methods of aggregation are applied to the group of consumers having similar statistical characteristics of time series of power consumption, it is possible to count on considerable progress in the solution of objectives. However, in order to improve the accuracy, our goal is to investigate the possible benefit of combining clustering procedures with forecasting methods. We have used several known approaches such as Holt-Winters forecasting, ARIMA model, Support Vector Regression and some others. The cluster analysis can also be beneficial for finding the patterns in data [3, 4].

2. Machine learning algorithms applications for energy consumption modeling

The problems of application of clustering methods to the time series of electricity consumption are mainly in high dimension and high noise level of the data, which can be solved with the use of machine learning methods. In the paper the comparative analysis of two approaches of classification of consumers is carried out: on the basis of clustering and without it (aggregation). Our cluster approach has three steps: the first step is to normalize the data and calculate the energy consumption model for each consumer. In the future, the study uses four different models based on the representation of time series, which serve as inputs to the clustering method. The second stage consists of calculating the optimal number of clusters for the given time series representation and the selected data learning window. The third stage is clustering and aggregation of consumption within clusters. For each cluster, the forecast model is trained and the forecast for the next period is run. Then the forecasts are aggregated and compared with the real consumption data. Next, we construct a forecast for day-ahead for the received representations of the clusters using the above-described prediction methods.

2.1 Modeling of the energy consumption time series

Time series X is an ordered sequence of n real variables

$$\boldsymbol{X} = (\boldsymbol{x_1}, \boldsymbol{x_2}, \dots, \boldsymbol{x_n}), \boldsymbol{x_i} \in \boldsymbol{R} \quad (1)$$

The main reason for time series presentation using is a significant decrease in the dimension of the analyzed data, respectively, reducing the required memory and reducing the computational complexity. Four different model-based representation methods were chosen: (a) Robust Linear Model (RLM), (b) Generalized Additive Model (GAM), (c) Holt-Winters Exponential Smoothing, and (d) Kalman filter. The first presentation is based on a robust linear model (RLM). Like other regression methods, it is aimed at modeling the dependent variable by independent variables

$$\boldsymbol{x_i} = \boldsymbol{\beta_1 u_{i1}} + \boldsymbol{\beta_2 u_{i2}} + \dots + \boldsymbol{\beta_s u_{is}} + \boldsymbol{\varepsilon_i} \quad (2)$$

where i = 1, ..., n, x_i– is energy consumption, $\beta_0, \beta_1, \dots \beta_s$ are the regression coefficients, u_{i1},..., u_{is} are the binary variables, ε_i is a white noise. Extensions for regression model (2) are generalized additive models (GAM) [7]

$$\boldsymbol{E(x_i)} = = \boldsymbol{\beta_0} + \sum_{l=1}^{K} \boldsymbol{\beta_i f_s(u_{is})}, \quad (3)$$

where f_l are B-splines [14]. Model parameters (3) can be evaluated by the method of gradient descent.

2.2. Cluster analysis for energy consumption in smart grids

Usually, utility divided their customers in industrial, commercial and residential sectors based on some fixed information like voltage level, nominal demand etc. Based on this approach a set of customer class load profiles were defined and each user was assigned to one of these classes. However, this is still a fundamental problem, and the procedures for dealing with customers segmentation need to be revised greatly. Firstly, the consumption data of customers, those who have installed smart meters, are now accessible. Secondly, the time period of measurement is not restricted and usage information for some successive years is available. These two factors affect the dimensionality of data which is not comparable with previously used data sets. Finally, as the data is continuously recorded, it can have possible applications for real-time operation and management of power systems. All of these factors emphasize the use of new clustering methods for electricity consumption characterization.

For classification consumers into groups (clusters), we used the centroid based clustering method K-means [9]. K-means is a method based on the mutual distances of objects, measured by Euclidean distance. The advantage over conventional K-means is based on carefully seeding of initial centroids, which improves the speed and accuracy of clustering. Before applying the K-means algorithm the optimal number of clusters k must be determined. For each representation of a data set, we have determined the optimal number of clusters to k using the internal validation rate Davies-Bouldin index [10,11]. The optimal number of clusters ranged from 10 to 15. It works as follows. Let d(x) denote the shortest Euclidean distance from a data point x to the closest centroid we have already chosen. Choose an initial centroid K_1 uniformly at random from X. Choose the next center $K_i = \hat{x} \in T$, selecting with probability $d(\hat{x})^2 / \sum_{x \in X} d(x)^2$. Repeat previous step until we have chosen a total of K centers. Each object from data set is connected with a centroid that is closest to it. New centroids are then calculated. Last two steps are repeated until classification to clusters no longer changes. Euclidian distance measure is one of the best measures for comparison of time series of electricity load because of its stronger dependence on time. In each iteration of a batch processing, we have automatically determined the optimal number of clusters to K using the internal validation rate Davies-Bouldin index.

2.3. Energy consumption time series forecasting

We used three methods to improve forecasting energy consumption time series: Support Vector Regression (SVR), a method based on a combination of STL decomposition, Holt-Winters exponential smoothing and ARIMA model [8]. Seasonal decomposition of time series based on LOESS regression is a method, which decomposes seasonal time series into three parts: trend, seasonal component and remainder (noise) [11]. For the final three time series any of the forecast methods is used separately, in our case either Holt- Winters exponential smoothing or ARIMA model. The original idea of random decision forests was created by Ho [4]. Also Random Forest (RF) algorithm is suitable for classification and regression. The method constructs the large number of decision trees at training time. Its output is the class that is the mode of the classes (classification) or mean prediction (regression) of the individual trees. Extreme Gradient Boosting (XGB) is an efficient and scalable implementation of gradient boosting framework by Friedman [8]. Bagging (Bagg) predictors generate multiple versions of predictors and use them for determination an aggregated predictor. The aggregation is an average of all predictors. The bagging method gives substantial gains in accuracy, but the vital element is the instability of the prediction method. In the case that perturbing the learning set has significant influence on the constructed predictor, the bagging can improve accuracy.

3. Computer experiments for customer energy consumption

We performed several computer experiments to evaluate the profit of using clustering procedures on four time series representation methods for one day ahead forecast. Our testing data set contains measurements from customers of Central Russia Region [12,13]. Each forecasting method was evaluated on 5 datasets; 4 datasets are clustered with different representation methods (Median, HW, GAM, RLM) and aggregated electric load consumption (Sum). The following conclusions can be derived from our computations. Optimized clustering of consumers significantly improves accuracy of forecast with forecasting methods SVR, Bagging, XGB. Despite this, clustering with STL+ARIMA, RF, R-Tree does not really improve accuracy of forecast. Three robust representation methods of time series Median, GAM and RLM performed best among all representations, while HW was the worst in most of the cases, because robust representations are stable and less fluctuate. The best result of all cases achieved by Bagging with optimized clustering using GAM representation with mean daily MAPE error under 3,17% [14].

4. Conclusion

Improving the accuracy of forecasts of electricity consumption is a key area in the development of intelligent energy grids. To implement this problem, we used machine learning methods, namely cluster analysis. The main purpose of this paper is to show that the application of the clustering procedure of consumers to the representation of time series of energy consumption can improve the accuracy of their forecasts for energy consumption. Robust linear model, generalized additive model, exponential smoothing and median linear filter were used as such representations. In this paper we applied a modified K-means++ algorithm to more accurately select centroids and the Davis-

Boldin index to evaluate clustering results. Numerical experiments have shown that the methods of forecasting such as LOESS+ARIMA, SVR, RF, Bagging considered in the paper are more effective for improving forecast accuracy if used together with clustering. Prediction methods performed the best reliable representations of RLM, GAM, and median filter. The most accurate prediction result is obtained by Bagging with the GAM presentation. Among the perspective applications of clustering for smart grids are benefits for tariff design, compilation smart demand response programs, improvement of load forecast, classifying new or non-metered customers and other tasks.

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THE ROLE OF SOFT MEASUREMENTS IN CREATING THE TECHNOLOGICAL BASIS OF THE DIGITAL ECONOMY

PROKOPCHINA S. V.

Abstract. The paper proposes the concept of soft measurements as one of the promising directions of creating a methodological framework and technological base of the digital economy. Within the framework of this concept, soft measurements are implemented on the basis of the regularizing Bayesian approach (RBA) and Bayesian intelligent technologies (BIT). The basic principles and properties of soft measurements important for solving practical problems of the digital economy are formulated. The proposed concept of professional intelligent networks based on intelligent jobs specialists. The examples of the developed applied systems of soft measurements focused on the functioning in the conditions of information uncertainty are given.

Key words: soft measurements, regulatory Bayesian approach, digital economy.

Artificial intelligence is one of the five basic directions that make up the technological basis of the digital economy [1]. Its methods and means are designed to provide full-scale solutions to new economic problems that arise in the formation of the information society. As noted in [2]," the formation of the digital economy is the result of technological development, and its theory is the fruit of the theory of information society and information economy "(knowledge economy). The so-called "super-intelligent" or "society 5.0" (in the terminology proposed by Japanese scientists) is formed on the wave of the fourth industrial revolution, which is based on digital technologies. Post-industrial society (in the terminology of American sociologists D. Riesman and D. bell), part of which is the digital economy, is characterized primarily by the fact that it is the main driving force of development are knowledge-intensive.

The generation of knowledge, as the main resource of the digital economy and society as a whole, is determined by the efficiency of intellectual methods and means used to obtain them. Advanced 5G telecommunications technologies, as noted in various articles of mobile companies, will provide a significant number of benefits for the economic development of society. But at the same time, the main issue is not so much the question of how fast to transmit information, as the question of the content of such programs, which determines the essence and effectiveness of the socio-economic tasks, the question of "compression" of data to the level of useful knowledge. This knowledge can be transferred over the network many times faster than the data, which will reduce the transmission speed requirements.

For the digital economy, as for any economy, it is important not only and not so much transactions as the generation of effective evaluation and management decisions. It is the problem that solves the methods and means of artificial intelligence, which include methods and means of Bayesian intelligent technologies and soft measurements.

Conceptually, [3] soft measurements are fuzzy, multivariate, conditional (the measurement result is reliable within the framework of certain experimental conditions) measurements with soft logic of forming a solution to the measurement problem and a complete metrological justification of the measurement results .If the criterion for the choice of measurement solutions is the Bayesian criterion for the minimum average risk of solutions, such measurements are called soft Bayesian measurements (MBI). They are based on RBA and BIT. Soft measurements are designed to measure the properties , states, dynamics, trends, characteristics of complex objects, processes and systems in terms of their continuous development and active interaction with the environment [3], Almost all real modern economic systems can be attributed to complex objects operating under conditions of uncertainty under the powerful influence of environmental factors. So the concept of soft measurement is adequate to the nature of economic systems.

The use of methods and means of soft measurements proved to be effective in solving many basic problems of the modern economy, some of them will be given below, others are covered in the works of the author and his scientific school, as the results of completed projects in Russia and abroad. In fact, these works are convincing examples of solving the problems of the main directions of the digital economy. Currently, the creation of data collection and transmission systems, the solution of economic problems based on the ideas and means of the digital economy, its "digitalization" is gradually beginning in almost all regions of the Russian Federation. First of all, these are the tasks of organizing public services, large-scale industry, energy and transport.

According to information from various sources, in particular, [1,2], the most advanced in these matters are Moscow and Moscow region, St. Petersburg and Leningrad region, Kazan and Innopolis in Tatarstan and other regions.

In fact, the "digitalization" of the regional economy began not with the introduction of this term, but much earlier and not only in these types of economic activities. So at the end of 80-ies of the last century was put into operation intelligent system of accounting and evaluation of the state of wild animals in Russia, which was designed not only to collect information on the number of animals of different populations, but above all to make optimal management decisions to ensure the safety of species. In those difficult economic years, the decisions of the system largely contributed to the adoption of urgent measures to restore the number of wild animals, such as elk and wild boar populations, for which hunting licenses were banned for several years in some regions. In 1991, in the North-Western region of the Russian Federation (Sevzaprybvod), a fisheries management system was put into operation for 9 regions of the Russian Federation, which collected and analytically processed information on fish resources and transmitted it through the network to the center for management decisions and for scientific purposes.

In the period from 1997 to 2002, Lentransgaz established a network of environmental audits of oil and gas industry enterprises for 9 regions of the Russian Federation on the basis of international and Russian standards.

On the basis of the RBA methodology, intelligent utilities networks have been created, which are designed to monitor the state of all infrastructure components of housing and communal services in real time, as well as to generate management decisions. Figure 1 presents a cognitive scheme for assessing the state of the water supply system in an urban area. All these systems were essentially systems of the digital economy, as they solved the problem of digitalization of economic entities. Methodological and technological bases for these systems were the technology and tools and a BIT that have been implemented on platforms of "environmental analyst" and "Infoanalyst" in the form of Intelligence working stations (IWS) with a variety of professional functions [3].

Currently, 28 different types of IWS (licensed and patented software systems) have been created, the configuration of which in accordance with the purpose of the task can be organized almost any professional management network.

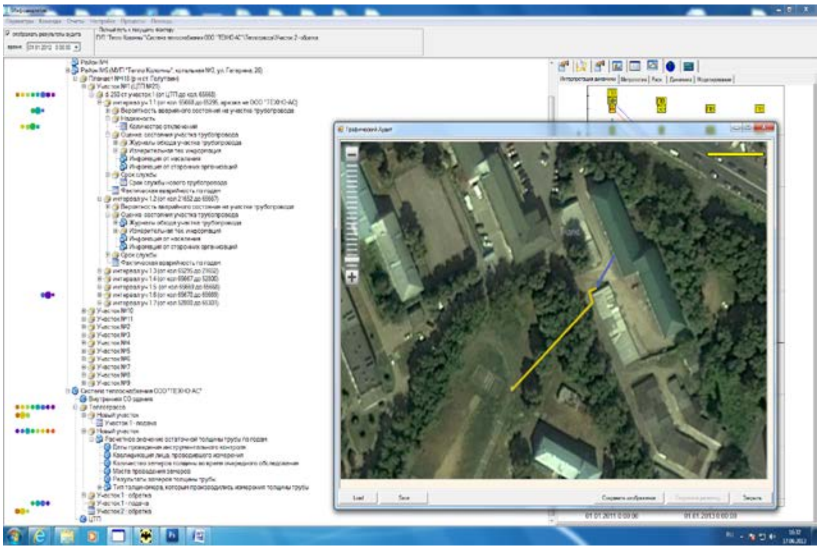
The concept of such networks is developed on the basis of the methodology of cognitive Bayesian intelligent networks (KBIS) within the methodology and technologies of RBA and BIT, including soft measurements. A detailed description of the methodology and examples of KBIS implementation is given in a number of works of the author, for example in [3]. The essence of this concept is that the subject, the specialist is included in the contour of the measuring and analytical network as a source and receiver of information, as well as a device of intellectual information processing.

The use of Workstations IWS allows specialists to achieve several objectives. The main goal is to organize professional activities and related processes on the basis of intellectual processing of information from various industrial and external sources. To do this, a network of IWS, focused on this field of activity.

The second goal is the qualification of professional knowledge of specialists included in the circuit of such a network. Each IWS is capable to certify the decision of the expert at any time that provides an opportunity of metrological justification of knowledge of experts on certain criteria and requirements, and also creation of a hypercube of qualimetric scales of experts as a whole for all network.

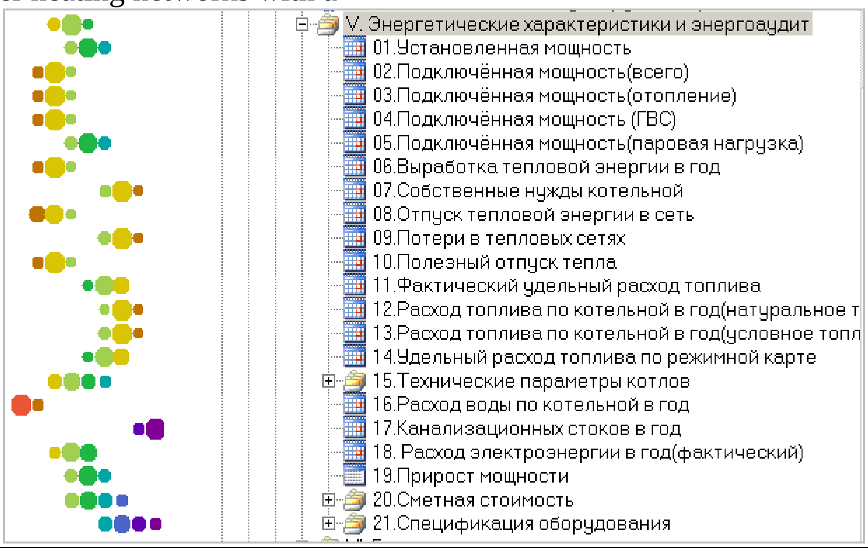
The third goal, which is achieved by using the IWS network, is continuous self-education and training of specialists.

Figure 1 shows an example of using IRM networks to control thermal energy in its distribution over heating networks with a cognitive map of the States of the sites and devices of the heat network.



Rice.1. An example of the recovery route of the water supply network on the basis of LIMB

Figure 2 shows an example of using IRM networks to control thermal energy in its distribution over heating networks with a cognitive map of the States of the sites and devices of the heat network.



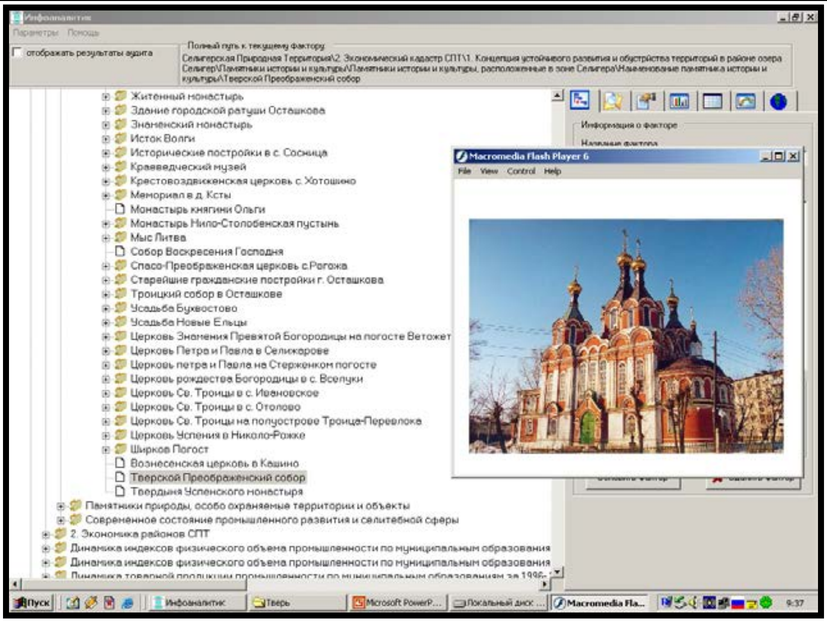


Figure 3 shows a model for determining the socio-humanitarian potential of the Russian regions

Based on the methodology of RBA with the use of the system "Infoanalyst", which was developed for the project of the Accounts Chamber of the Russian Federation.

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JEL C68

ANALYSIS OF RUSSIAN ECONOMIC DEVELOPMENT SCENARIOS USING COMPUTABLE GENERAL EQUILIBRIUM MODELS

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***Abstract*.**
Introduction. The paper considers a number of scenarios for the development of the Russian economy using the apparatus of computable general equilibrium models in order to obtain a quantitative assessment of hypothetical economic policy measures.
Purpose: to analyze the possibilities of using the CGE modeling apparatus for describing the national economy and to build a simple CGE model in the RunGTAP environment.
Methods. To build a three-sector model with three factors of production use GTAP 8.1 (free version) containing the statistical database of 2007 is taken.
Results. On the basis of the social accounts matrix data, sectoral disaggregation of GDP was carried out, the share of various production factors in the sectors was shown.
It is shown that subsidizing the manufacturing will positively affect the growth of the national economy. Effects of a 10% output subsidy in Russia manufacturing is an increase in the output of manufactured goods by 5.28%, demand for labor by 5.88%, and GDP by 0.56%
It is calculated that the welfare of Russia will increase by $ 157.85 million if all subsidies and tariffs for domestic agricultural production, as well as export and import duties on agricultural products are canceled.
Discussion. Further development of the research topic can be carried out in at least two directions: through scenario variations of model experiments in various areas of public policy; and also by searching for opportunities for a quantitative assessment of the development of the Russian economy based on current-based statistical data.Text Text

Keywords: Computable general equilibrium models, CGE models, SAM, Russian economy development

INTRODUCTION

There are many factors affecting the economic development of a country. The multidirectional and sometimes unpredictable nature of their impact on the economy requires state managers to make more thoughtful decisions based on an analysis of the consequences of the reforms being carried out, including using economic-mathematical models that work on the principle of “what happens if ... ".

In this connection, studies aimed at systemic modeling of the economy in order to obtain a quantitative assessment of government decisions are of particular relevance.

The variety of existing economic models is enormous. In this paper, a computable general equilibrium model (CGE) is considered. This model describes the motives and behavior of all producers and consumers in the economy and the connections between them.

CGE modeling involves conducting an experiment, that is by changing the exogenous variable ("shock") in the model creates disequilibrium. For example, an increase in import tariffs will change the economy — consumers are likely to buy less imports and more domestic products, and domestic firms are likely to increase their production to meet increased demand.

CGE models are designed to create a numerical basis for empirical analysis and evaluation of economic policy. So, for example, with the help of CGE modeling, it is possible not only to make recommendations on changes in tax rates, import tariffs, etc., but to quantify these changes.

General equilibrium models allow us to estimate the impact of economic shocks on all sectors of the economy at once. For example, using CGE modeling, one can trace the effect of changes in tax legislation not only on a particular sector, whose products will be taxed in a new way, but also on the economy as a whole.

There is a fairly extensive practical experience in implementing CGE modeling in various countries of the world [1, 2]. This class of models is an effective tool for assessing scenarios of economic development with the change of various economic parameters.

The main hypothesis of the study: Quantitative estimates of the effects of state regulation of the Russian economy can be obtained using the CGE modeling apparatus.

METHODS

To date, the most common software environment for building and analyzing CGE models is a constantly evolving, with current technical and educational support, the GTAP project (Global Trade Analysis Project). GTAP is a comparative static global model of general equilibrium, with the possibility of aggregation and disaggregation of sectors, factors of production, countries. In this work, CGE modeling of the Russian economy was carried out in this package.

RESULTS AND DISCUSSION

In this work, CGE modeling was carried out in several stages.

At the first stage, a matrix of social accounts for Russia was constructed.

For this, 134 countries are grouped into 2 groups: Russia and the Rest of the World, 57 sectors are combined into 3 sectors (agriculture, industry and services), 5 factors of production are grouped into 3 factors (labor, land, capital).

Based on the social accounts matrix (SAM matrix) calculated in the GTAPAgg package, the GDP was calculated (including by industry, production factors), the value of which completely coincided with the data of the Russian Statistical Committee (table 1).

Table 1

GDP structure based on SAM matrix of Russia

	GDP - $US billions		Factor shares in industry cost			Industry shares in factor employment		
	Industry GDP	Industry shares in GDP	Land	Labor	Capital	Land	Labor	Capital
Agriculture	72	6	14	32	9	100	9	3
Manufacturing	462	36	0	11	23	0	21	32
Services	765	59	0	25	32	0	70	65
Total	1 300	100	N/A	N/A	N/A	100	100	100

Source: author's calculation

In table 1 are shown that the predominant sector in the structure of GDP (according to 2007 data) was services (59%), the manufacturing was 36%.

The second stage of the simulation is the construction of a computable general equilibrium model in the RunGTAP software product.

In this work, the modeling of the development scenarios of the Russian economy was carried out in two sectors: manufacturing and agriculture. In manufacturing was considered how the introduction of subsidies for manufactured output will affect the economy as a whole, and in agriculture, and various options for changing tax tariffs and export duties are modeled in agriculture.

It is shown that subsidizing the manufacturing will positively affect the growth of the national economy. Effects of a 10% output subsidy in Russia manufacturing is an increase in the output of manufactured goods by 5.28%, demand for labor by 5.88%, and GDP by 0.56%

Anderson and Martin concluded that the full removal of all import tariffs, export subsidies, and domestic agricultural subsidies would boost global welfare by nearly $300 billion [3].

Let us check how the elimination of tariffs for Russia, which represents a small open economy, can change global welfare. In this work, a model experiment was carried out, consisting in decomposing the hypothetical reforms of world trade into 4 blocks:

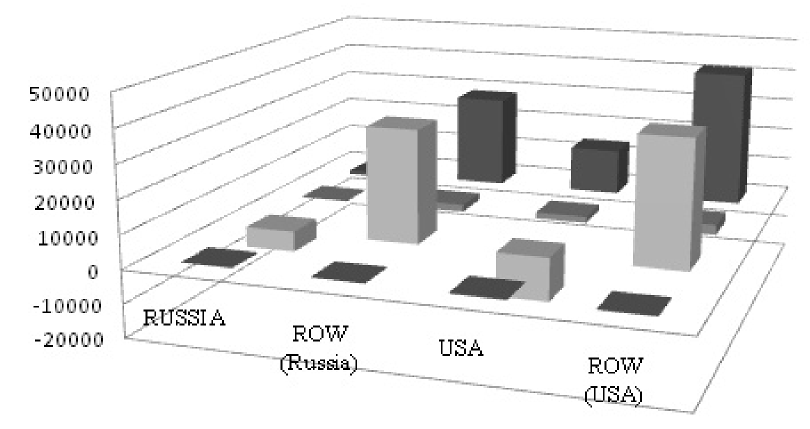
1. Agricultural Policy Reform: eliminate agricultural domestic production subsidies and tariffs and export subsidies on its agricultural trade with Rest of World (ROW)- *Scenario 1.*

2. Nonagricultural Policy Reform: eliminate tariffs and export subsidies on its manufacturing trade with ROW - *Scenario 2.*

3. ROW Agricultural Policy Reform: eliminate ROW agricultural production subsidies and tariffs and export subsidies on its global agricultural trade - *Scenario 3.*

4. ROW Nonagricultural Policy Reform: eliminate ROW tariffs and export subsidies on its global manufacturing trade.- *Scenario 4.*

The result of the implementation of the 4 scenarios is presented in comparison with the US economy, which is a large open economy (see Figure. № 1).



	RUSSIA	ROW (Russia)	USA	ROW (USA)
Scenario 1	157,85	-137,42	-372,34	-244,78
Scenario 2	-6221,29	34180,31	-13280,5	37825,43
Scenario 3	-115	2170,25	1929,37	3102
Scenario 4	-1276,48	28523,2	14156,15	41759,31

Fig. 1 **Changing the welfare of the world**

Source: author's calculation

For Russia, the most favorable scenario is *Scenario 1*. In this case, Russia's welfare will increase by $ 157.85 million.

CGE modeling in the RunGTAP software product undoubtedly has many undeniable advantages, however, it is not without flaws.

The advantage can be attributed to the fact that CGE modeling in the RunGTAP software product allows to evaluate the effect of changes in various economic parameters. With the help of CGE modeling, it is possible not only to give recommendations on how to change various parameters of a model, but also to quantify the results of these changes. Such a simulation can be carried out for any of the 134 countries included in the model.

The disadvantages include the fact that the freely distributed RunGTAP package contains a limited set of options, with a fairly high level of agregistration, which does not allow a detailed study of the consequences of possible changes in the sub-sectors. In addition, the study with 2007-year data loses its relevance and serves only as a basis for further research related to the study of the possibility of constructing and numerically solving the CGE model using updated data.

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JEL D83

REPRESENTATION OF TOLERANCE RELATIONS VALUED IN COMPLETE HEYTING ALGEBRAS AND GRANULATION OF FUZZY INFORMATION

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Abstract. Tolerance relations with an estimate of the intensity in a complete distributive lattice are considered. Given a tolerance relation we construct the space of fuzzy attributes and embed the original space of tolerance in the space of classes of tolerance. The connection of the described construction with the lattices of fuzzy concepts is established. It is proved that any tolerance relation with an estimate in a complete distributive lattice can be represented as a composition of the object-attribute relation and its inverse. The example shows that the above representation may not be unique, even with the minimum requirement. The structure of minimal representations is rather complicated and requires further research.

Keywords: tolerance relation; distributive lattice; knowledge representation; information granules

The paper deals with tolerance relations valued in the complete distributive lattice (Heyting algebra). We build a set of fuzzy attributes and relate objects with these attributes. Under this construction the initial tolerance relation can be treated as the tolerance relation generated by the relation between objects and attributes. The incentive for writing the paper served researches in two areas of modern science about data. On the one hand, this is a formal concept analysis in its fuzzy version (see [1]). On the other hand, this is a fuzzy clustering and information granules (see [2], [3]).

From the point of view of traditional logic, each concept is characterized by its volume (all objects belonging to the concept) and intent (all attributes shared by those objects). A mathematical model of formal concept was proposed in the 1980s (see [4], [5]). Then the theory of formal concepts was developed both within the framework of traditional mathematics, and in the context of many-valued logics and category theory [6], [7], [8], [9].

The notion of formal concept can be formalized within the framework of the general theory of binary relations. A triple (G, M, I) is called a formal concept, where G is a set of objects, M is a set of attributes, and $I \subseteq G \times M$ is a binary relation. Formal concept generates a Galois connection of subsets of G with subsets of M. Given $A \subseteq G$ let $A' \subseteq M$ be the set of all attributes that are related to all objects in A. Similarly, given $B \subseteq M$ let $B' \subseteq G$ be the set of all objects that are related to all attributes in B. A formal concept is defined as a pair (A, B) such that $A \subseteq G$, $B \subseteq M$ and $A = B'$, $A' = B$ hold. The set A is called the extent while B is called the intent of the concept (A, B).

Formal context (G, M, I) generates a similarity (tolerance) relation $T = I \cdot I^{-1}$ on G. Objects x and y are related by T if x and y share at least one common attribute. If the intensity of the relationship is estimated in a classical binary scale, any tolerance relation can be represented in this form [10] (see also [11]).

In other words, for an arbitrary tolerance relation R on the set of objects X, one can specify a formal context (X, Y, S) such that $R = S \cdot S^{-1}$. In the present paper it is shown that this result can be extended to the case when the relations are estimated in a logical scale, which is a complete distributive lattice (Heyting algebra). Thus, the fuzzy tolerance relation is immersed in a context that allows constructing concepts (information granules).

In what follows we suppose that $\boldsymbol{L} = \langle L, \wedge, \vee, 0, 1\rangle$ is a complete distributive lattice. It will play the role of logical scale.

By an **L**-fuzzy set we mean a fuzzy set with membership values in L. Thus **L**-fuzzy set A is defined by its membership function $\mu_A: X \to L$. If it is clear which logical scale is involved, we will simply talk about fuzzy subsets. Sometimes instead of $\mu_A(x)$ we write $A(x)$ for short.

For $\alpha \in L$ we denote by A^α the α-cut of A that is $A^\alpha = \{x \in X \mid A(x) \geq \alpha\}$. If $\beta \geq \alpha$ then $A^\beta \subseteq A^\alpha$. It can be easily seen that $A(x) = \sup\{\alpha \mid x \in A^\alpha\}$. Conversely, let $(A^\alpha)_{\alpha \in \mathrm{L}}$ be a family of sets such that $A^\beta \subseteq A^\alpha$ for $\beta \geq \alpha$ and $A^0 = X$. Then there is a fuzzy set A such that A^α is an α-cut for all $\alpha \in L$. The membership function of A is defined by $A(x) = \sup\{\alpha \mid x \in A^\alpha\}$.

Fuzzy sets (with base X) are naturally ordered by cuts:

$$A \subseteq B \text{ iff } A^\alpha \subseteq B^\alpha \text{ for all } \alpha \in L.$$

It can be easily seen that $A \subseteq B$ if and only if $A(x) \leq B(x)$.

Fuzzy relations on X are fuzzy subset of $X \times X$. Fuzzy relation R is defined by its membership function $\mu_R: X \times X \to L$.

We say that R is

-reflexive if $R(x, x) = 1$ for all $x \in X$,

-symmetric if $R(x, y) = R(y, x)$ for all $x, y \in X$,

-transitive if $R(x, y) \wedge R(y, z) \leq R(x, z)$ for all $x, y, z \in X$.

Given fuzzy relation R it is reflexive, symmetric or transitive if so are all α-cuts R^α considered as crisp relations on X.

We say that R is a tolerance relation if R is reflexive and symmetric. If a tolerance relation R is transitive then R is an equivalence relation.

Let $R: X \times X \to L$ be a tolerance relation. Following [12] we say that fuzzy subset K is a pre-class of tolerance if $K^\alpha \times K^\alpha \subseteq R^\alpha$ for all $\alpha \in L$. Pre-class K is said to be a class of tolerance if K is maximal pre-class with respect to inclusion.

Lemma 1. Any pre-class of tolerance is included in some class of tolerance.

Proof. We show that any chain of pre-classes has upper bound and then apply Zorn's lemma. Let $(K_i)_{i \in I}$ be a chain of pre-classes. We define fuzzy set K putting $K^\alpha = \cup_{i \in I} K_i^\alpha$ for $\alpha \in L$. Obviously K is an upper bound of $(K_i)_{i \in I}$ being considered as a fuzzy set. We have to show that K is a pre-class. Let $x, y \in K^\alpha$. Then we have $x \in K_i^\alpha$, $y \in K_j^\alpha$ for some $i, j \in I$. We may suppose that $K_i^\alpha \subseteq K_j^\alpha$. Then $(x, y) \in K_j^\alpha \times K_j^\alpha \subseteq R^\alpha$.

Lemma 2. For any $a \in X$ there exists a pre-class of tolerance K such that $K(a) = 1$.

Proof. It's enough to put $K^0 = X$ and $K^\alpha = \{a\}$ for $\alpha > 0$.

Using lemma 1 and lemma 2 we get the following theorem..

Theorem 1. For any $a \in X$ there exists a class of tolerance K such that $K(a) = 1$.

Lemma 3. Given $a, b \in X$ we have

$$R(a, b) = \sup_K(K(a) \wedge K(b)),$$

where K varies over the set of classes of tolerance.

Proof. First, note that there exists a pre-class K' such that $K'(a) \wedge K'(b) \geq R(a, b)$. It suffices to put $K'^\alpha = \{a, b\}$ if $\alpha \leq R(a, b)$ and $K'^\alpha = \varnothing$ otherwise. Further, by lemma 1 there exists a class of tolerance K such that $K' \subseteq K$. Then $K(a) \wedge K(b) \geq R(a, b)$ so $\sup_K(K(a) \wedge K(b)) \geq R(a, b)$.

Conversely, Let K be a class of tolerance and $K(a) \wedge K(b) = \alpha$. Then $(a, b) \in K^\alpha \times K^\alpha$. So $(a, b) \in R^\alpha$ where it follows that $R(a, b) \geq \alpha$. Therefore $R(a, b) \geq \sup_K(K(a) \wedge K(b))$.

Denote by Y the set of classes of tolerance. For $K \in Y$ and $a \in X$ we put $S(a, K) = K(a)$. Using the composition of $\boldsymbol{L}$-fuzzy relations we get

$(SS^{-1})(a, b) =$
$= \sup_K(S(a, K) \wedge S^{-1}(K, b)) = \sup_K(K(a) \wedge K(b)).$

In virtue of theorem 1 and lemma 3 we have the following theorem.

Theorem 2. For any $\boldsymbol{L}$-fuzzy tolerance relation R there exists $\boldsymbol{L}$-fuzzy relation S such that

$$SS^{-1} = R.$$

$\boldsymbol{L}$-fuzzy relation S can be considered as an object-attribute relation. Representation $SS^{-1} = R$ is not unique. It is natural to require S being minimal, i.e. no proper $\boldsymbol{L}$-fuzzy subset S' of S satisfies equation $R = S'S'^{-1}$. In the case when the tolerance relation is transitive, and, therefore, is an equivalence relation, the attribute space and the object-attribute relation are uniquely determined up to natural isomorphism. It should be noted that the attribute space in this case may happen to be a set with $\boldsymbol{L}$-fuzzy equality and not a set with $\boldsymbol{L}$-fuzzy membership (see [13], [14]).

If a tolerance relation is not transitive minimal attribute spaces may differ. We illustrate it by the following example. Let $X = \{x, y, z\}$, and let $L = \{0, 1, u, v\}$ be a Boolean algebra. We define R by $R(x, y) = 1$, $R(y, z) = 1$, and $R(x, z) = 0$. First let Y be a two-element set, $Y = \{a, b\}$. Put $S(x, a) = S(y, a) = S(y, b) = S(z, b) = 1$ and $S(x, b) = S(y, a) = 0$. It can be easily seen that $SS^{-1} = R$ and S is minimal. On the other hand let $Y = \{k, l, m\}$ be a three-element set and $S(y, k) = S(y, l) = S(y, m) = 1$, $S(x, m) = S(z, k) = 0$, $S(x, k) = S(z, l) = u$, $S(x, l) = S(z, m) = v$. It can be easily checked that $SS^{-1} = R$ and S is minimal.

Generally speaking, a set of minimal attribute spaces can have a complex structure. Its study is the subject of further research.

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JEL 338.27

INSTRUMENTAL ESTIMATION OF SYSTEMS OF SIMULTANEOUS EQUATIONS: INTERRELATION OF METHODS

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Abstract. The article is devoted to the interrelation between the methods of estimating the parameters of simultaneous equations. The Simultaneous equations is used to model complex economic objects, and is a system of interdependent equations in which the variables on the right of the regression equations are determined simultaneously with the dependent variables. This raises the problem of endogeneity, and leads to biased and untenable evaluations. To solve the problem of endogenous regressors, a whole arsenal of special methods has been developed: the method of instrumental variables (*IV*), the indirect least squares method (*ILS*), the two-step least squares method (2*SLS*) , three-step least-squares method (3*SLS*). In the article, on an empirical example, the relationship between 2*SLS* and *IV*, *ILS* and 2*SLS*, *ILS* and *OLS*- estimator with constraints on structural parameters is shown. Equivalence of point estimates of parameters and their autocovariance matrices is shown.

Keywords: system of simultaneous equations, instrumental variables method, parameter constraints, parameter estimates, autocovariance matrix of parameter estimates.

To describe complex economic objects in econometrics, systems of equations are used: systems of independent equations, systems of seemingly unrelated equations, systems of simultaneous equations (SSE) in which the same variables in some equations are endogenous, and in others - regressors. This feature of the SSE causes the problem of endogeneity of regressors and the inapplicability of the OLS to the estimation of the parameters of the structural form of the model (the result of the formalization of the studied patterns)

$$A \cdot Y_t + B \cdot X_t = V_t \ , \qquad (1)$$

where A, B are matrices of structural parameters, Y_t — $(m \times 1)$ - is a vector column of values of endogenous variables, X_t — $(k \times 1)$ - is a vector column of values of predefined variables, V_t — $(m \times 1)$ - is a vector of random disturbances column, t is an observation number. To the reduced form of the SSE (the result of the representation of the vector of endogenous variables in explicit form):

$$Y_t = MX_t + U_t, \ \ M = -A^{-1}B,$$
$$U_t = A^{-1}V_t, \qquad (2)$$

OLS for parameter estimation is applicable, however, specification (2) during the transformation loses some of the relationships between variables. Special econometric methods have been developed for estimating the parameters of the SSE: the indirect least squares method (*ILS*), the two-step least squares method (2*SLS*) , three-step least-squares method (3*SLS*), which solve the problem of endogeneity of variables arising from the evaluation of structural parameters of the system, and are varieties of the instrumental variable estimator (*IV*-estimator). The paper discusses the relationship of methods for evaluating the parameters of the SSE on an empirical example of the model of the enterprise's economic activity [3]:

$$\begin{gathered} Y_1 = a_{10} + a_{12}Y_2 + b_{11}X_1 + v_1, \\ Y_2 = a_{20} + a_{23}Y_3 + v_2, \qquad (3) \\ Y_3 = a_{30} + a_{32}Y_2 + b_{32}X_2 + v_3. \end{gathered}$$

The vector of endogenous variables of the system (3) includes the elements: Y_1-

production volume (in thousands of pieces); Y_2 - number of employees (in thousands of people); Y_3 - the cost of fixed assets (in million zlotys), the vector of exogenous variables: X_1 - used raw materials (in thousand tons); X_2 - investments (in millions zlotys). Data for 11 years are shown in table1.

Table 1

Data for consecutive 11 years.

t	Y_1	Y_2	Y_3	X_1	X_2	*t*	Y_1	Y_2	Y_3	X_1	X_2
1	46	3,4	24	2,3	1,0	7	57	3,9	28	3,4	1,1
2	48	3,4	25	2,4	1,1	8	59	4,0	29	3,4	1,3
3	49	3,5	25	3,2	1,1	9	59	4,3	31	3,5	1,5
4	52	3,7	26	3,4	1,0	10	60	4,5	33	3,5	1,6
5	52	3,8	27	3,4	1,1	11	61	4,8	35	3,6	1,7
6	54	3,8	27	3,4	1,2						

Source:[3].

To solve the problem of endogeneity inherent in the SSE, and leading to biased and inconsistent estimates, the method of instrumental variables is used. As tools that replace regressors that correlate with a perturbation, variables are used that strongly correlate with this regressor and that do not correlate with a perturbation of the model. Generalized evaluation of the method of instrumental variables GIV-estimator [4]:

$$\hat{\beta}_{МИП} = \left(X^T P_Z X\right)^{-1} X^T P_Z Y, \qquad (4)$$

where $P_Z = Z\left(Z^T Z\right)^{-1} Z^T$ is the projector on the subspace of instrumental variables, Z is the matrix of instrumental variables, is used if the number of instruments is greater than the number of replaced regressors ($p > k$). The auto-covariance matrix of parameter estimates is calculated by the formula

$$\hat{C}_{\hat{\beta}\hat{\beta}} = \hat{\sigma}^2\left(X^T P_Z X\right)^{-1} = \hat{\sigma}^2\left(X^T Z\left(Z^T Z\right)^{-1} Z^T X\right)^{-1}. \qquad (5)$$

The task of choosing instrumental variables is not always easily solved. One way is to replace a variable with its estimate. In relation to the first equation of the structural form of the SSE (3), as a tool for the endogenous regressor Y_2 in the *IV*-estimator, one can use its estimate obtained in the framework of the regression for all exogenous variables of the model:

$$\hat{Y}_2 = \hat{m}_{21} + \hat{m}_{22} X_1 + \hat{m}_{23} X_2 = \underset{(0,283)}{1,171} + \underset{(0,102)}{0,295} \cdot X_1 + \underset{(0,184)}{1,440} \cdot X_2, \qquad (6)$$

where X_1 - raw materials, X_2 - investments. Below is the result of evaluating the SSE in the framework of the *IV*-estimator (4) - (6):

$$\hat{Y}_1 = \underset{(5,516)}{10,667} + \underset{(2,056)}{8,278} \cdot Y_2 + \underset{(2,035)}{3,462} \cdot X_1, \qquad (7)$$

$$\hat{C}_{\hat{\beta}\hat{\beta}} = \hat{\sigma}^2\left(X^T Z\left(Z^T Z\right)^{-1} Z^T X\right)^{-1} = \begin{pmatrix} 30,424 & -6,619 & -1,285 \\ -6,619 & 4,227 & -3,081 \\ -1,285 & -3,081 & 4,139 \end{pmatrix}. \qquad (8)$$

Such a procedure in the theory of SSE received the name the two-step least squares method (2*SLS*). *ILS* is used for exactly identifiable equations and consists of the following steps [2]: the reduced form (2) is built according to the structural form of the model (1); According to the data of Table 1, the OLS-estimates of the parameters of the reduced form are determined:

$$\left.\begin{aligned}
\hat{Y}_1 &= \hat{m}_{11} + \hat{m}_{12}X_1 + \hat{m}_{13}X_2 = \\
&= \underset{(5,031)}{20,358} + \underset{(1,812)}{5,908} \cdot X_1 + \underset{(3,274)}{11,923} \cdot X_2, \\
\hat{Y}_2 &= \hat{m}_{21} + \hat{m}_{22}X_1 + \hat{m}_{23}X_2 = \\
&= \underset{(0,283)}{1,171} + \underset{(0,102)}{0,295} \cdot X_1 + \underset{(0,184)}{1,440} \cdot X_2, \\
\hat{Y}_3 &= \hat{m}_{31} + \hat{m}_{32}X_1 + \hat{m}_{33}X_2 = \\
&= \underset{(2,013)}{7,716} + \underset{(0,725)}{1,709} \cdot X_1 + \underset{(0,184)}{12,005} \cdot X_2
\end{aligned}\right\}, \quad (9)$$

on the least-squares estimate of the parameters of the reduced form (9), using the equation of the relationship between the structural and reduced parameters

$$\overline{A} \cdot \begin{pmatrix} M \\ I \end{pmatrix} = 0, \qquad (10)$$

$$\overline{A} = \left(A \middle| B\right) =$$

$$= \left(\begin{array}{ccc|ccc} 1 & -a_{12} & 0 & -a_{10} & -b_{11} & 0 \\ 0 & 1 & -a_{23} & -a_{20} & 0 & 0 \\ 0 & -a_{32} & 1 & -a_{30} & 0 & -b_{32} \end{array}\right)$$

where I is the unit matrix, estimates of the parameters of the structural form are calculated, for example, for the first equation of the system (3):

$$m_{11} - a_{12}m_{21} - a_{10} = 0$$

$$m_{12} - a_{12}m_{22} - b_{11} = 0$$

$$m_{13} - a_{12}m_{23} = 0$$

или

$$\begin{pmatrix} 1 & 0 & m_{21} \\ 0 & 1 & m_{22} \\ 0 & 0 & m_{23} \end{pmatrix} \begin{pmatrix} a_{10} \\ b_{11} \\ a_{12} \end{pmatrix} = \begin{pmatrix} m_{11} \\ m_{12} \\ m_{13} \end{pmatrix}. \qquad (11)$$

Thus, the *ILS* - estimates of the structural parameters of the first equation of the system (3) are equal: $\hat{a}_{12} = 8,278$, $\hat{b}_{11} = 3,465$, $\hat{a}_{10} = 10,667$, and coincide with their 2*SLS* - estimates (see (7)). To determine the autocovariance matrix of parameter *ILS* - estimates, we formulate the problem of estimating them as OLS-estimator with linear restrictions on parameters [1]: $H_0 : H\beta = r$, β — $(k \times 1)$- is the vector of parameters, r is a vector of restriction constants $(q \times 1)$, H is a matrix of restrictions $(q \times k)$, $ranr(H) = q$, $q \le k$,

$$\hat{\beta}_R = \hat{\beta}_{UR} + b, \qquad (12)$$

where $\hat{\beta}_{UR} = \left(X^T X\right)^{-1} X^T Y$ is the least-squares estimate of parameters without considering restrictions, $\hat{\beta}_R$ is the least-squares estimate of parameters with restrictions, b is the correction factor:

$$b = (X^T X)^{-1} H^T (H(X^T X)^{-1} H^T)^{-1} (r - H\hat{\beta}_{UR}) =$$
$$= Kr - KH\hat{\beta}_{UR}, \qquad (13)$$

$$V = \left[H(X^T X)^{-1} H^T\right]^{-1}, \; K = (X^T X)^{-1} H^T V.$$

Let us OLS-estimate the first equation of the model (3) without taking into account the restrictions

$$Y_{1t} = \underset{(5,406)}{10,788} + \underset{(1,970)}{3,518} \cdot X_{1t} + \underset{(1,934)}{8,201} \cdot Y_{2t} + \underset{(1,937)}{e_t},$$

OLS-estimator of structural parameters $\hat{\beta}_{UR} = (a_{10};\; b_{11};\; a_{12})^T$ are biased and inconsistent, due to the problem of endogeneity. To calculate the correction term (13), as parameter constraints, consider the interconnection (11) between the matrices of structural $\overline{A}$ and reduced parameters M, using as the constraint matrix H and the constraint constant vector r OLS-estimator of the reduced form (9):

$$H = \begin{pmatrix} 1 & 0 & \hat{m}_{21} \\ 0 & 1 & \hat{m}_{22} \\ 0 & 0 & \hat{m}_{23} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 1,171 \\ 0 & 1 & 0,295 \\ 0 & 0 & 1,440 \end{pmatrix},$$

$$r = \begin{pmatrix} \hat{m}_{11} \\ \hat{m}_{12} \\ \hat{m}_{13} \end{pmatrix} = \begin{pmatrix} 20,358 \\ 5,908 \\ 11,923 \end{pmatrix}.$$

Estimates of the parameters of the structural equation of the SSE (3) in the framework of the OLS with restrictions on the structural parameters:

$$\hat{Y}_1 = \underset{(5,516)}{10,667} + \underset{(2,056)}{8,278} \cdot Y_2 + \underset{(2,035)}{3,462} \cdot X_1, \qquad (14)$$

coincide with the *ILS*-estimator and 2*SLS*-estimator that solve the problem of endogeneity. Standard errors of the coefficients of the model (14) were obtained from the estimate of the autocovariation matrix of the vector (12):

$$C_{RR} = Cov\{\hat{\beta}_{UR} + b, \hat{\beta}_{UR} + b\} =$$
$$= Cov\{\hat{\beta}_{UR}, \hat{\beta}_{UR}\} + 2Cov\{b, \hat{\beta}_{UR}\} + Cov\{b, b\} =$$
$$= C_{\hat{\beta}\hat{\beta}} - KHC_{\hat{\beta}\hat{\beta}}H^T K^T + KC_{rr}K^T = KC_{rr}K^T,$$

where $Cov\{\hat{\beta}_{UR}, \hat{\beta}_{UR}\} = C_{\hat{\beta}\hat{\beta}}$ is the autocovariance matrix of parameter estimates without restrictions, C_{rr} is the autocovariance matrix of constraint estimates.

The article, on an empirical example, shows the equivalence of parameter estimates and their autocovariation matrices in the framework of the main methods for estimating the parameters of an SSE. As a result of the formalization of the *ILS* algorithm as an *OLS* with restrictions on parameters, a formula for estimating the autocovariance matrix of the *ILS*-estimator was obtained.

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JEL: C15

ANALYSIS OF INFORMATION CONTENT OF METRIC DATA WHEN CONSTRUCTING MODELS OF LINEAR REGRESSION

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Abstract. This article is devoted to the analysis of methods aimed at solving the problem of multicollinearity of data arising due to the high information redundancy of metric data. Decision making in modern conditions is based on the analysis of huge amounts of data, which often have only a small amount of informational content, which means that information redundancy is high.
In the case of a linear regression model, multicollinearity can be interpreted as a type of redundancy. The possibility of using the red indicator PETRES Red — red indicator to measure the proportion of useful content when evaluating linear regression parameters, that is, to quantify the degree of redundancy, is considered. The article provides a comparative analysis of the PETRES Red test with the most used multicollinearity detection procedures among the regressors, which are implemented in the **mctest** R package: Farrar-Glober test, VIF (dispersion inflation factor) and others. Comparative analysis was performed on data from the author's earlier work on 186 enterprises related to the crude oil production activity for 2016. It was concluded that the use of an integrated approach to testing multicollinearity with the help of the r-package **mctest**, which calculates general and individual diagnostic multicollinearity tests.

Keywords: multicollinearity, information redundancy, red indicator, R-package mctest

Introduction. The accumulation of large amounts of data is accompanied by the problem of data redundancy, that is, the accumulation of data that do not convey new or noteworthy information in terms of the problem being solved. Therefore, the task of analyzing the information content of metric data is important in econometric modeling. Multicollinearity, which occurs quite often in the construction of linear regression models, can be interpreted as a type of redundancy.

Estimates of the coefficients of the regression equation $\hat{\beta}$ we get by solving the system of normal equations: $X^T X \cdot \hat{\beta} = X^T Y$. The system of linear equations has a unique solution if the matrix of the system ($X^T X$) has full rank, that is, if all columns of the matrix ($X^T X$) linearly independent. If the columns of the matrix are collinear, then they speak of a strict (full) multicollinearity between the columns. The case of full multicollinearity is extremely rare in the practice of econometric modeling. Strict multicollinearity, as a rule, arises due to errors in the specification of the model, it is rather simply diagnosed and corrected.

If there is a close correlation between the columns of the matrix, then they say that there is a partial (lax) multicollinearity. It is this type of multicollinearity that is much more difficult to detect because it is not an error in specification or modeling, in fact it is a manifestation of data redundancy [1].

Multicollinearity and identification of its causes are often a serious problem in economic research, because, on the one hand, negative consequences of multicollinearity do not always occur, and on the other hand, multicollinearity can be caused not only by one variable, but also by a group of variables [2]. To avoid incorrect conclusions from the model about the effect of regressors on the endogenous variable, the existence of multicollinearity should always be checked when analyzing a data set as an initial step in multiple regression analysis [3].

Multicollinearity testing. The red indicator — PETRES Red, proposed by P. Kovacs [4] is proposed to be used to measure the proportion of useful content in relation to the estimate

$\hat{\beta} = (X^T X)^{-1} X^T Y$, i.e. to quantify the degree of redundancy and, consequently, multicollinearity.

The red indicator is based on the following assumption. If the database used as the source of the explanatory variables is redundant with respect to the $\hat{\beta}_j$ estimate, that is, if the covariance of the data is significant, not all the data will have useful content. The smaller the proportion of data with useful content, the greater the redundancy. The greater the variance of eigenvalues, the greater the covariance of the explanatory variables. There are two extreme cases: all eigenvalues are equal to each other, or all eigenvalues except one are zero. The degree of dispersion can be determined quantitatively by the relative dispersion of the eigenvalues of the correlation matrix R of exogenous variables:

$$V_\lambda = \frac{\sigma_\lambda}{\bar{\lambda}} = \frac{\sqrt{\frac{\sum_{j=1}^{k}(\lambda_j - \bar{\lambda})^2}{k}}}{\frac{\sum_j^k \lambda_j}{k}} =$$

$$\frac{\sqrt{\frac{\sum_{j=1}^{k}(\lambda_j - \bar{\lambda})^2}{k}}}{\frac{k}{k}} = \sqrt{\frac{\sum_{j=1}^{k}(\lambda_j - \bar{\lambda})^2}{k}} = \sigma_\lambda,$$

where k is the number of regressors, λ_j— the eigenvalues of the matrix.

To make the redundancy of different databases comparable, the above indicator should be normalized. Since the eigenvalues are non-negative, the normalization is performed with the value $\sqrt{k-1}$ because $0 \le V_\lambda \le \sqrt{k-1}$.

Red Indicator (red indicator) is defined by the formula:

$$\boldsymbol{Red} = \frac{\boldsymbol{V_\lambda}}{\sqrt{\boldsymbol{k}-\boldsymbol{1}}}$$

If the value of the red indicator is zero, it indicates the absence of redundancy, and the value close to 1 indicates the maximum redundancy (multicollinearity).

The red indicator can be expressed without calculating the eigenvalues of the correlation matrix of independent variables, simply as the mean square of the correlation coefficients [5]

$$\boldsymbol{Red} = \sqrt{\frac{\sum_{i=1}^{k}\sum_{j=1}^{k} r_{i,j}^2}{k(k-1)}},\ j \ne i.$$

testing functions are included. The red indicator is included in the mctest package R [7]: to detect collinearity among regressors, in the **omcdiag** function, which implements the general diagnostic test of multicollinearity [6].

The **omcdiag** function implements several tests for checking the multicollinearity of the entire data array [7]:

- checking the equality to zero of the determinants of the correlation matrix;
- Farrar-Glober test (the first part, checking the presence of multicollinearity of the entire array of variables using the chi-square test);
- Red Indicator (red indicator);
- test — Sum of Lambda Inverse (sum of inverse values of eigenvalues);
- Theil indicator;
- Condition Index (CI).

Empirical results

We test for redundancy data prepared in the SPARK system for enterprises belonging to the activity "Extraction of crude oil" to solve the problem of analyzing the impact of twenty-two indicators on the variable profit (loss) before taxation of a number of enterprises [9]. A sample was made of data representing the financial performance of 186 firms. The indicators for 2016 were used as regressors of the model - the average number of employees, return on assets, the cost of fixed production assets and equipment, the value of total assets, tangible assets, etc. There was a close correlation between many variables $(r_{i,j} > 0{,}9)$.

As a result of the **omcdiag** function at given thresholds, only two Red Indicator and Theil's Method tests did not reveal the presence of multicollinearity.

In the **mctest** package, there is an imcdiag () function that includes seven tests to test the effect of each regressor on multicollinearity. Among them are the most well-known and widely used *VIF test*, which is also included in the package **car** and *Farrar wi* (Farrar-Glober test, the second part is the identification of regressors leading to multicollinearity). According to the VIF test, only 8 of the 22 variables were not involved in multicollinearity, and according to the Farrar-Glober test, only two.

Conclusion. The results of applying the two functions of the **mctest** package indicate the presence of the strongest multicollinearity in the analyzed data and confirm the conclusions made from these data in [10] using the Belsley method.

In conclusion, it can be noted that combining various tests in the **mctest** package allows us to analyze the multicollinearity problem and the data redundancy problem associated with it, from different angles, changing the test suite, threshold values, and the form of results output.

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JEL 510.644.4

MODERN TRENDS IN THE DEVELOPMENT OF THE CONCEPT OF THE SOFT MEASUREMENTS

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Abstract. Progressive and continuous development of technical and information technology bases of various measuring systems has significantly expanded their applications. The use of these tools has led to the possibility of successful solution of the problems of evaluation and control of the properties of complex objects, effective management. In such systems, information systems are implemented based on the measurement approach. This approach involves the principle of uniformity of measurements at each stage of the measurements. The application of the measurement approach covers a wide range of tasks for its use for parametric and structural identification, for classification and image processing, for evaluation of production systems management, product quality assessment, monitoring of ecosystems.

Keywords: fuzzy systems, object-based approach, management and measurement

Currently, fuzzy logic is a fruitful and rapidly developing direction, making a major contribution to the development of intelligent technologies. Fuzzy logic is increasingly used in expert systems and systems of support and decision-making, cluster analysis, semiotics, image analysis. Fuzzy controllers and intelligent control systems have become widespread.

Modern trends in the development of intelligent systems are directly related to soft computing, that is, the complex development and use of fuzzy mathematics in close integrative connection with neural networks and genetic algorithms. The appearance of the direction of soft measurements contributed to the active involvement of devices theories of optimal solutions, artificial intelligence, fuzzy systems in the modern measuring environment. Efforts are being made to study the various measuring scales. Currently, the concept of "measurement" is used to determine the membership function and the degree of fuzziness of various phenomena and processes.

In turn, soft measurements are undoubtedly useful in the implementation of measuring processes and significantly improve their quality. For systems of soft measurements the sphere of their application considerably extends, the computing power as methods of numerical processing of information are used, there are new opportunities of purposeful regulation, constant estimation of quality of the received analytical decisions.

Progressive and continuous development of technical and information technology bases of various measuring systems has significantly expanded their applications. The use of these tools has led to the possibility of successful solution of the problems of evaluation and control of the properties of complex objects (CO), effective management.

Complex objects include technological processes, production systems and complexes, information transmission networks, material resources (man-made objects), ecosystems, processes and natural phenomena. In such systems, information processes are implemented based on the measurement approach. This approach involves the principle of uniformity of measurements at each stage. In addition, according to this principle, continuous metrological support of the results of the work of complex objects of intermediate and final nature, that is, the actual measurements of certain processes occurring in them.

The modern concept of soft measurements covers a wide range of tasks for parametric and structural identification of objects, for classification and image processing, for evaluation of management of production systems, continuous assessment of product quality, periodic monitoring of ecosystems, for the implementation of environmental management. The solution of such problems takes place against the background of a complex information situation - a priori uncertainty of knowledge about the properties of the object to be controlled, uncertainty of knowledge about the environmental factors affecting the object, the lack of direct observation of them, the presence of inaccuracy and incompleteness of the experimental information. Thus, the methodology of solving such problems becomes fundamental.

Application of classical models and approaches of measurements in the form of numerical value and experimental component or application of method of processing of measuring information without observance of the principle of unity of measurements do the solution of the above problems practically impossible.

Therefore, it is necessary to timely and relevant study of the issue of improving the methodological base of measuring systems in the direction of strengthening the role of the cognitive function of measurements, obtaining results in the form of knowledge-analytical expressions, key conclusions, practical recommendations on the basis of all a priori and continuously incoming information in the process of measuring procedures. Ensuring this requirement attracted to the measuring environment devices of the theory of optimal solutions, artificial intelligence and fuzzy systems. On the basis of the desire to measure the non-quantified properties of various objects, a General theory of measurement was created. Currently, the semantics of different types of measurement scales is used to improve the efficiency of measuring resources.

The integration and interpenetration of different methodologies led to the emergence of the concept of intelligent measurement. In 1994, L. Zadeh introduced the terms "computational intelligence" and "soft computing" into scientific use. He also formulated the main principle of soft computing, which consists in the admissibility of inaccuracy and incompleteness of truth to achieve the ultimate interpretability, flexibility and low cost of a solution. Approximate models, which include methods of fuzzy calculations based on functional approximation, optimization and random search for solutions, are the basis of soft calculations.

When creating systems that work with uncertainty, it is important to understand which of the components of soft measurements or their combination is suitable for solving a particular problem, in this case, it is advisable to use hybrid intelligent systems.

Hybrid intelligent systems are divided into several classes:

a) a hybrid system with a fixed substitution, where one model is used in which one of the elements replaced with another model;

b) hybrid systems with interaction-independent modules that exchange information and perform a variety of functions to obtain a common solution;

C) polymorphic hybrid systems – one model is taken to simulate the functioning of others, reasoning through a chain of rules is modeled, for example, using a neural network.

The methodology of Bayesian intellectual measurements (BII), based on the regularizing Bayesian approach (RBP), was developed in response to the direction of development of the concept of intellectual measurements given by modern science and the challenge of time. RBP is a modification of the Bayesian approach to obtain optimal solutions to these problems under conditions of significant a priori uncertainty with mandatory compliance with the principles of unity of measurements in the process of solution formation.

The concept of BII is a new type of synthesis methodology for the implementation of generalized measurements for the purpose of qualitative solution of the applied problem, based on a comprehensive knowledge of the properties of a complex object and the environment in which it operates. The process of solving an applied problem based on the BII methodology is a process of purposeful transformation of the hierarchical structure of scales with dynamic constraints (SDOS), which have the ability to adaptively change their structure when accumulating information about a complex object (CO) and its functioning environment, which in turn has the ability to adequately reflect the properties of an evolving complex object. The results of the application of the SDO can be obtained numerical values of various parameters, a certain analytical form of functional dependence or the whole system of analytical dependences that determine the state of a complex object, linguistic values and expressions regarding the properties and States for the CO, recommendations that ensure the stable operation of the CO.

The main principles of BII are:

- integration of information, diverse in form and content, to improve or achieve the required quality of measurement results;

- metrological substantiation of the obtained solutions, which can be presented in the form of quantitative indicators of a posteriori (residual) uncertainty measure;

- implementation of the principle of self-development of models of objects of measurement and environment of their functioning on the basis of adaptation of structures of SHDO to properties of CO which are studied and learned in the course of BII.

The ability to quickly change the method of processing fuzzy knowledge gives the use of modern fuzzy logic. In this logic, reliability is presented as a fuzzy true value – that is, an arbitrary subjective value that makes no statistical sense. Fuzzy logic is a logic that uses as generalized conjunction and disjunction operators a t-norm and a t-conorm satisfying a system of certain axioms.

In turn, in the modern analysis of big data, together with the uncertainty present in them, give rise to the problem of shortage of information resources, which occurs when they are processed. Algebraic Bayesian network (ABN) provides the ability for the solution to this problem. They decompose the database into small, interconnected sets-a kind of fragments of knowledge. Decomposition provides an opportunity to abstract from the structure of knowledge fragments in the situation of work on global structural issues and forms a task of another kind and direction – maintaining the integrity and consistency of ABS. Currently, there is a rejection of rigid schemes of reasoning, which are based on a deductive procedure. Interest from closed formal systems modeling subject areas will be redirected to the study of quasi-axiomatic systems, where a part of axioms will have variable character.

Thanks to the development of the concept of soft measurements, the means of cognitive graphics suggest a new approach to solving problems and their formulation is also developing. The theory of cognitive computing becomes the Central point of development of works in the field of cognitive processes. In turn, the logic of actions in connection with the continued development of robotics will go beyond formal systems into a new field of semiotic modeling and multi-agent systems, which will lead to a deeper development of the mathematical theory of dynamic open systems. Soft computing will continue to develop, that is, the complex development and use of measurement methods that are based on fuzzy logic, neural and genetic calculations implemented in various combinations in hybrid intelligent systems will continue.

The directions of intelligent measurements based on the receipt and use of metrological knowledge in the process of obtaining the result, neural and evolutionary changes that are implemented in various combinations in intelligent measurement systems based on the concept of soft measurements are created and developed. The development of the direction of soft measurements in modern science allows to use all the positive qualities and advantages of this approach: simplicity, processing speed, flexibility of inference logic, a variety of forms of presentation of the results, a variety of complexes of metrological characteristics.

For systems of soft measurements expands the scope of their applications, significantly increasing their quality and capacity, as use of modern methods of numerical processing of information, opportunities for focused regulation, the permanent evaluation of the quality of analytical solutions for practical use.

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JEL F19

NEW APPROACHES TO ASSESSING THE RESOURCES OF THE MODERN WORLD ECONOMY

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Abstract. Here it is proposed to include non-economic factors for economic models that assess the resource base of the modern world economy, including a civilizational resource that functions in a post-industrial society, which affects the environment of economic communication of subjects belonging to different civilizations.
There is a need to develop methods for assessing this type of resource and its involvement into the world's reproductive chains.
On the basis of soft calculations, the author suggests an original method for assessing the civilization resource and its impact on the foreign economic activities of economic entities.
The relative proximity of civilizations is calculated on the basis of some countries.
The results of the research make it possible to increase the efficiency of foreign trade operations and promote the promotion of Russian companies to the foreign market.
The application of the methodology of volumetric spatial analysis provides an opportunity to comprehensively approach the assessment of the resource potential of countries and the world economy as a whole.

Keywords: non-economic factors; civilizational re-source; coefficient of civilization intimacy; adaptation of foreign economic.

The construction of economic models for the development of post-industrial society has demanded the inclusion of fundamentally new factors, primarily non-economic ones. Against this background, a civilizational resource has vividly declared itself.

Pre-industrial society was able to form a specific mentality in relation to economic models, in other words, a civilizational resource, within local, closed frameworks. Further development, transition to the post-industrial stage and globalization brought the civilizational resource into the arena of geo-economic relations between countries.

The civilizational resource is related both to local ethno-national models and to those introduced from outside. If in the first case, the civilization environment is a powerful resource for the functioning of the local economic system, in the second case, it is possible to completely block reproduction models.

The neo-economic civilization model, which is supported by ethno-economic systems, competing with the post-industrial model for a number of decades, receives a new impetus to development at times of imbalance in the global community.

In most cases, economics considers reproduction processes in a relatively homogeneous environment, and all its stages and connections are impersonal. This approach was valid earlier. At present, the reproduction process has long gone beyond the national framework and functions in an environment characterized by ethno-national polychromatism. Consequently, in order to harmonize world economic relations, it is necessary to reckon with ethno-economic systems. That is why the problem of operating with a civilization resource is on the agenda. Here there are their theoretical and methodological foundations and approaches.

The geo-economic paradigm of world development, which is expressed in the formation of new subjects of world communication with their flexible boundaries of the division of the world, with particular force manifests a civilizational resource. The environment mentality of the lack of common economic reproduction cooperation in which the export articles were reproduced was not needed in a civilizational resource. When the economic community and close cooperation ties emerged, the civilization resource became one of the priority places in the development of the geo-economic space.

The studies that classify the civilization that was formed at the present stage of the world historical development are generally similar. And allocate 6-9 civilizations, for example: Western, Hindu, Islamic, Confucian, Latin American, Orthodox Slavic, Japanese and African [1].

Each civilization has its own civilization resource. The civilization resource, interacting with other resources, has a differentiated effect on the internationalized reproduction cycles, due to the inherent system differences. At the heart of the resource gradation are non-economic criteria.

The perception of the same resource in different civilizations is not the same. When concluding a contract for the exchange of a resource, the parties to the transaction, belonging to different civilizations, should take into account the peculiarities of the civilization resource, which affect the transaction price, volumes, and even its affordability.

There is a need for a quantitative assessment of the quality of a civilization resource through a system of relative indicators.

Such a project was the study of R. Inglehart's World Values Survey [2]. The project addressed the problem of locating individual countries in a two-dimensional coordinate system in which the X axis reflected an integral indicator of the polarity of survival / self-expression values associated with the formation of a post-industrial society, while the Y axis reflected an integral indicator of polarization of countries traditional values and Secular-rational values associated with the process of industrialization. It was found that the coordinates of countries belonging to the same civilization are close to each other. On the basis of the data obtained, R. Inglehart, together with C. Welzel, once worked on the Cultural Map of the World, drawing the boundaries between civilizations.

This map, in our opinion, can be improved by giving it relief (three-dimensionality) by adding the third Z-axis to the coordinate system. On this axis, we will postpone the integral indicators of the socio-economic development of countries. In addition, Inglehart and Welzel themselves recognize the priority level of socio-economic development level and the community of countries belonging to the same civilization [3, p. 42].

Indicators that form the integral index of socio-economic development can be: the level of per capita income of the population, level of education, life expectancy, etc. For this report, the indicator of life expectancy is chosen as an example for the integral indicator [4]. The base scale along the Z axis of the volume coordinate system is from -2 to 2, as well as along the X and Z axes. 45.91 years was taken as the minimum life expectancy, 83.7 years as the maximum, and 64.805 median. The Z value is calculated by direct scaling.

The coordinates of selected countries, one from each civilization on such a modernized Cultural Map of the World, are presented in Table. 1.

Table 1

Country Coordinates

Countries (Civilizations)	Axis X - Survival values versus Self-expression values	Axis Y - Traditional values versus Secular-rational values	Axis Z - integral indicator of the level of social and economic development
France (Western)	1.13	0.63	1.80
India (Hindu)	-0.21	-0.36	-0.07

Countries (Civilizations)	Axis X - Survival values versus Self-expression values	Axis Y - Traditional values versus Secular-rational values	Axis Z - integral indicator of the level of social and economic development
Pakistan (Islamic)	-1.25	-1.42	-0.02
China (Confucian)	-1.16	0.80	0.84
Brazil (Latin American)	0.61	-0.98	1.13
Russia (Orthodox Slavic)	-1.42	0.49	0.43
Japan (Japanese)	-0.05	1.96	2.00
Nigeria (African)	0.28	-1.53	-1.54

Source: axis X u axis Y – [], axis Z – calculated by the author

Let us apply the coordinates indicated in the table to calculate the coefficient of civilizational proximity of countries. Since the straight line connecting the points of coordinates of the countries taken in pairs is the diagonal of a rectangular parallelepiped, the sides of which are formed by the lines of the projections of these points on the axis of the coordinate system, the formula for calculating the distance between points will be identical to the formula used in geometry for calculation of the diagonal of the parallelepiped:

$$K_{mn} = \sqrt{(x_n - x_m)^2 + (y_n - y_m)^2 + (z_n - z_m)^2},$$

where K_{mn} is the proximity coefficient of civilizations m and n;

x_n - coordinate of the *n*-th country along the axis of values survival and self-expression;

x_m is the coordinate of the *m*-th country along the axis of survival and self-expression values;

y_n is the coordinate of the n-th country along the axis of traditional and secular-rational values;

y_m - coordinate of the *m*-th country along the axis of traditional and secular-rational values.

z_n - coordinate of the *n*-th country along the axis of the level of social and economic development;

z_m - coordinate of the *m*-th country on the axis of the level of socio-economic development;

Based on the calculations performed, the matrix of civilizational closeness of countries is compiled, which is presented in Table. 2

Table 2

Matrix Countries Civilizational Proximity

Countries	France	India	Pakistan	China	Brazil	Russia	Japan	Nigeria
France	-	2,500	3,632	2,490	1,819	2,896	1,789	4,066
India	1,666	-	1,486	1,750	1,578	1,560	3,110	1,945
Pakistan	3,141	1,485	-	2,383	2,234	1,972	4,119	2,156
China	2,296	1,499	2,222	-	2,528	0,571	1,983	3,626
Brazil	1,692	1,028	1,911	2,510	-	2,602	3,136	2,748
Russia	2,554	1,479	1,918	0,405	2,506	-	2,548	3,296
Japan	1,778	2,326	3,587	1,606	3,013	2,009	-	4,982
Nigeria	2,321	1,268	1,534	2,739	0,641	2,640	3,506	-

Source: – calculated by the author

The shaded part of the table shows the proximity factors of countries calculated without taking into account the indicator of the standard of living, that is, on a two-dimensional cultural map of the world. In this case, the formula of the coefficient of closeness of countries looks like this:

$$K_{mn} = \sqrt{(x_n - x_m)^2 + (y_n - y_m)^2}$$

The smaller the estimated proximity ratio of the two countries, the lower the costs of adapting foreign trade transactions between their representatives, and the influence of non-price factors in trade transactions between them will be minimal compared to other couples.

Analyzing Table 2, we can come to the conclusion that the representatives of the Orthodoxy-Christian civilization and the Confucian (Russia and China) can have the greatest mutual understanding in conducting foreign trade transactions. And the least understanding share Islamic and Japanese representatives.

The application of the proposed methodology for the assessment of a civilization resource allows us to increase the efficiency of foreign trade operations and contribute to the promotion of Russian companies on the foreign market. The methodology of volume-spatial analysis allows a comprehensive approach to assessing the resource potential of countries and the world economy as a whole.

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JEL 330

THE DEVELOPMENT OF METHODS OF COMPETITIVE INTELLIGENCE BASED ON THE CONCEPT OF FUZZY LOGIC STATEMENTS (ON MATERIALS OF THE GLASS INDUSTRY)

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Abstract. The article reveals the possibilities of modern methodology, which affects the issues of competitive intelligence. As a tool of effective competitive intelligence organization, the authors propose fuzzy logic and fuzzy logical statements. The glass industry of the Vladimir region was chosen as the base of the research.

Keywords: competitive intelligence, fuzzy logic, glass industry

In the context of globalization of the economy, increased competition in international and national markets, one of the most important conditions in ensuring economic development and national security is the intensification of competitive intelligence at different levels of economic systems management. Innovative development contributes to the achievement of a new level of development of productive forces that meet the challenges of modernity, the formation of a new model of spatial allocation of resources, thereby ensuring the formation of a new technological structure. Competitive intelligence is a tool for studying the competitive environment, which is a purposeful collection of information about competitors to make management decisions on further strategy and tactics of doing business. In this case, it is usually recommended to carry out competitive intelligence within the framework of the law and in compliance with ethical standards (as opposed to industrial espionage). If the Western world has adopted competitive intelligence as a useful tool for analysis, modestly keeping silent about the unethical sides of this phenomenon, but actively using questionable methods of obtaining information, the attitude to competitive intelligence in Russia continues to be fragmented and non-systemic.

Of particular relevance is the problem of competitive intelligence acquires in the processing industries, among which an important place belongs to the glass production, which has sufficient potential that can be used for economic and social development of the country in the conditions of "Industry 4.0". The term "industry 4.0" is used to describe the fourth industrial revolution. For the first time it appeared in Germany, where it served as the name of the eponymous legislative act and the direction of industrial policy development. It can best be explained as a new level of organization and control along the whole chain of building the value of the product life cycle, which is moving towards greater individualization of the consumer's requirements. The reason for the emergence of industry 4.0 was the need for information for real-time production by bringing together all those involved in the value chain.

For capital-intensive industries, which include glass, the technology of "Industry 4.0" open the possibility of a significant increase in efficiency, but do not entail a radical transformation of the business model. Industry

4.0 technologies contain a set of tools including innovative methods such as big data analysis, machine learning, machine vision, industrial Internet, virtual reality and robotics [1].

For glass factories, the optimization potential lies in improving the efficiency of the production process through automation, the use of sensors connected to the industrial Internet and in-depth analysis.

Automation processes in all areas of activity of glass companies are implemented in a variety of areas – from the search for new areas of sand to surface treatment and sales of products. The possibilities of digital transformation give glass companies a chance to step forward: from automation to digitalization, that is, to the introduction of technologies based on artificial intelligence, neural networks, big data - all those attributes of Industry 4.0, without which a new industrial revolution is impossible.

In the block "Extraction and preparation of raw materials" are promising projects in the field of digital transformation, which really lay the foundations of the future glass companies:

* "Digital batch preparation»;
* "Cognitive engineering»;
* "Digital production management»;

The most large-scale pilot project can be considered the beginning of the work of the production management Center (DPC), which would combine solutions to improve the efficiency of individual production processes of sand extraction in a single integrated environment.

Over time, the functionality of the data CENTER will expand due to the "digital twins" systems of maintenance, energy supply, preparation and disposal of waste, control of marriage.

Examples of digitalization in the glass industry:

Virtual start-up: ex-press-start of equipment. Due to the special software in virtual mode, it is possible to test all functions, as well as management processes. Thus, all potential critical situations that may arise later in production can be analyzed and eliminated at the earliest stages. This reduces not only the start-up time, but also increases the availability of production equipment. Thanks to the possibility of remote maintenance and monitoring of the current state of the equipment, its smooth and efficient operation can be guaranteed.

Production of special glass without cleaners. The melting process in a fully automated electric smelting plant is carried out by means of platinum-based systems, without the use of any purifiers. These technologies make it possible to completely abandon the use of arcenic and antimony, polluting the environment and harmful to human health. The bath can operate at low temperatures, which allows not only to reduce energy consumption, but also to reduce the wear of anti-heat materials, which favorably affects the durability of the melting bath. Another advantage is that glass produced without the use of cleaners is more suitable for recycling.

Energy saving due to laser bending of thin-layer glass. The market of glass, in particular for the production of displays, is constantly growing and developing, and therefore growing requirements for manufacturers of industrial equipment. Thanks to the technology of laser bending, there is no need for further refinement of the display and other types of thin-layer glass. Thus, for the manufacture of curved glass for smartphone displays, one operation is enough, which will speed up the production process, reduce energy consumption, as well as production costs.

High-precision laser cutting of thin-layer glass. Like laser bending, a number of significant advantages compared to traditional technologies differ and laser cutting glass. Innovative technologies allow to refuse from expensive procedure of elimination of such mechanical damages as cracks and chips. In addition, this type of cutting significantly increases the accuracy of the contours and the impact strength of the glass. Innovative laser cutting technologies allow fast and seamless glass cutting with a thickness of 50 micrometers to 10 millimeters, as well as a straight and curved profile on other transparent or brittle materials.

Large-size coating plants. Today, functional glass is able to shade or illuminate the room, creating a shadow at the touch of a button, or passing light, as well as, if necessary, heating water for heating and technical needs, thereby contributing to energy saving. Machines and equipment for coating are able to work not only faster, but also more economical, suitable including for large-size Production. Developing such solutions, manufacturers respond to the current market trends, in particular the growing demand for large functional glass. These solutions help to save resources, reduce weight and, at the same time, reduce production costs.

Digitalization should also affect the creation of a single digital platform in the processing, logistics and sales of glass products. The starting point of the process is the opening of the performance management Center (EAC). The center will allow to combine all assets and capital in the value chain in a single digital space, will increase the efficiency of planning through the use of data in real time. Data collection is supposed to be automated as much as possible, eliminating the human factor, which will reduce distortion to a minimum. TSUE will participate in the creation of glass factories full-fledged "digital production". The company will be able to automatically monitor more than 90% of the production parameters; analyze the reliability of more than 40% of the process equipment and develop measures to prevent losses from marriage and waste.

"Glass industry 4.0" and the introduction of digital technologies in the glass industry is not an end in itself-STEL companies. The main goal of the industry-left manufacturers of glass products is to increase the efficiency of production in all business processes, with regard to both electricity supply and consumption, and consumption of raw materials and materials, financial resources and budgeting, while optimizing all design changes of steel companies.

Thus, in this section the aspects of digitalization of the economy of glass production are considered. The influence of digitalization on the emergence of new and change of existing business models is shown. The prospects of development of digital technologies at steel plants are touched upon. When assessing the effectiveness of innovation management in the industry, as noted earlier, there is a need to obtain information that does not have a formal assessment, i.e. assessment of quality indicators. At the same time, decision-making on innovative development of the industry is carried out in the conditions of a priori uncertainty caused by inaccuracy or incompleteness of input data, stochastic nature of external actions, lack of adequate mathematical model of functioning, fuzzy goal, human factor, etc. In this case, the apparatus of the fuzzy set theory, in particular the fuzzy logic method can be used for evaluation. Built on the basis of fuzzy logic expert system allows to assess the effectiveness of management of the enterprise, taking into account not only quantitative but also qualitative information, which eliminates the shortcomings of methods for assessing the efficiency of management, based solely on the calculation and evaluation of financial indicators. In the course of evaluating the effectiveness of management faced with the task of governmental formalization of any utterances. Thus, the task of modeling is to translate qualitative statements of the expert into quantitative representations. From this point of view, odd-multiple descriptions are, on the one hand, a set of adequate forms for modeling economic systems in conditions of significant uncertainty, and on the other hand, they are a powerful mathematical apparatus for predicting the behavior of economic systems. The theory of fuzzy logic allows formalizing cause-and-effect relationships between input and output variables. These relationships are determined with the help of specialists (experts) in the field of knowledge and form the knowledge base in the forecasting model. On the basis of the knowledge base thus created it is proposed to carry out modeling and forecasting of the level of innovative development of the industry.

Building a model for predicting the level of innovative development of the industry on the basis of fuzzy logic is advisable to carry out on the basis of the following principles:

1) Linguistic model variables (specific inbound and based on model parameters are treated as linguistic variables quality);

2) Linguistic essence of statements (conclusions) when making certain decisions.

Cause-and-effect relationships between the input and output parameters of the model are described verbally (verbally), and then formalized as a set of fuzzy logical statements (conclusions) such as "if, then", "otherwise", etc.;

3) hierarchy of linguistic statements (conclusions);

4) classification of incoming variables (parameters) of the model and construction of a "tree" of the output, which is a system of nested statements (conclusions, knowledge) of experts of "smaller dimension". This avoids the difficulties associated with the analysis and formalization of a large number of input variables (parameters). Compliance with this principle allows us to take into account an almost unlimited number of input variables that affect the formation of the innovative potential of the industry.

Thus, the construction of a model for predicting the level of innovative development of the industry based on the use of fuzzy logic theory is reduced to the following stages:

1) The definition of clear and fuzzy input variables (parameters) of the model or obtaining linguistic statements (conclusions) of experts;

2) Building the output tree;

3) Determination of the boundary of change of input variables (parameters);

4) An assessment of linguistic statements of experts, which are taken as input variables (parameters) of the model;

5) Building knowledge base;

6) Formalization of the knowledge base in the form of fuzzy logical statements (conclusions);

7) Construction of a system of fuzzy logical equations;

8) The choice of a method for constructing membership functions that will provide a representation of quantitative and qualitative variables (parameters) in the form of fuzzy sets for linguistic terms included in the knowledge base.

In a fuzzy knowledge base, each line is a fuzzy rule, which is a "if, then" statement. Fuzzy rules have the same outgoing parameter, combined with each other in an equation with power of the word "or".

To obtain a fuzzy logical expression (conclusion) it is necessary to make the transition from linguistic statements to fuzzy logical equations. The result of solving a system of fuzzy logic equations is a fuzzy logical conclusion (a set of values of the membership functions of the model's initial parameter). The transition from the obtained set of values of the membership functions to the value of the forecast output parameter is carried out with the help of the dephasing operation. Dephasing represents the inverse transform is foundation of a fuzzy logical expression (the conclusion) to output the predicted parameter (variable) to be fashion-to encourage and forecasting. To generate a prediction model, we use the Fuzzy Logic Toolbox extension of the MATLAB program editor, which implements dozens of fuzzy inference and fuzzy logic functions. The developed model is hierarchical [3].

Unfortunately, the Fuzzy Logic Toolbox extension, which is responsible for fuzzy modeling, cannot simultaneously perform phasing and dephasing operations. Fuzzy inference is performed for intermediate variables with subsequent transmission of clear values of these variables to fuzzy systems of the next level of hierarchy. Therefore, over each hard intermediate values you have supplemented operations of phasing and dephasing.

It was found that the prediction model has a sufficiently high degree of reliability-the level of error is slightly less than three percent.

The introduction of the developed model for assessing and forecasting the level of innovation development should ensure adequate management of innovation processes in this strategically important sector of the economy. In addition, the model can be seen as typical for the given class of objects, and developed on the basis of the modelling methodology can be applied to other economic systems, characterize fuzzy relation between input and output parameters, it is difficult formalization of the factors of influence, and has the possibility of bringing expert knowledge to build the model. The use of the fuzzy logic tool in the construction of forecasts of the development of the industry should become an integral part of the General methodology of innovation development management.

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УДК 336.7
JET E58, G21, C53

MODELS AND METHODS OF SYSTEM ANALYSIS OF DATA IN THE MONEY LAUNDERING COMBATING

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Annotation. The involvement of credit institutions in illegal activities, the creation and organization of work of money laundering schemes, the provision of shadow financial services using banking infrastructure is a serious problem that creates high risks to the financial security of the state.
The purpose of the study is to increase the efficiency of identifying credit institutions that are at risk of involvement in illegal activities.
Methods. The study applied the methods of cluster, factor and regression analysis.
Results. The article proposes approaches to finding the bank's integral reliability indicator for the current time using methods of cluster and factor analysis. On the basis of the obtained integral assessments, predictive models were built, allowing to identify trends, assess the prospects for the financial situation of banks in the medium term, predict license withdrawal.
Discussion. The proposed solution makes it possible to identify potentially problematic credit institutions that require the adoption of appropriate measures by the Central Bank of the Russian Federation in the exercise of its prudential supervision functions. With the help of the described approach, it became possible to identify banks involved in illegal activities, the organization of schemes for the provision of shadow financial services, which is essential for the Federal Service for Financial Monitoring.

Keywords: credit organizations; principal component method; predictive models; anti-money laundering.

Introduction In order to assess the situation, which is the initial and most important stage in the decision-making contour, the financial monitoring processes and analyzes the incoming data.

In solving large-scale government problems, information systems are widely used. In particular, a powerful information system is used in the Federal Financial Monitoring Service. The complexity of the use of such systems is due to large flows of heterogeneous information coming from various ministries and departments [1].

The existing approach to assessing the situation in Rosfinmonitoring is reduced by experts assigning weights to the components of the vector, in the form of which one can represent the object of evaluation, and adding the results obtained.

This approach is accompanied by large time and resource costs and expert subjectivism.

In order to make competent management decisions, Rosfinmonitoring management requires reliable information obtained in conditions of limited time, computing and human resources.

This circumstance requires scientific reflection, on which the proposed study was directed.

Thus, the aim of the work was to improve the quality of management decision-making in the field of financial monitoring, develop and theoretically substantiate new approaches to the process of assessing the situation with the support of decision-making that exclude expert subjectivity in data processing and satisfy the time and resource indicators.

Methods and results. When ranking multidimensional objects, expert methods are usually used that are not free from expert preferences and subjectivism. An attempt was made to use evidence-based data.

For example, decisions were used to liquidate legal entities of the Supreme Arbitration Court of the Russian Federation. The analysis of these decisions showed that some liquidated organizations have signs of one-day firms. Such solutions were selected and systematized. The source material was obtained, based not on the intuitive guesses of expert analysts, but on court decisions.

From the decisions of the arbitration court, the most informative indicators were presented, presented in the correlation matrix of features.

From the correlation matrix it can be seen that the indicators are not independent and some of them strongly correlate with each other. Correlation of signs indicates that they are not orthogonal. Although this is sometimes seen intuitively, in this case, exact objective quantitative estimates, which are the correlation coefficients, come to the place of subjective assessments.

Taking into account the correlation of the indicators allowed to reduce the dimension of the tasks being solved twice and, thus, to reduce the complexity of solving the tasks.

The analysis of the weighting coefficients of the initial features for different main components is different, which gives grounds for their interpretation.

The second main component positively correlates with such indicators as the “period of the organization’s activity”, “the absence of non-current assets”, “the lack of personnel”, and negatively with the “lack of settlement accounts”, “no address”, “no movement of funds on accounts”. This gives grounds to assume that the first group of weighting factors of the signs indicates that the legal entity that possesses them was created for the purpose of conducting real business activities, but due to some reasons, the organization went bankrupt. While the second group of signs suggests that a legal entity was created to cover illegal activities [2].

Thus, the lower the indicator containing the second main component, the higher the number of deviant subjects in the region.

Of particular interest is the analysis of the fourth main component, on the basis of the values of which zoning maps of deviant objects were obtained. This component reflects the geographical component of money laundering. Large values of the components fall on the subjects of the Federation, which have borders with foreign states or seaports, which is consistent with empirical results. Thus, for the first time, distribution maps of potential subjects of money laundering were synthesized.

When applying the method of principal components of factor analysis and when applying methods of the theory of pattern recognition, similar results were obtained, which indicates their internal convergence and reliability.

In order to verify the results obtained earlier, the ranking of the federal districts of Russia was carried out when processing data on limited liability companies contained in the Unified State Register of Legal Entities.

The first main component characterizes the business activity of the region.

The second main component reflects the level of the possibility of using legal entities for illegal purposes. In addition, new quantitative estimates of the performance of the Rosfinmonitoring staff have been obtained. The proposed methodology for ranking structural units of Rosfinmonitoring, which allows you to increase the effectiveness of decisions taken in the distribution of the bonus fund.

Credit organizations according to the Federal Law “On Banks and Banking Activities” No. 395-1 dated December 2, 1990 publish their financial statements quarterly [3]. The forms of this report contain hundreds of different indicators, which leads to the situation of a “curse of dimension” when solving regression problems.

Were obtained integral assessment of the reliability of banks. On their basis, predictions were made of the change in the state of the CR.

In the course of the analysis, various time series models were constructed for 723 credit institutions, both operating and with a revoked license. Such models as ARPSS, models of exponential smoothing — simple seasonal, Winters model, Brown model, damped trend, Holt model are considered. The Bayes information criterion takes the smallest value for a simple seasonal exponential smoothing model (JSC Miraf Bank) and Winters model (Millennium Bank CJSC). This means that these models most adequately describe the historical values of the considered time series.

CJSC Millenium Bank, as well as JSC Miraf-Bank, tend to decrease the values of the second internal factor, which, in turn, indicates the deterioration of the financial situation of the credit institution and the inevitable revocation of the license by the Bank of Russia.

The assumptions were justified in February 2016, when these institutions were liquidated due to their inability to continue banking activities under the legislation in the credit and financial sphere.

The application of the principal component method in analyzing the attribute space of credit institutions makes it possible to obtain integral indicators of banks 'reliability at the current time, and also on their basis to identify trends, assess the prospects for banks' financial position in the medium term, predict license withdrawal.

Results and Discussion. The proposed solution has practical value. It allows you to identify potentially problematic credit organizations that require the adoption of appropriate measures by the Central Bank of the Russian Federation in the exercise of their prudential supervision functions. With the help of the described approach, it became possible to identify the banks involved in illegal activities, the organization of schemes for the provision of shadow financial services, which is essential for the Federal Financial Monitoring Service. At the same time, accurate objective quantitative assessments, free from subjectivism, a possible political and corruption component, come to the place of expert assessments.

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УДК 332.1
JEL R12

SELECTIVE ALGORITHM FOR FORMING EFFECTIVE INDUSTRIAL PROFILE OF THE REGION (ON THE EXAMPLE OF PLASTICS AND SYNTHETIC RESINS INDUSTRY)

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Abstract. The issues of ensuring the competitiveness of a country and a region are among the key issues on the agenda of federal and regional authorities. When implementing industrial policy to ensure a dynamic, balanced industry, it is proposed to form an industrial profile as the center of the object of managerial influences. Industrial profile is a composition of the core and priority types of economic activities and industrial companies that contribute to the rapid growth of socio-economic indicators of the region, forming the current and strategic level of competitiveness. Formation of effective industrial profile includes selection types of economic activities and industrial companies which comply with criteria of advanced dynamics. In order to form an industrial profile we developed a selective algorithm which implies an assessment of the effectiveness of regional producers basic localization.

Keywords: region, industrial profile, structural decomposition, advanced dynamics, selective algorithm

In the conditions of continuing global turbulence and macroeconomic crisis the issues of finding ways to develop new growth points are of particular relevance in the context of solving the problems of regional competitiveness and interregional balance. Industry as a basis of economic sustainability is one of the important components of the socio-economic system of the region. In order to ensure a dynamic, balanced and efficient industry, it is proposed to form an industrial profile as a central object of managerial influences [1, 2].

We understand an industrial profile as a composition of core and priority types of economic activities (at the meso-level) and industrial companies (at the micro level), contributing to the rapid growth of socio-economic indicators of the region at the macro level, forming the current and strategic level of its competitiveness [3].

For the purpose of forming a dynamic industrial profile of the region, it is necessary to proceed from the position of advanced growth and development. If an enterprise on its way of development overcomes all growth banks, fulfilling the advance conditions at each level of the structural position from CL to NIL, such an enterprise can be considered anchor and can be included in the industrial profile of the region (Figure 1). The condition of advancing growth in this case can be expressed as follows:

$$cCL > cRL > cRIL > cIL > cNIL \quad ,$$

$cNIL_{pij}$ – a component of the macroeconomic level of the manufacturing industry for the p-th production of the i-th region of the j-th type of economic activity;

cIL_{pij} – a component of the macroeconomic level of type of economic activity for the p-th production of the i-th region of the j-th type of economic activity;

$cRIL_{pij}$ – a component of the meso-level of the manufacturing industry for the p-th production of the i-th region of the j-th type of economic activity;

cRL_{pij} – a component of the meso-level of type of economic activities for the p-th production of the i-th region of the j-th type of economic activity;

cCL_{pij} – a component of the micro level of production for the p-th production of the i-th region of the j-th type of economic activity.

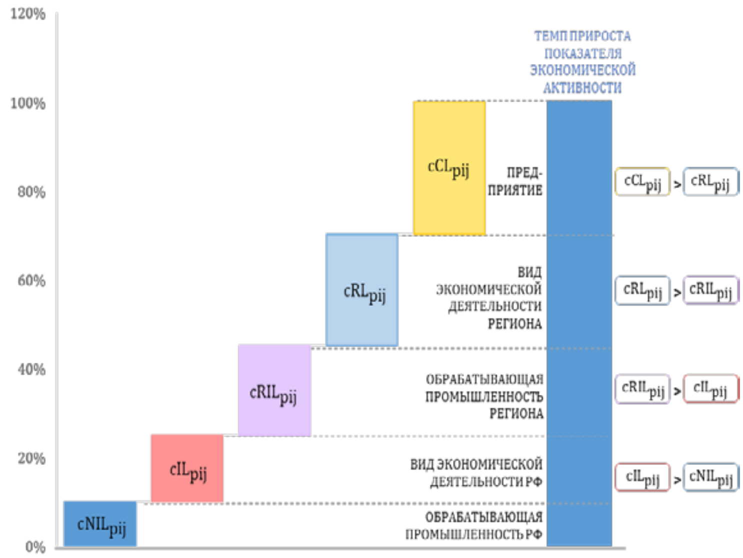

Fig. 1 **The direction of development of the enterprise when the condition of priority development**
Source: author's approach

A selective algorithm involves the selection of subjects of economic activity when the condition of the leading dynamics is fulfilled. Schematically, the algorithm is presented in Figure 2. Fulfillment the condition of advanced development provides the necessary growth trajectory of the enterprise in the event of its inclusion in the industrial profile of the territory. The production is considered in two aspects: regional and industrial, verifying the fulfillment of the required conditions both at the macro, meso and micro levels, and at the industrial level - a type of economic activity. Due to the variability of possible combinations, the general scheme of the selective formation algorithm assumes the following condition: each of the levels of the hierarchy must be ahead of the next level in growth rates, thereby acting as an industry growth driver. In general, the selection criterion is as follows: the growth rate of the micro-level is ahead of the growth rate of the meso-level, which is ahead of the growth rate of the macro-level. In total, there are 8 possible scenarios within the framework of the selection of enterprises, for each of which a number of conditions are fulfilled. For each scenario, two outcomes are possible: either inclusion in the profile when fulfilling the above criteria, or refusal to include. The decision on the inclusion is made at the third stage of the selective algorithm, when selecting manufacturers on the basis of specified advance conditions [4]

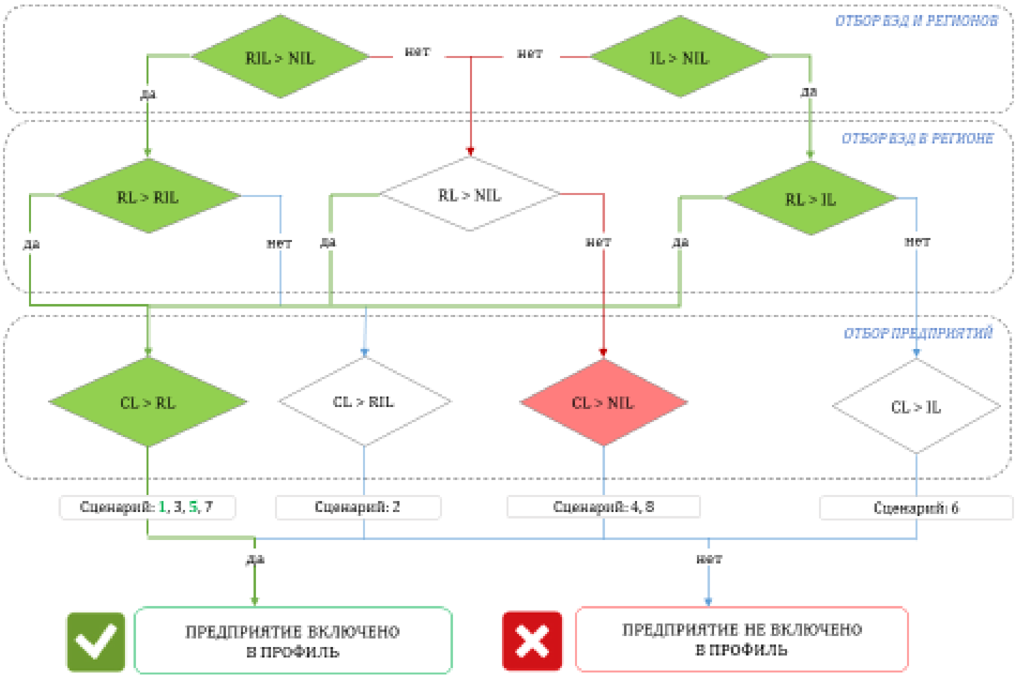

Рис. 2 / Fig. 2 **Селективный алгоритм формирования эффективного промышленного профиля региона/ Selective algorithm of forming an effective regional industrial profile [4]**

Источник / Source: авторский подход / author's approach

In order to test the proposed hypothesis and the developed algorithm, the approbation was carried out on the example of the type of economic activity "Production of plastics and synthetic resins" (OKVED 20.16).

Таблица 1

Результаты апробации селективного алгоритма формирования промышленного профиля / Results of a selective industrial profile formation algorithm

Manufacturing enterprise	Regional scenario	Industrial scenario
BSK	1	5
KAZANORGSYNTEZ	1	5
KUYBYSHEVAZOT	4	6
STAVROLEN	2	6
ZAVOD NOVYH POLIMEROV SENEZH	4	6
DAU IZOLAN	1	5
POLYOM	1	5
SAYANSKHIMPLAST	2	6

Источник / Source: авторский подход / author's approach

The application of the selective algorithm to the type of economic activity "Production of plastics and synthetic resins" significantly distinguishes the manufacturers of this type of economic activity. This difference is typical both for the scenario selection and for the structural decomposition of dynamics, where a significant component is shifting from the macroeconomic level (cNIL) to the level of type of economic activity of the Russian Federation (cIL). In terms of algorithmic selection, enterprises have different types of scenarios. Kuibyshevazot and the New Polymers Plant Senezh relate to scenarios 4 and 6. The regional 4 scenario characterized by the fact that the advance conditions are not fulfilled at the macro and mesolevels, which is why this scenario is considered the least preferred. The industry level 6 scenario assumes the fulfillment of the first level condition; however, at the next levels, the advance condition is not met and enterprises cannot be included in the industrial profile. Stavrolen and Sayan-skhimplast enterprises are also referred to as Scenario 6 in the sector, in the regional - as Scenario 2, which is characterized in a similar way by the implementation of the first stage of selection and the failure to follow. The enterprises of BSK, Kazanorgsintez, DAU Izolan and Poliom are assigned to scenarios 1 and 5 - the most preferred scenarios in terms of the selective selection of enterprises in the formation of an industrial profile. At the third level, Kazanorgsintez enterprises and DAU Izolan enterprises also showed a negative result when verifying compliance of manufacturers with the advance condition at the third level, and, as a result, these enterprises cannot be recommended for inclusion in the industrial profile of the region during the analyzed period. In the plastics market, two manufacturers are exceptions, both for this market and for the analyzed enterprises of other foreign economic activities. BSK and Poliom, which are characterized by alternative scenarios, rather than competitors of this market, have an excellent structural decomposition with a predominance of the regional level of foreign economic activity in determining the dynamics and direction of the enterprise. The noted producers are assigned to scenarios 1 and 5 in the regional and sectoral sections, respectively. BSK and Poliom fulfill the condition of advancing at the third selection level, thereby obtaining a recommendation for their inclusion in the industrial profile of the Republic of Bashkortostan and the Omsk Region. These enterprises, in their dynamics, are ahead of the growth rates of local foreign economic activities, which, in turn, are ahead of the manufacturing industry of the Russian Federation.

The results of selective selection allow not only to determine the profile production for the regions, but also to highlight the industry leaders in order to study in detail the factors that increase their efficiency in localization in these regions.

A selective algorithm for the formation of an industrial profile allows for an analysis of the current profile of a region in terms of its structural conformity with the objectives of the long-term dynamic development of industry. Another aspect of the application of the algorithm is the formation of macroeconomic and mesoeconomic benchmarks. The anticipated development condition laid in the basis of the algorithm makes it possible to form a stable framework of the industry of the regions and ensure long-term growth due to the advanced development of production.

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JEL D01, D91

APPLICATION OF SYSTEM ECONOMIC THEORY IN NEURAL NETWORK MODELING OF RISK MANAGEMENT PROCESSES

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Abstract. This study proposes an approach to the formation of decision-making models, which is based on the use of artificial neural networks. We propose the development of solutions in problems of managing the level of risk in enterprises based on the system economic theory of G. B. Kleiner. Four aspects of the functioning of the socio-economic system are considered: planned, forecast, informational and operational.

The problem of modeling risk management in an enterprise is difficult. The number of homogeneous and independent operations at the enterprise is small, unlike the banking sector, insurance or retail trade, so the use of methods of probability theory and statistical methods is limited. In this study we are considering the use of artificial neural networks in risk management tasks.

Universality of use of neural networks is expressed in the following: the type of dependency between the initial data set and the result of its processing will be determined during neural network learning. The use of artificial neural networks in modeling is constrained by the lack of standardized approaches to the creation of neural network structure. For forecasting and classification problems, the choice of neural networks as a tool is optimal.

The use a set of four interacting subsystems (intentional, expectational, cognitive, functional) and artificial neural networks will allow one to adequately describe complex situations of economic risk. Even if we do not have a clear idea of the formalized form of the relationship between a set of economic risk factors and the result of their treatment.

Keywords: enterprise risk management, artificial neural networks

The complexity of the development of scientific knowledge in the field of enterprise management creates the need to integrate many areas of humanitarian knowledge, such as: economics, psychology and sociology. This fact determines the need for a multidisciplinary approach to improving the mechanisms of support for management decision-making. At the same time, the uncertainty of the external environment of the enterprise, can significantly limit the decision-making and the degree of feasibility of management decisions. Therefore, the use of modern methods of behavioral economic theory can be very promising. Since the modeling process takes into account the fact that many alternatives are known to the head of the enterprise in advance, but in the selection process may be additional factors, the presence of which was previously unknown (Thaler, 2017). This may contribute to the significant development of the theory of risk management in the enterprise.

Using a systematic approach, in the structure of any enterprise that represents an example of a socio-economic system, four main transboundary subsystems can be distinguished (Klejner, Rybachuk, Ushakov, 2018). Each subsystem influences the decision-making process. The first subsystem is a subsystem that includes the formation of intentions for future activities, the so-called *intentional subsystem*. The second one is subsystem covering the expectations of the system with respect to the reaction of the environment on those or other actions or *expectational subsystem*. The third subsystem is including the formation of knowledge about the environment and the system itself or *cognitive subsystem*. The subsystem responsible for the actions necessary for the system to perform its functional purpose is the *functional subsystem*.

This study, supported by the Russian Foundation for basic research (project 18-010-01042), proposes an approach to the formation of decision-making models based on the use of artificial neural networks to support decision-making. There is a view of the development of solutions in the tasks of managing the level of risk in enterprises on the basis of the system economic theory developed by G. B. Kleiner (Kleiner, 2013). This approach takes into account four aspects of the functioning of the socio-economic system: planned, forecast, informational and operational.

The type of dependency between the initial data set and the result of its processing will be determined during neural network learning. The use of artificial neural networks in modeling is constrained by the lack of standardized approaches to the creation of neural network structure (Orlov, 2003).

Artificial neural network is configured in the learning process on the example of a particular enterprise, taking into account its inherent set of risk factors, the four main cross-border subsystems and the propensity of its leaders to accept the risk. It should be noted that the advantage of the system approach is that it allows to compare different-scale economic agents, to reveal their common ground (Kleiner, 2015a, 2015b).

We understand that risk management involves the development of intentional and exploratory subsystems, which imply various social impact mechanisms: organization, moderation, mediation, support, stimulation, etc.

It is assumed that the setting of an artificial neural network is carried out according to a certain algorithm, based on the development of a cognitive subsystem, which implies a comparison of several evaluated alternatives. Such an algorithm involves evaluating each of the alternatives when making anti-risk controlling action. Each network element - a neuron - builds a weighted sum of its inputs and then passes this value through the activation function, obtaining the value of the estimated characteristic of this network element at the output.

Elements are arranged layer-by-layer with direct signal transmission. Such a neural network allows us to build a model of a function of almost any degree of complexity. And the complexity of the function is determined by the number of layers and the number of elements in each layer. The number of input elements of the network is determined by the number of risk factors taken into consideration, and the output elements can be treated as a level change for each type of risk.

Interpretation of initial sets of output elements is made on the basis of expert evaluation (Kachalov, 2012, Kachalov, Sleptsova, 2015). Thus, the plausibility criteria in the model are set by the subjective opinion of specialists. This fact can be regarded as a drawback of the model (Smith, 1994).

Determining the number of intermediate layers and the number of elements in each layer is a key issue in the design of multilayer neural networks. As independent variables, the elements of the above subsystems are used:

a) variables, elements of the expectational subsystem, which describe the assessment of the significance of risk factors by the criterion of the possibility of the occurrence of adverse events, or the magnitude of the expected damage;

b) variables, elements of the cognitive subsystem, containing an assessment of the effectiveness of anti-risk controlling action, for example, based on the life experience of this particular specialist.

This takes into account the dynamic nature of these effects.

If unrealistic output elements of the neural network are detected, the model is adjusted to increase the likelihood of the results obtained with it. The final choice is made on the basis of a comparison of the expected effects for each recognized alternative.

To assess the reliability of a management decision, each decision is evaluated in the context of the most unfavorable developments. (Gabrel, Murat, 2014). To select the worst case scenario, you can use a finite number of scenarios from the historical database.

The use of four main cross-border subsystems in the neural network approach of risk management will allow to describe complex situations of economic risk quite correctly, without having a clear idea of the formalized form of the relationship between the set of economic risk factors (set of initial data) and the result of their processing. For the tasks of predicting possible adverse events in the activities of the enterprise, and the planning of appropriate anti-risk controlling action, the choice of neural networks as a tool may be the best.

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UDC 338.001.36
JEL E20

SYSTEM ANALYSIS OF THE ECONOMICS OF DEVELOPING COUNTRIES OF THE WORLD

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Annotation
The application of the culturological approach allowed building a qualitative theory of money, which ensures the innovative development of the economies of the countries of the world. Thanks to the model of social and political order, it becomes possible to correctly assess the indicators of the quality of national money. This opens the way for further development of methods for analyzing regulatory policy.

The work is finalized in The institute of mathematics and mathematical modeling, Ministry of education of Republic of Kazakhstan and science and supported by grant financing of scientific and technical programs and projects by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan, grant No. AP05131044.

1. The structure of the presented report consists of 7 sections:

• a model of analysis and assessment of the macroeconomic situation in the country;
• a model for analyzing and assessing the situation in microeconomic processes;
• a model for analyzing and assessing the situation in the management economy sector;
• an algorithm for analyzing the innovativeness of projects (and operational plans) in the real sector and estimating the cost effectiveness of their implementation based on multipliers;
• an algorithm for analyzing the innovativeness of projects (and operational plans) in the financial sector and assessing the cost-effectiveness of their implementation;
• an algorithm for analyzing the equilibrium in commodity and financial markets to manage the balance of the growth of the country's economy.

The concept of the report is aimed at building a system of models of digitalization processes in Kazakhstan’s economy and determining the appropriate system of algorithmic task operators for conducting mutually agreed calculations for assessing the efficiency of the country's economy in terms of its regions and activities. Each section of the concept is represented by integrated indicators of macro-and microeconomics.

2. It is interesting that the ratios of well-known macroeconomic indicators, like nominal GDP and intermediate consumption of the national accounts system, or the ratio of normal profits and wages express production-economic relations. In the Western economic school, more oriented towards the theoretical legacy of Adam Smith, rather than Karl Marx, very little attention is paid to researching and solving the problems of developing production-economic relations, to assessing their compliance with the level of development of productive forces of labor and capital.

More recently, the 1979 Nobel Prize in economics, Theodor Schulz, showed that knowledge not only increases individual productivity, but also the economic value of working time, which is a hallmark of modern economic growth. It is the rise in the price of working time that becomes the most important criterion for the sustainable development of the economy. With a simultaneous increase in the price of working time and normal profit, as the main representative of the financial sector of the economy, ensuring that the previous level of profitability of the business is maintained, all other conditions being the same.

Raising the educational level of not only workers, but also the entrepreneurs themselves, as well as government employees, is becoming the same effect of investments in science and education, like scientific and technological progress and higher technology.

- It is investments in human development, as the main component of the development of the country's productive forces that express progress in the development of the country's scientific and technological, socio-economic and socio-political potentials, and trends in their movement. At the same time, the report contains three calculated indicators, which are called "multipliers of scientific and technological, socio-economic and socio-political progress, respectively". They are the new carriers of three different types of progress, expressing a system of relations between:
- • the natural environment and representatives of the real sector and SMEs, in the structure of full costs (indicated in the SNA system, issue (X)), thereby simultaneously evaluating the productivity of intermediate consumption in the country and the efficiency of the distribution of the country's environmental and economic resources between regions and sectors of the real economy, respectively on the production of GRP and GVA;
- • a fund for labor compensation and gross profit in the structure, respectively, of nominal GDP, GRP, GVA (NGDP), thereby simultaneously evaluating the productivity of savings (gross capital formation) in the country and the efficiency of the distribution of the country's investment resources among regions and sectors of the real economy;
- • average annual remuneration and used for the production and consumption of time spent by employed people in the economy.

On their basis, situational models of the multipliers of the scientific and technological potential (c), socio-economic progress (q) and socio-political progress (c * q) are built. Only at first glance, these multipliers are well-known ratios, and in fact they express the levels of knowledge and culture of busy people in the economy among themselves and with the natural environment.

3. With the development of their knowledge and the growth of the culture of production, distribution, exchange and consumption, the dynamics of all "these well-known relationships" will grow. Thus, the dynamics of the "multiplier of the scientific and technological potential", which statically expresses the share of nominal GDP in the total output, and in dynamics represents the productivity function of the local ecological and economic resources used in production.

Similarly, the "socio-economic progress multiplier" is defined, which in the short-term expresses the share of labor remuneration in GDP, and in the long-term, its dynamics represent the productivity function of investment resources used in the economy and thus allows to evaluate the level of project innovativeness.

The "multiplier of sociopolitical progress" is the product of the above two multipliers and determines their labor equivalent in the working time of employed people in the economy. Simply put, as a result of the work of this multiplier, the price of one hour of work for busy people in the country's economy is established. Thus, this multiplier allows to solve the problem posed by Michael Baye, in his monograph "Managerial Economics and Business Strategy" (1999), which is devoted to modeling the problems of human capital development.[1].

[1] Baye M.R. Management economics and business strategy: a textbook for universities / Per. from English by ed. A.M. Nikitin / UNITI 1999, p.129

4. To solve the problem of M. Baye, for each progress multiplier, its own situational model for analyzing and evaluating the innovativeness and effectiveness of the project is built.

4.1. According to the situational model of scientific and technological progress, an increase in the share of GDP in output means an increase in the efficiency of the real sector, which uses resources in smaller quantities or more efficiently in the production of goods and services. This, in turn, implies an increase in revenues, which should then be effectively distributed in order for human capital to multiply, which, in turn, will be further directed to improving the efficiency of the real sector of the economy. That is, it increases the share of GDP in the issue of X. The proposed model of economic relations between agents of production and consumption of environmental and economic resources will be focused on human development, in the international scientific community, is absent.

4. 2. In the model of socio-economic progress or the model of analysis and situation in microeconomic processes, a function is described that calculates the multiplier of socio-economic progress and their laws of its movement. Specific calculations will describe the state of this parameter in the historical period of the analysis.

4. 3. In the situational model of socio-political progress, or the model for analyzing and assessing the situation in the sector of managerial economics, the change in the multiplier of socio-political progress is described. The concept states that the nature of the change of this multiplier is the basis for the relevant state policy, since its change expresses the price of one unit of the total amount of working time fund used in the economy. This is generally known and logical, but its establishment determines the monitoring and evaluation of the entire process of development of the national economy of the country.

5. The final part of the report outlines the algorithm for analyzing the innovativeness of projects (and operational plans) in the real and financial sectors and evaluating the cost effectiveness of their implementation and the algorithm for analyzing the equilibrium in product and final markets to manage the balance of economic growth based on the above three multipliers. This part consists of the algorithm for calculating the analysis of innovativeness of projects in two ways, and will be presented in tabular form with indicators for the base year 2016 and the calculated year 2028. On the basis of these two options, the advantages of the principles of the macroeconomic approach will be analyzed in comparison with the principles of the work of the direct-costing system for analyzing innovative projects.

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JEL 338.2, 65.01

NEW POSSIBILITIES OF STRATEGIC PLANNING

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Abstract. The report is dedicated to the strategic planning (SP) tasks solutions and forecasting in the wide area of «research and development», namely economic and other goals of target forecasting. Application of popular (probabilistic) statistical methods (analysis of variance (ANOVA) and regression) for SP is discussed. It is necessary to apply distribution free rank criteria, especially expert methods (paired and multiple comparisons) and their generalization (more complicated methods) at least to the extent of GOST 23554.0-79, GOST 23554.1-79, GOST 23554.2-81.

According to the authors' opinion and it is proposed to draw public attention to the acute deficiency of real scientific and practical SP activity. This deficit caused innumerable works (articles and books) about strategic planning (SP) This report is an attempt to resist the above-mentioned non-productive process.

Keywords: strategic planning (SP), statistical methods and SP, expert judgement and SP, deficiency of fundamental theory and significant applications, distribution-free rank methods, soft measurements.

«I feel that in the last few days we have been exchanging anecdotes and stories with the intention that they will be remembered, at least for a while. I think there is a long Jewish tradition that history and wisdom are being transmitted from one generation to another not through lectures and history books, but through anecdotes, funny stories, and appropriate jokes».

Amos Tversky (1937-1996) [15]

Since the 60s there have been some well-known models in strategic planning by Saaty AHP/ANP [13]. These multilevel models make it possible to solve direct and reverse problems – forecasting and planning respectively. Yet, from the point of view of carrying out “soft calculations” (for the information about soft measurements and calculations, look up journal “Soft Measurements and Calculations” as well as article by S.V.Prokopchina “Modern Theory of Measurements: Types of Measurements” [10]) these models are disadvantageous. We are here to eliminate these drawbacks.

AHP/ANP models are worked out in such a way that it is possible to estimate how lower levels impact higher levels (for all levels). These impacts are looked upon as non-random variables. Probabilistic approach can be regarded as the fulfillment of “soft” calculations. Such an approach requires a shift from one variable to the confidential interval (that is, random variable) and continuous distribution.

This report is an attempt to build the original model by Saaty with random variables, which meet certain assumptions – impacts are independent, the type of distribution through all the levels is known and all parameters can be estimated.

Let us draw an example which illustrates that high-accuracy measurements do not hold any meaning as estimation in shift location μ1 is equal to = 38,1ºC (a child body temperature). Another value of this parameter estimation is, for instance, equal to = 37,9ºC. Their difference is not huge and is equal to 0,2ºC and it shouldn't be thought that μ1 > μ2.

The matter is that (Let us assume!):

a) the accuracy of body temperature measurement by a usual thermometer is 0,1 ºC,

b) inherent variation of child body temperature centigrade depending on circumstances of measurement (measured in the morning or in the evening, etc)

Accuracy of variations may lead to the amount 0,2-0,3ºC, or even more.

Soft measurements can be called body temperature measurements in 10-points scale, in which 3 points (equal to app 36,9ºC) and 9 points (equal to app 38,9ºC) may signal to the doctor, examining the child, that there is an inflammatory process (on condition that the doctor does not know when the temperature was measured, either in the morning or in the evening). In the meantime, when considered 10-points scale, the difference in 6 points turns quite essential. Under field conditions 10-points scale would be suitable for the "tactile" contact, for example, by putting your palm on the child's forehead.

Difference in 5 or more points is essential.

Let us come back to example 1. Assume

$$Y = \sigma X + \mu, \sigma \neq 0, \qquad \text{(G1)}$$

where σ – scale parameter, μ –shift in location parameter. Let us denote all such transformations by

g (X) = g(t) = $\sigma T + \mu, \sigma \neq 0$.

Let us denote via

Pg(x(t)) = P [g(X)ϵB] = P (X ϵ g^{-1} (B)), that is, probability distribution function g(X) is fully defined by probability distribution of vector-argument X. See [3, p. 214-216], [7, p. 146-149].

For linear function:

$$p_{g(x)}(t) = \frac{1}{|\sigma|} p_x\left(\frac{t-\mu}{\sigma}\right) \qquad \text{(G2)}$$

If X – discrete vector-argument with function of frequency Px, then g(X) is discrete and has frequency function:

$$p_{g(x)}(t) = \sum_{\{x: g(x)=t\}} p_x(x) \qquad \text{(G3)}$$

Assume X is a continuous random variable with density Px, function g is real-valued and one-to-one on open sets S, in which P [$X\epsilon S$] = 1. Assume that derivative g′ function is g and turn into 0 on S. Then, transformation g(X) is continuous with density:

$$p_{g(x)}(t) = \frac{p_x(g^{-1}(t))}{|g'(g^{-1}(t))|}, \qquad (1)$$

where $t \epsilon g(S)$ and equal to 0 when $t \bar{\epsilon} S$.

Formula (1) is called change of variables formula.

Therefore, we can observe that this structure enables us to model "probabilistic" target trees and target net with the help of variables substitution formula.

This data points out the path to soft measurements and calculations.

Let us consider example 2. Assume that a university management plans to increase performance of majority of students in mathematical statistics (MS).

Let us regard S(x) as performance in MS. It is possible to frame S(x) in the following way:

$$S(x) = A(x) + B(x) + C(x), \qquad (2)$$

Where A_1(x) – input to the performance from the increase of academic lecture,

A_2(x) – input to the performance from the увеличения количества семинарских занятий,

B_1(x) – input to the performance from the increase of tutorials,

$B_2(x)$ – input to the performance from the students' motivation rise,

$C_1(x)$ – input to the performance from the teachers' motivation rise,

$C_2(x)$ – input to the performance from the enhancement of the lecture course contents,

$C_3(x)$ – input to the performance from the improvement of study process arrangement

Let us simply assume that variables A_i, B_j, C_k, i = 1,2, j = 1,2, k = 1,2,3 are measured in the same units, for instance, in % (₽) «expenses» for so-called actions (see Figure №1).

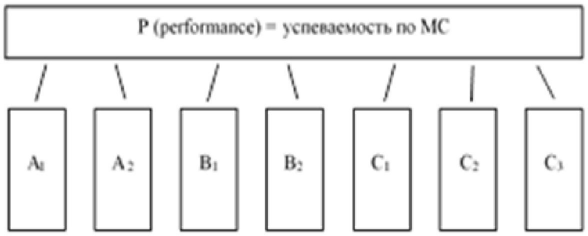

Fig. 1 **A model scheme, increasing students' performance level**

Here A_i, B_j, C_k, i = 1,2, j = 1,2, k = 1,2,3. Then:

$$\sum_i A_i + \sum_j B_j + \sum_k C_k = 100 \quad (3)$$

It is possible to use 100-points scale, etc.

In order to get all $A_i(x)$, $B_j(x)$, $C_k(x)$ we can apply statistical methods (like regression analysis), either jointly or seperately from the methods of expert estimation. See [14,9] about regression analysis, GOST 23554.1-79, GOST 23554.1-79, GOST 23554.2-81. GOST 23554.3-81), [16, 17] about expert judgment.

Let us denote F = {i, j, k, i = 1,2, j = 1,2, k = 1,2,3}. To ensure expert estimation of input to the performance (higher target level) of lower targets level it is possible to apply as numerical variables (that is, a_i*, b_j*, c_k*, which correspond to A_i, B_j, C_k $\forall i, j, k \in F$), as points, ranks, paired comparison. See [13, 17].

Here we are looking into forecasting performance with known A_i, B_j, C_k. This is, so to call, a direct problem. The problem of performance planning, shown on picture 1, is interpreted as a diverse problem. The performance level is set to reach, for instance, 90 points out of 100-points scale. It is necessary to find A_i, B_j, C_k for all i, j, k.

For example, A_1 is equal to 2 hours per week (additional hours devoted to increase of lecturing).

There is a linear function

$$A_1(x) = a_1 x + \widetilde{c_1} \qquad (3)$$

We should estimate a_1 and we should apply different methods for it (for instance, least square method, maximum likelihood method, etc.) Let us suppose that the increase of lectures by 2 hours per week will lead to the increase of performance by 10 points by the end of the term. Analysis of variance serves for estimating the hypothesis about the influence of factors on variables. See [12].

In the current climate the Russian and foreign community are taking a much closer look at SP. The evidence of this is received from the Federal Law dated 28.06.2014 N 172-ФЗ [1] and Edict of the Russian Federation President dated 07.05.2018 № 204 [2]. As well as some other works are very illustrative of this issue [4, 5, 6, 8, 12].

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JEL H60

FINANCIAL RISKS OF THE STATE: MANAGEMENT BASED ON SYSTEM APPROACH

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Abstract. To identify and manage the financial risks of the state, system approach must be applied. It is advisable to conduct joint analysis and management of sovereign assets and liabilities, which in international practice was called the ALM (asset-liability management) approach. This approach involves quantifying and monitoring the impact of changes in parameters such as exchange rates, interest rates, inflation, commodity prices on sovereign assets and government liabilities. Based on the study of foreign experience, in particular, New Zealand, Denmark, Turkey, it was concluded that the introduction of the ALM approach involves a number of difficulties, but it has undeniable opportunities to improve the efficiency of decisions in public finances.

Keywords: financial risk, decision making, management of assets and liabilities, system approach

DEFINITON OF FINANCIAL RISKS AND THE NECESSITY TO APPLY SYSTEM APPROACH TO MANAGEMENT OF FINANCIAL RISKS

The financial risks of the state are a new and poorly studied class of financial risks. This is a category inherent to all sovereign subjects of international financial, monetary and credit relations. Within a narrow approach, financial risks include: central government budget risks; risks of the budgets of municipal governments (in Russia these are the risks of the budgets of sub-federal and local authorities); risks of social funds' budgets; sovereign debt risks. When taking a broad approach, financial risks also include financial risks initiated by state or joint organizations within the government sector. Sovereign risks in a broad sense cover all financial and economic activities of organizations in the general government sector that operate in the market and non-market fields through the use of state financial resources [1, p.51].

At present, each state combines market and non-market forms of activities, and is active player in the domestic and foreign financial markets. In the course of its performance, the state borrows in the domestic and foreign debt markets; finances investment programs and projects at home and abroad; invests in the capital of enterprises and financial institutions; acts as a co-investor of large international commercial projects; forms and allocates state reserves; manages and administers state-owned objects; creates and finances (in whole or in part) state-owned enterprises and structures. Thus, the state is a large-scale investor, entrepreneur, the largest holder of capital that needs effective financial management, aimed at minimizing risks, saving property, increasing revenues [1, p.48].

With the deepening of financial globalization processes, increasing geopolitical instability and market volatility, the financial risks of states have increased. Therefore, the study of financial risks of the state is a relevant topic.

ASSET-LIABILITY MANAGEMENT APPROACH AS A METHOD TO DEAL WITH FINANCIAL RISKS

Now we must consider the conceptual issues. Basic approaches to this problem are presented in the work of U. Das et al.[2]. An important, breakthrough work on the management of public assets and liabilities is the publication of F. Kos, who analyzed the experience of New Zealand, Denmark and Turkey, countries that to some extent used this approach[3].

Management of assets and liabilities

(abbreviated ALM) is an approach widely used by financial sector enterprises, especially banks and insurance companies. More actively ALM approach began to be used approximately since the 1970s. This was a time when financial institutions faced an increased interest rate risk. With the development and active use of financial innovations such as forwards, futures, options and swaps the ALM approach made it possible to manage the currency risk, interest rate risk, credit risk and liquidity risk.

To a certain extent the state is similar to a financial company. The state budget receives income from taxation and other sources, which are then sent to pay for expenditures. However, the implementation of the ALM approach is much more difficult in the case of a sovereign state. As noted by World Bank and IMF experts in the Guidelines for Public Debt Management, "the public balance sheet is far more complex and diversified than that of a private company" [4, p. 33]. Joint management of assets and liabilities is based on the balance approach. The conceptual balance of the public sector is presented in the work of Traa, B., Carare, A. [5], where it is clearly demonstrated that the difference between financial and non-financial assets, on the one hand, and debt and other liabilities, on the other hand, is the net asset value of the public sector.

The presented balance can be further detailed if it is required. Various authors dealing with this approach indicate the following types of assets: gold and foreign currency reserves, sovereign wealth funds, loans granted to other states; other assets can include derivatives, REPO instruments, other accounts receivable. Among non-financial assets, investments in infrastructure are singled out separately [6]. In addition, it is proposed to include in the composition of future assets various revenues to the budget, for example, tax receipts. As for the liabilities, they are additionally detailed in the following way: accounts payable, deposits of local authorities and commercial banks, as well as future budget expenditures, including contingent liabilities.

A joint analysis of sovereign assets and liabilities is designed to identify and effectively manage the key financial risks of the public sector as a whole. This approach involves monitoring and quantifying the impact of changes in parameters such as: exchange rates, interest rates, inflation and commodity prices, both on sovereign assets and government liabilities.

Study of the nature of sovereign assets and liabilities as a whole can be a guide for the risk management of the public sector balance sheet. Conducting tests of the impact of various types of macroeconomic risks provides valuable information that can significantly improve the effectiveness of decisions taken.

State budgets are subject to various risks and uncertainties related to their assets and liabilities, which is predetermined by the specifics of the country's economy and the level of economic development.

It is possible to give the following examples, when the analysis of sovereign assets and liabilities leads to an understanding of the need to improve economic policy.

1. Exposure to external shocks and the likelihood of upheaval, up to a default, associated with a simultaneous decrease in the value of assets and an increase in the value of liabilities. For example, as a result of a sharp outflow of investment, prices for financial assets fall, and this coincides with the currency crisis. As a result, the burden of external debt grows.

2. Budget instability, identified on the basis of intertemporal accounting. Contingent obligations are quite diverse. A classic example of contingent liabilities are future commitments associated with an unfavorable demographic situation, which in the future will increase the costs of health care and social security. Contingent liabilities also include expenses related to state support for private and public companies and banks, which are

necessary due to their excessive debt burden, primarily external debt.

3. Depletion of natural resources can be better revealed based on ALM approach. At certain times, the country's export earnings do not cause any concern, despite the fact that stocks are being exhausted and the net worth of assets is decreasing.

The study of sovereign assets and liabilities involves an analysis of financial characteristics associated with assets and liabilities, identification of risks and costs. If the characteristics of assets and liabilities coincide only partially (not covering each other), then in the process of risk management it is necessary to focus on unclosed (net) positions.

To reduce the currency risk, interest rate risk and refinancing risk, hedging strategies should be applied. In this case, both active hedging (derivatives) and natural hedging can be used, for example, by matching revenues to expenditures without using complex financial instruments. The use of such strategies depends on several factors, including the ability to analyze the risk and the degree of development of the relevant financial markets. In any case, derivatives are much less acceptable for use in order to reduce the risks of the state balance than in case of the private company's balance. Recommendations for the choice of risk reduction instruments depend on the type of country. To use active hedging of risks (which is often used in developed countries), some legal and technical problems must be solved.

The strategy of natural hedging is considered more suitable for countries with emerging markets, such as Russia. The issuance of indexed inflation bonds, the natural hedging of currency risk and the creation of liquidity reserves for the event of the refinancing risk are relatively easy to implement in most countries. At the same time, domestic financial markets in such countries are generally not developed enough to use active hedging instruments to achieve the desired and optimal portfolio of assets and liabilities. The natural methods of hedging are fairly simple. An example is the approach to reducing foreign exchange risk is the accumulation of international reserves, the currency structure of which corresponds to the structure of government obligations. This approach can be very effective in solving the problem of currency risk, while active hedging instruments, such as interest and currency swaps, are much more difficult to apply. Another example of a natural hedging strategy is the use of a "liquidity buffer" that helps reduce the risk of short-term market volatility. The accumulated liquid reserves provide the freedom of maneuver for the debt manager when holding auctions for placing debt securities. The question of the adequacy of the level of reserves and approaches to solving this problem requires special attention. There are no common generally accepted criteria for the adequacy of reserves.

From the standpoint of the ALM approach to joint management of sovereign assets and government obligations, the structure of international reserves should be determined by the type of external shocks that are possible. As a rule, the share of highly liquid assets is calculated on the basis of an assessment of potential liquidity needs, based on the balance of payments' stress tests and past interventions. In addition, countries with limited access to the capital market can structure the reserves in such a way that they correspond to the structure of the currencies in which the import settlements will be effected. If international reserves cover the external debt, then their structure must correspond to the currency structure of this debt.

DISCUSSION OF THE DIFFICULTIES IN THE IMPLEMENTATION OF ALM APPROACH INTO PRACTICE

Until now the full integration of management of sovereign assets and public debt is not a common practice. Despite the potential benefits, the implementation of joint management of sovereign assets and public debt is fraught with a number of problems, that were revealed in [7]. These problems include difficulties in collecting statistical data for compiling a public sector balance, measuring non-financial assets, and analyzing the risks of a portfolio of sovereign assets and liabilities.

Many governments do not know what assets they have acquired over the years or who own property rights (for example, in case of conditional or some future obligations).

There is the problem of determining the value at which assets or liabilities in the state balance sheet should be reflected (market or book value).

In addition, the issue of the applied exchange rate of the national currency in relation to foreign currencies should be resolved when preparing the public balance sheet.

Another challenge is the choice of a discount rate to determine the net present value of future expenses and revenues.

So, the implementation of ALM approach poses a number of difficulties, but has undeniable opportunities. A study of the discrepancies between the accumulated assets and liabilities of the state can be an additional tool to identify and start to solve economic problems. Centralization of management of all financial risks and the creation of institutional foundations are important elements in building an efficient system for joint management of public debt and sovereign assets.

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JEL I22, I25

SYSTEM APPROACH TO THE ASPECTS OF APPRENTICESHIP TRAINING BY INDUCRTIAL CORPORATIONS AND VOCATIONAL EDUCATION AND TRAINING SYSTEM

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Abstract. In market economy the decision whether to start the apprenticeship program in the corporation or not is highly influenced by the commercial factor — the ability to return investments in human capital. The studies of the economic aspects of apprenticeship programs in Germany and Switzerland demonstrate that they can be profitable within the course or after graduation due to young employee's work in company. In Russia the time addressed for practice in companies is very limited, the army withdraws graduates from the labor market and the corporate training skills are largely lost. In that context apprenticeship programs are unprofitable for domestic industrial enterprises and the risk of the investments loss is high

Keywords: qualified workers, apprenticeship programs, VET, qualification framework

Since the early 2000's in the Russian Federation, there was a significant economic upturn against the backdrop of an increase in global demand for commodities, which was accompanied by increased investment, modernization of old and the creation of new enterprises. First of all, there developed industries for the extraction of minerals - oil and gas, as well as related manufacturing industries of chemical industries. Also investment came in metallurgy, energy, construction and agriculture, automotive, power engineering and other industries.

Along with significant achievements in these sectors, in general in the domestic economy and especially in industry, serious problems were not solved. In 2012, Academician of the Russian Academy of Sciences E.M. Primakov noted in his article [1] structural imbalances in the domestic economy. They noted that if the extractive industry is quite comparable with other developed countries, namely 5.7% of GDP, the share of the manufacturing industry is very small - 14%, while trade provides a record 27 % Of GDP. The Russian Federation is very much dependent on imports of foreign equipment and high-tech industries in general.

In the work of well-known domestic researchers S.D. Bodrunov, R.S. Greenberg and D.E. Sorokin [2, c. 27-29] proposed systemic tools for the development of the domestic economy, including the overcoming of these structural disproportions. And as one of the key factors for the successful implementation of the submitted plans, the scientists singled out the human resources potential of the country. Drawing attention to the outflow of workers from processing industries and the aging of personnel, the researchers conclude that the success of economic policy in general and industrial policy in particular will be determined in large part by the quality of the personnel policy of the state and corporations.

For domestic enterprises, the problem of the lack of qualified specialists (first of all workers, operators, apparatchiks, machinists and machines, and specialists of the highest professional skill level) is among the top three most important constraints to the growth of enterprises, at least, according to the polls of the Russian Union of Industrialists and Entrepreneurs since 2007 [3]. Although, if we compare the statistics of the labor market and education, then the data for 2014 and 2015. and earlier periods (the study is given in the work of

V.E. Gimpelson [4]) on the proposal of the system of secondary vocational education (hereinafter - the VET) for working professionals and specialists more than twice on the aggregated indicators of pre- hides demand from business. In other words, the problem of staffing for economic growth lies also in the quality of training of trainees, the territorial disparity in their distribution, and in the fall in the attractiveness of labor in industry for graduates of the system of secondary vocational education.

The investment of an enterprise in apprenticeship programs is an investment in human capital, rather than a kind of corporate charity or the execution of orders from higher authorities. Like all investments, they require risk assessments, have their own anticipated payback period, after which they should make a profit. It is this approach to the interaction of enterprises with colleges and technical schools in the joint training of personnel is seen most appropriate in a market economy.

S. Muehlmann and S. Walter in their study [5] emphasize the analysis of the costs of apprenticeship programs and the revenue received in this connection by enterprises: will the training result in a net loss or net profit. The fact is that this factor can be decisive for the enterprise. The difference between all the costs incurred by the company during the apprenticeship (in Switzerland and Germany this is 3-4 years depending on the profession and specialty), and the revenue received gives the value of net losses - NC (Net Costs). If it is negative, then all investments of the enterprise pay off during the time of apprenticeship, and it brings profit. In this case, from the economic point of view, further employment of the student to the enterprise does not play a role. Either it is positive, then to fill these costs the company must hire an employee.

S. Muehlmann and S. Walter singled out the following factors that determine whether training will benefit the enterprise or not. However, some of them are endogenous, and the enterprise can manage them, and some - exogenous. [5. from. 9]:

- state regulation of the system of education and apprenticeship (exogenous);
- competition in the labor market and goods (exogenous);
- structure of labor costs at the enterprise (endogenous);
- the contribution of students to productive activities (endogenous).

In German and Swiss education systems, pupils spend from half to three quarters of their time on the subject in accordance with the curriculum [5, p. 12]. №.). And throughout the whole period of training the productivity of their labor grows, as can be seen in Figure 1.

In Russia, the time for practical training at an enterprise provided for by educational standards, unlike the reference situation of Germany and Switzerland, is much smaller, and the training itself begins later - in the second or third year. During this time, the productivity of labor MP increases insignificantly and, coming out of the educational organization, the student has a productivity considerably less than the average worker and needs additional training in the workplace. The Institute of Conscription into the Armed Forces seizes a significant part of students in industrial specialties. After its passage, if they return to the enterprise where the practice was held, their productivity level for the year falls. A young worker or specialist, whom an enterprise recruits, goes through a long period of adaptation and training at the workplace before it reaches the necessary performance indicators.

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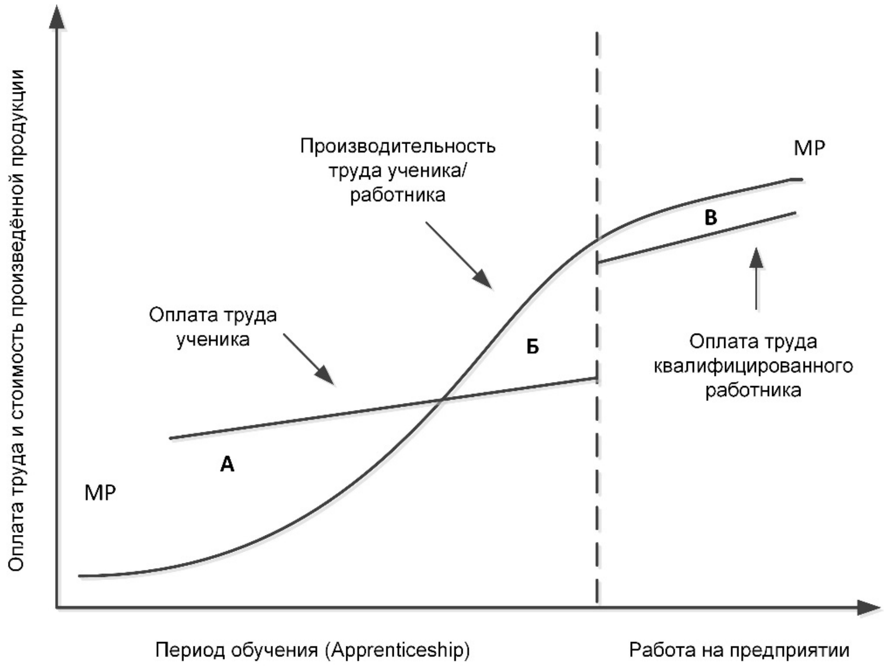

Fig. 1 **Figure title Apprenticeship model**

Source:[6]

The model of apprenticeship at the domestic enterprise is schematic and is based on the author's analysis of qualitative data and expert opinion, since the necessary quantitative indicators are not available. However, a systematic analysis of the current state of the system of secondary vocational education in Russia allows us to conclude that apprenticeship programs are likely to be unprofitable for enterprises with a high probability. The fact is that the time allocated for production and pre-diploma practice is not long, the army institute withdraws some of the graduates from the labor market, the experience of corporate training is largely lost, and there are a number of other reasons [7. p. 91]. This makes the enterprise investment in apprenticeship programs risky, and their payback is not obvious. The unresolved nature of this problem hampers the establishment of close relations between enterprises and colleges and technical schools, which in turn exacerbates the problem of the personnel supply of industrial development.

When analyzing the VET systems in foreign countries (USA, England and South Korea), as well as mechanisms and participants in public-private partnerships and promising forms of training, a number of important patterns and examples of best practices were revealed. First of all, in all the countries studied, the introduction of the on-the-job training system (apprenticeship programs) is recognized as the foremost direction of the development of the VET system. Great Britain and South Korea and the USA to a lesser degree have developed and carry out the purposeful policy on attraction of employers to educational processes. Within the framework of this policy, an infrastructure is formed, the components of which are educational organizations, state authorities, employers and their associations, and public organizations. A big role is played by the financial and methodical provision of the rest of the participants by the state bodies. An obligatory element of the introduction of the curriculum is the availability of a national qualifications system and an independent evaluation system. In order to receive feedback on the results of the implemented activities, the programs stipulate scientific research and an independent evaluation of the results achieved. All these systemic provisions, as well as examples of best practices identified, can and should be used in developing proposals for improving the Russian system of training.

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УДК 33
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ANALYSIS OF FACTORS AFFECTING LIVING STANDARDS OF THE POPULATION OF THE REPUBLIC OF KAZAKHSTAN

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Abstract
The article discusses a number of factors that may affect the standard of living of the population of Kazakhstan. The aim of the study is to find indicators that will help measure the quality of life of the population of Kazakhstan. The statistical data characterizing the life expectancy of the population, the differentiation of incomes of the population and the size of the average annual exchange rate of the dollar are analyzed.
In the framework of this study, using the proposed indicators of quality of life, a model of integral calculus of indicators was constructed, and a practical measurement of the quality of life in the Republic of Kazakhstan was carried out.

Keywords: per capita GDP; correlation-regression analysis; living standards; factor analysis; living standards factors

President of Kazakhstan Nursultan Nazarbayev mentions in his messages to the people that “human capital is the basis of sustainable economic development and the main engine of innovation, and the policy of a sovereign state is built from these positions” [1].
Consequently, the task facing our country is to invest in human potential and promote its development.
Time-based monitoring and analysis of the development of human capital in Kazakhstan contributes to the further growth of the economy. Determining the factors influencing the state of human potential will allow shaping the future path of Kazakhstan’s policy towards achieving the country's competitiveness on the world stage.
The standard of living is one of the most important social categories. The standard of living is understood to be the provision of the population with the necessary material goods and services, the achieved level of their consumption and the degree of satisfaction of reasonable (rational) needs [2].
To identify the factors affecting the standard of living of the population, we will conduct a correlation and regression analysis. For the correlation and regression analysis, as an effective indicator, we take the expected life expectancy of the population. According to the results of the correlation analysis, the life expectancy depends on the nominal income, the minimum pension and the average annual exchange rate of the US dollar (Figure 1).

Simple Statistics							
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
minimumpension	22	60.23227	36.12205	1325	16.37000	125.30000	minimumpension
inflation	22	111.91364	12.24812	2462	101.90000	160.30000	inflation
indexofinvestment	22	112.59545	25.69246	2477	67.00000	174.80000	indexofinvestment
lifespan	22	67.17136	2.70767	1478	63.50000	72.42000	lifespan
exchangerates	22	141.67682	57.98429	3117	60.95000	342.16000	exchangerates
nominalincome	22	166.40731	123.14945	3661	28.20000	371.08233	nominalincome

Pearson Correlation Coefficients, N = 22 Prob > |r| under H0: Rho=0						
	minimumpension	inflation	indexofinvestment	lifespan	exchangerates	nominalincome
minimumpension minimumpension	1.00000	-0.35368 0.1064	-0.20768 0.3537	0.87939 <.0001	0.46896 0.0277	0.97282 <.0001
inflation inflation	-0.35368 0.1064	1.00000	-0.63074 0.0016	-0.39159 0.0715	-0.37596 0.0846	-0.32770 0.1365
indexofinvestment indexofinvestment	-0.20768 0.3537	-0.63074 0.0016	1.00000	-0.12138 0.5905	0.01606 0.9434	-0.22621 0.3114
lifespan lifespan	0.87939 <.0001	-0.39159 0.0715	-0.12138 0.5905	1.00000	0.81044 <.0001	0.86714 <.0001
exchangerates exchangerates	0.46896 0.0277	-0.37596 0.0846	0.01606 0.9434	0.81044 <.0001	1.00000	0.46670 0.0286
nominalincome nominalincome	0.97282 <.0001	-0.32770 0.1365	-0.22621 0.3114	0.86714 <.0001	0.46670 0.0286	1.00000

Figure 1 - Correlation Analysis

In regression analysis, it suffices to have only two factors affecting y. Taking into account the multicollinearity of the selected factors, we investigate the following relationships: nominal income and exchange rate (USD). Using the following codes, we can build a model and make a regression analysis (Figure 2).

The REG Procedure
Model: MODEL1
Dependent Variable: lifespan lifespan

Number of Observations Read	22
Number of Observations Used	22

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	148.17094	74.08547	243.13	<.0001
Error	19	5.78952	0.30471		
Corrected Total	21	153.96046			

Root MSE	0.55201	R-Square	0.9624
Dependent Mean	67.17136	Adj R-Sq	0.9584
Coeff Var	0.82179		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	61.45266	0.31829	193.08	<.0001
nominalincome	nominalincome	1	0.01374	0.00111	12.43	<.0001
exchangerates	exchangerates	1	0.02422	0.00235	10.31	<.0001

Figure 2 - Regression Analysis

Got the following model for multiple regression:

$$y = 61{,}452 + 0{,}0137x1 + 0{,}024x2$$

According to the regression equation, we can draw the following conclusions:
if nominal income increases by $ 1, then life expectancy will increase by 0.013 years;
if the exchange rate increases by 1 tenge, life expectancy will increase by 0.024 years.

As a result of the analysis, it was found that the multiple correlation coefficient is R = 0.98, and the coefficient of determination is R = 0.96. Therefore, the relationship between indicators is closer. Those employment rate is affected by 96% of nominal income and exchange rate. The remaining 4% are unrecorded factors. The regression equation is adequate, since

$$F = 243{,}1 > F_{кр} = 3{,}52$$

Regression parameters are also statistically significant.

$$1) t_b = 12{,}43 > t_{кр} = 2{,}074\ ;$$
$$2)\ t_b = 10{,}31 > t_{кр} = 2{,}074.$$

Figure 3 shows the predicted value of the effective indicator, residual plots and normal distribution. Based on the graph, we can say that the effective indicator has the character of a normal distribution.

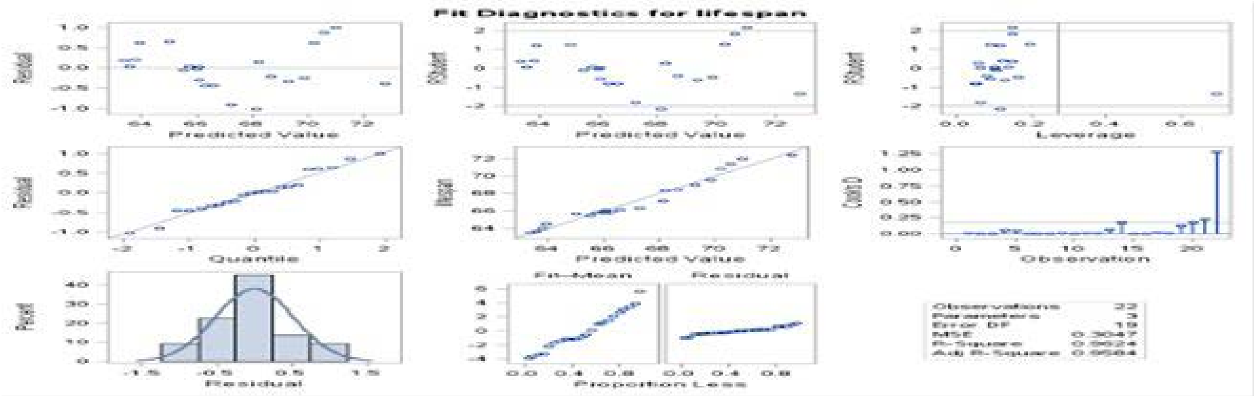

Figure 3 –Diagnosis of life expectancy

The nominal cash income per capita from 1995-2016 increased by an average of $ 8.89 per year. And the average annual exchange rate of the US dollar in the years 1995-2016, increased by an average of 12.78 per year. If this trend continues, we assume that in 2018 the nominal income will be 232.69 US dollars and the exchange rate is 354.94 tenge, and in 2019 the nominal income will be 241.58 US dollars and the exchange rate will be 367.72 tenge :

$$y_{прогноз2018} = 61{,}452+0.0137*232{,}69+0{,}024*354{,}94=73{,}15 \text{ ле}$$
$$y_{прогноз2019} = 61{,}452+0.0137*241{,}58+0{,}024*367{,}72=73{,}58 \text{ ле}$$

Life expectancy at birth will be 73.15 years in 2018, and 73.58 years in 2019 if the predicted value of the factors is met.

Conclusion: Improving the standard of living (social progress) is a priority direction of social development. When developing programs to improve the standard of living for the Republic of Kazakhstan, one can rely on the factors identified by econometric analysis in this article. Thus, raising the level of health care, creating conditions for education, regulating the environmental situation and creating conditions for the realization of human needs should be priority areas for development in all countries of the world. Life expectancy is also the most important factor in raising the standard of living. As life expectancy increases, the country's economy will also improve accordingly.

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THE PEDAGOGICAL VARIATION MODEL: CREATING A SYSTEM FOR SUCCESSFUL LEARNING AND TEACHING IN THE VIRTUAL CLASSROOM FOR TOURISM INDUSTRY

SUSIE ROGERS (UNITED KINGDOM, NEWPORT)

1. INTRODUCTION

The importance of tourism for the European economy is undisputable as it accounts for over 5% of direct employment and proportion of European GDP and its multiplying effect over other economic sectors is really tremendous (Burukina and Yandovsky, 2015) This paper introduces the conceptualization of a model for the better understanding of learning and teaching in general but for the tourism industry in particular. Tom Denham (2010), visualises the professional personality in tourism to include amongst others the following ten personality traits (i) positive attitude ("championship thinking") (ii) enthusiasm (iii) high ethics (iv) goal focusing (v) ability to listen with interest (vi) networking (vii) persistence (viii) self-awareness (ix) self-confidence and (x) self-discipline. With these personality traits in mind, Rogers (2013) recognised that the leadership paradigm originating from Avolio, Bass and Jung (1999) provides a pertinent backcloth to successful teaching online. Therefore, the aspects of leadership became central to Rogers' research, including Grow's (1991) 'stage approach' for learners to become self-directed.

2. METHODOLOGY:

The creation of the Pedagogical Variation Model (PVM, Rogers 2013) was underpinned by the research assumption that teachers/trainers/coaches exhibit certain qualities, e.g. knowledge of online learning technologies, expertise in using computer-mediated communication skills, creative problem-solving, socializing, and online sharing and collaborating with others (Avolio, Sosik, Kahai, & Baker, 2014). Rogers (2004, 2005/2011) undertook an extensive preliminary critical exploration of the literature to establish how online teaching and online learning attributes are revealed in pedagogical conceptual frameworks, found in both traditional face-to-face, i.e. Also including Tourism Industry Coaching, and virtual classrooms.

For example, Garrison (2011), in his proposed framework for learning in the 21st century, noted the absent notion of pedagogical leadership, since "the teacher's scholarly leadership ... a legitimate and important authoritative, essential teaching responsibility has been either ignored or downgraded, in online learning environments" (p.70). In consequence, the current research problem was to address this gap in knowledge on pedagogical leadership in teaching, by developing a model for teachers, based on teachers' and that can also be said for Tourism Industry Trainers' and Coaches' leadership qualities (Rogers, 2004, 2005/2011) for teaching and learning.

Framing the research question became an important starting point. The research question (Rogers, 2013) emerged as:

"To what extent do e-moderators implement leadership strategies in their day-to-day online teaching in asynchronous discussion forums?"

Using a similar connotation Rogers (2018) formulates the following question for investigation:

"To what extent do Teachers/Trainers/Coaches implement leadership strategies in their day-to-day teaching and coaching strategies to develop courses relating to Tourism for children, youth and adults?"

The availability of tools for research become an essential consideration, including potential research samples, tools for gathering qualitative and quantitative data as well as data analysis techniques. Four main research objectives resulted in the original research design, namely to:

1. Conceptualize and develop a model for teaching and learning;
2. Elicit teacher perceptions of their online roles in asynchronous discussion forums;
3. Corroborate the emerging conceptual framework with data from (2); and
4. Design and implement a hypothesis testing instrument to evaluate the hypothetical model

Researchers Avolio, Bass and Jung (1999) provide a significant insight to leadership relating to two conceptual frameworks namely (i) transactional leadership and (ii) transformational leadership. These led Rogers (2004) to initially investigate teacher perceptions of their online role through a leadership paradigm lens. In her initial investigation, Rogers designed a Multifactor Leadership Questionnaire (MLQ) for a sample of e-moderators (n=24) to identify their perceptions regarding transactional and transformational leadership styles. It became evident that some teachers regarded transactional (task-giving) leadership more important than transformational (empowering/ motivating) leadership whilst others preferred to focus more on transformational leadership. In addition, there were others that found equal importance in both styles of leadership i.e. transactional and transformational (Cob, 2018). Further research with samples of Tourism Industry Trainers, Mentors and Coaches would be a great opportunity to follow up.
The study (Rogers 2013) was followed by the conceptualization of the PVM relating to both (i) teacher perceptions of their online roles based on a leadership paradigm and (ii) learner perceptions regarding variables such as collaborative capability and online knowledge construction ability. Kelly's (1955/1991) personal construct psychology (PCP) was adapted to elicit teacher perceptions of their online roles regarding their teaching skills in six aspects, namely (i) knowledge construction (ii) social interaction (iii) weaving (iv) summarizing (v) archiving and scaffolding, with respect to supporting their e-learner cohorts with an effort to maximise their learning opportunities online to increase their ability for knowledge construction and capabilities in online collaboration. It was found that their teacher leadership style much influenced their learner achievements (Avolio, Bass and Jung, 1999). With this observation, Rogers (2013) conceptualised the PVM in three stages using at each stage the format of a Boston Matrix. MacDonald (2002, p.211) shows how the 2 x 2 Matrix Format allows a researcher to identify two variables, one on the horizontal axis and the other on a vertical axis, thereby forming four quadrants, such that each quadrant symbolises a certain feature.
Thus, the PVM (Rogers 2013) uses one Boston 2 x 2 Matrix format in an analysis to capture teacher leadership strategies namely leadership variables as:

(i) Transactional (i.e. task-giving) and
(ii) Transformational (i.e. empowering)

Another Boston 2 x 2 Matrix format was implemented in an analysis to capture learner behaviour variables, namely:

(i) Collaborative Capability (i.e. sharing and exchanging ideas) and
(ii) Capacity for knowledge construction (i.e. creative thinking).

The 'matching' of the equivalent quadrants from the teacher matrix with those of the learner matrix is the central aim in the evaluation of the PVM.

A collaborative research project with the Faculty of Education, Kuwait University, directed by Dr. Fayiz Aldhafeeri. (2014) aimed at the evaluation of the PVM. Using an online questionnaire (Rogers 2013), that was translated into Arabic, it was possible to distribute the translated questionnaire amongst under-graduates and post-graduates in The Faculty of Education. The Arabic responses were collected and translated into English for analysis giving Interesting outcomes. In presenting this conference paper (Rogers 2018) invites you also to evaluate the PVM regarding its implementation for Tourism Coaching with samples of Trainers, Mentors and Coaches and young and not so young learners in the Tourism Industry.

3. OUTCOMES

From the collaborative research project (Rogers and Aldhafeeri, 2014) It was found that the majority of respondents from both samples under-graduate and post-graduate, preferred an instructivist teacher approach, whilst a constructivist-learning environment (learner centred) was recognised by a minority of respondents. Since a generalisation of the results cannot be made due to the samples being less than thirty respondents, nevertheless the very important outcome reveals that and instructivist (i.e. respect for teacher-centred learning) remains as a preferred learning environment for this sample of learners.

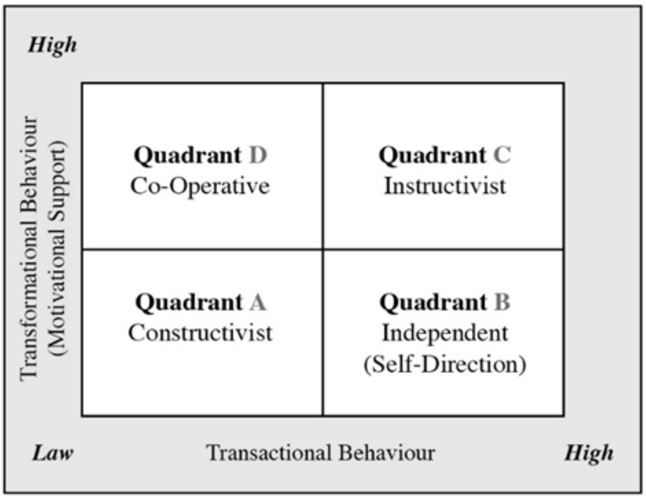
The research rationale is broached with insights into different pedagogical concepts that have shaped the research design, including:

(i) The paradoxical nature of two diametrically opposing pedagogies, namely instructivist (high teacher visibility) and constructivist (low teacher visibility) and

(ii) Pedagogical leadership in asynchronous learning networks

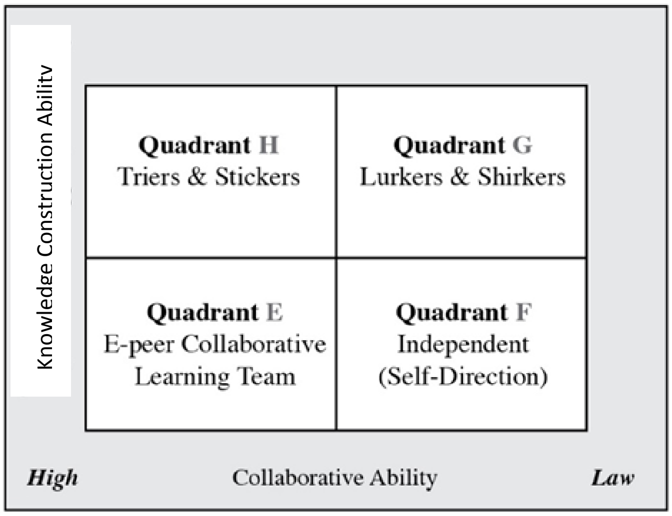
The following sections illustrate by diagrams how the PVM is designed.

The first Matrix conceptualised by Rogers (2013) looked at teacher leadership styles, namely (i) Transactional, task-giving role on



the horizontal axis and (ii) Transformational, empowering/ motivating student learning on the vertical axis, as shown below.in Figure 1. Figure 1 The PVM Matrix Model 1 for Teaching/ Coaching – Quadrants A, B, C and D

The second Matrix conceptualised by Rogers (2013) looked at learner features, namely (i) Collaborative Ability on the horizontal axis



and (ii) Knowledge Construction Ability on the vertical axis, as shown below in Figure 2.

Figure 2 The PVM Matrix Model 2 for Sports Learning - Quadrants E, F, G and H

When the two models are merged, such that the quadrants of Model 1 (A.B.C and D) overlap the quadrants of Model 2 (E.F.G and H) the PVM Matrix Model 3 is formed with respective quadrants AE, BF, CG and DH.as shown in Figure 3 below.

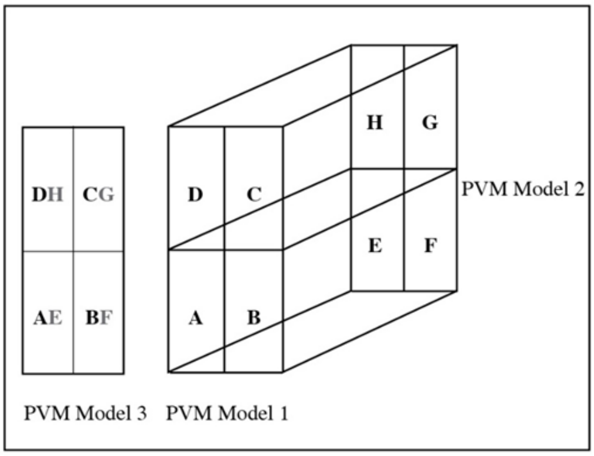


Figure 3. The PVM Matric Model 3 for Online Learning and Teaching by Matching Models 1 and 2.

4. CONCLUSION: Tourism Industry

Models are useful tools to better understand not only learning processed of students but also for educators to explore new dimensions in their teaching. This is the central aim in the evaluation of the PVM in a collaborative research project with the Faculty of Education, Kuwait University, directed by Dr. Fayiz Aldhafeeri in 2014. An online questionnaire (Rogers, 2013), translated into Arabic, was distributed amongst under-graduates and post-graduates in The Faculty of Education. The responses were translated into English for analysis. This survey instrument developed by Rogers (2013) to evaluate PVM for online teaching and learning, consisted of illustrations of (i) the PVM Model 1. Online Teaching Style and (ii) the PVM Model 2, e-learner Capability. Respondents were then asked to what extent the overlapping quadrants were matched (Good, Bad, Doesn't Matter, and Don't Know). This paper suggests that the same framework can be devised for Tourism Industry Trainers, Mentors and Coaches and those learners they coach also in the RF,

There emerges, from the current research paper, a need to create a community of practice (CoP) for learners, in the Tourism Industry and their teachers so that learners are given a fair chance to succeed. Researchers Wenger (1998), Thorpe (2009), Squire and Johnson (2000) and Goodyear (2001) , Vygotsky, (1978))amongst others state that "communities of practice" can act as a vital catalyst for the initiation and development of shared knowledge, expertise and 'know-how' using (online) networks to retain learners 'on task' rather than to ignore reasons for drop-out rates. For some, the re-skilling of lecturers and teachers for Education in The Tourism Industry amounts to a process of re-professionalization (Gornall et Al. ,2014). In addition, it is noted that further research to provide adequate training by such staff and institutions must be at the forefront of developing and delivering Sports and PE courses, in-house as well as reaching outward. As part of this aim, evaluation and pedagogical research by educational professionals are seen to be paramount. As Zhang and Nunamaker (2003) conclude, "It is a daunting task to maintain a well-educated and high-performance workforce in the global economy of today." (p.204). This re-professionalisation of teachers and Tourism Industry Coaches is also important for the future career prospects of their learners in the Tourism Industry, Sports' medicine, business, law, the media, and the arts, as well as for lifelong learning as much as it is important for teachers and Tourism Industry Coaches' ongoing employability. The emergence of newer educational professionals, teachers, "e-coaches," and "virtual trainers" through networks of knowledge sharing can be already recognised. (Gornall et Al. 2014). The ubiquitous scope of online education and training has many advantages—including the convenience, for both learners, teachers and coaches of being able to decide for themselves when and where to enter the virtual Arena of the Tourism Industry. This radical flexibility offers significant advantages to traditional teaching and learning. In addition, the portability of laptops and handheld devices means greater access to online courses that are properly benchmarked (Tobin et Al., 2015). Furthermore, Andrusyszyn, Iwasiw, and Goldenberg (1999) observed that as the population of learners increased, so too did the need for developing guidance. This includes the use of learning systems and disruptive technologies (Hartley & Bendixen, 2001; Russo and Benson, 2005) due to obsolescence, as one enabling technology is replaced by another providing round-the-clock access to learning and teaching systems (Rogers and Aldhafeeri, 2014) in online pedagogy to increase learner retention rates by decreasing learner attrition rates.

ACKNOWLEDGEMENTS

We should like to thank our research colleagues from The University of South Wales, UK,, namely Professor Emeritus Dr. Norah Jones, Dr Lynne Gornall and Christine Atkinson for their unfailing support and belief in our professional skills as educational researchers, pioneers and innovators. We also owe much gratitude to Professor Alejandro *Armellini*, the Director of the Institute of Learning and Teaching in Higher Education at the University of Northampton for his insightfulness in the evaluation of the PVM.

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JEL O16

FRAUD AS THE BASIC RISK OF FAILED ICO

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Abstract. In the article, the peculiarities of ICO as a form of financing the company are examined, as well as the main advantages and disadvantages of this way of fundraising are characterized. In analyzing the phenomenon of ICO, the author defines fraud as the key risk of ICO failure and suggests a system of project evaluation based on WhitePaper for preliminary identification of a possible deception.

Keywords: ICO, blockchain, crypto-currency, WhitePaper

Along with the development of modern technologies and forms of doing business, a new way of attracting financing for innovative projects has emerged, called ICO (initial coin offering - initial placement of coins (tokens)). This method of fundraising is based on the use of blockchain technology – decentralized digital transaction register.

ICO facilitates the simplification of the procedure for attracting financial resources, avoiding regulatory actions of the government and mediation of intermediaries. Startups that wish to conduct an ICO issue tokens for a new crypto-currency, which can be purchased by interested investors. People who invest in the project count on the increase of the price of tokens, which will ensure them a return on investment.

The similarity between ICO and IPO (initial public offering) is obvious, but in the case of ICO, the investor instead of shares receives tokens that do not confer ownership rights, but allow to receive economic benefits from the increase in funds at the conclusion of the ICO. There is a common feature in ICO and crowdfunding: funding is involved to implement a particular project, when a real product does not exist, but there is an idea.

The main advantage of ICO over an IPO is the ease of attracting financing. For project founders, this method is cheaper, allows them to conduct active communication with the target audience and delegate some of the financial risks to investors. At the same time, investors should be careful not to take part in fraudulent ICO projects. To do this, each potential investor, while deciding whether to invest, should independently or with the help of specialists assess the reliability and potential of the project.

Recently ICO has spread around the world, and with it certain difficulties of this method of financing became apparent. Investments in ICO are characterized by considerable risks because you cannot have absolute certainty about the receipt of a profit. The main factors impeding the successful development of projects will be briefly described below. The most serious reason for the failure of ICO projects, in our opinion, is the emergence and development of financial fraudsters in the industry who seek to raise funds to provide non-existent companies.

According to statistics for 2017, given by TokenData (the Website that is the base of all conducted ICO), 418 out of 902 ICO projects failed: 140 failed at ICO stage, 276 stopped existence after ICO. In addition to these already stopped startups, there are 113 projects whose activities are not known, and their founders do not answer investors and the media, and therefore they can be classed as fraudulent.

For the second quarter of 2018, 827 projects attracted $ 8, 359 million, which is 151% more than in Q1 ($ 3,331 million). For the first half a 2018 year, in total, ICO projects raised $ 11.690 million, which is 10 times more than the same figure in 2017. At the same time, statistics is still disappointing: 55% of projects failed.

The United States Securities and Exchange Commission (SEC) regulates the activities of ICO projects on the territory of the country. On July 25, 2017, the SEC introduced a document that establishes the possibility of applying US securities laws to sales of corporate tokens, thus equating them to assets and imposing certain bans on them.

The result of this regulation was the suspension of the Centra project and the arrest of its organizers, to whom the SEC filed charges of fraud. According to the regulator, the company's founders raised $ 32 million, trading unregistered tokens. At the same time, entrepreneurs disseminated information about the non-existent team and even created WhitePaper (the main document of the ICO project). As a punishment the founders of the company will be obliged to return all collected funds, as well as fines and interest. Moreover, project managers are banned from further distribution of any securities and deprived of the opportunity to occupy managerial positions.

The largest scam in the history of ICO occurred in Vietnam because of Modern Tech company, which announced two projects: Pincoin and iFan. In total, the organizers deceived about 32,000 people, appropriating $660 million. Pincoin attracted investors, promising a monthly stable return on investment of 40%, and iFan was seen as a platform for celebrities, offering them communication with fans and promoting their content.

In the ICO market, such fraud cases are called "scam", and as practice shows, every year they become more and more popular, while the number of promising and cost-effective projects is decreasing. Therefore, before investing financial resources in any ICO startup, it is necessary to conduct a thorough analysis. Despite the apparent complexity of this assessment, most of the information for it can be found through any search engine.

The question is how to distinguish a failed or fraudulent project from a real, potentially successful and profitable one? The first factor is the uniqueness and significant advantages of the idea underlying the project. It is necessary to evaluate the usefulness of the project for people, make sure that it is not plagiarism of another, even useful product.

Next, you should think about the feasibility of the project. To do this, you should carefully study WhitePaper - the main paper of each ICO project. WhitePaper is a document containing an in-depth analysis of the project, the purpose of which is to convince the potential investor of the prospects and value of the idea and the product. Each WhitePaper has a fairly formal structure:

1. Identification of obligations and risks associated with investing and the degree of investor’s responsibility;
2. Abstract describing a problem existing in a society that objectively requires a solution;
3. Review of the industry and proof of the existence of a niche and target audience for the submitted project;
4. A solution proposed by the team that can solve the problem described earlier;
5. Business model: implementation and concept of the project;
6. The economy of the token: its description, practicality and functionality. Here it is important to pay attention to the distribution of the token: what percentage will be released for sale, what will be involved in

the private sale, what will remain for developers and consultants.

Next, you should see whether the project team plans to prohibit the reselling of tokens – this action will serve as evidence of the seriousness and long-term nature of the project.

It is necessary to evaluate the correlation between the proposed technology or the product and its value. If the token has less than three functions and can be replaced by crypto currency, then this is one of the signs of the project's groundlessness. In the plan where the token is not integrated into the project economy, it is likely that the team uses it only to raise funds.

7. The reasonableness of the need for the use of blocking technology;

8. Details of ICO: the procedure for conducting a closed sale of tokens, pre-sales and main sale;

9. A roadmap describing the stages of the project implementation, its main dates - in this paragraph it is necessary to pay attention to which stage of the project is at this time period and to assess the degree of implementation of the previous stages;

10. Characteristics of the team with brief biographies of developers and project consultants. First you should pay attention to the composition of the team, make sure of the competence and availability of the necessary experience of its participants, the presence of specialized professionals. Suspicious factor will be the disunity of team members or their absence in social networks or reduced activity there.

11. References to the evidence of statements indicated in WhitePaper (their absence may indicate falsification of data) and links to social networks.

It is necessary to evaluate the uniqueness of the WhitePaper itself, as many scammers compile paper, only slightly modifying, and the original can be easily found on the Internet.

Also, each project has OnePaper – a one-page description of the project, which is a short version of WhitePaper. Often it consists of schemes and graphs, and is characterized by the lack of important information. Therefore, the decision to invest is inappropriate to accept, based only on this document.

Another important point for consideration is the program code of the project. It should be laid out on the GitHub (web service for placing the codes of IT projects) and have a discussion page on Bitcointalk (a forum for analyzing the technical side of the block projects).

To make a profit, a valid ICO project must have a real legal and physical address. The project team should organize a system for the sale of goods or services, the characteristic of which is formulated by real projects prior to the fundraising. If there is no information on the ways to monetize the project, it can also be referred to as fraudulent. You should check the official website and the communication facilities of the project founders with their target audience, including social networks (Facebook, Telegram, etc.).

One of the most obvious signs of a fraudulent project is guaranteed yield. If the site offers a stable percentage, the likelihood of fraud is high (as the situation was in the previously reviewed Pincoin project). This is especially evident in projects where the distribution of tokens is carried out according to the principles of network marketing – attracting new investors with the help of already existing.

Thus, ICO is an innovative and promising way of attracting financing, with undeniable advantages, the main of which are low access to the market for both entrepreneurs and investors.

However, in practice it turns out that a significant proportion of ICO projects do not succeed. This happens for various reasons, considered in the article, but the most dangerous is the rapidly developing risk of fraud.

The Crypto-currency community needs to become more vigilant and cautious while choosing a project for investments, and governments of the world should take measures to organize ICO in order to restrict fraudulent activity.

It is simple to deceive ignorant investors, despite the fact that the methods of scammers do not differ in originality. The analysis technique of reliability and potential success of ICO based on WhitePaper is considered in the article in order to help to identify the fraudulent projects and secure investments.

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JEL: A12

SYSTEMS APPROACH

IN SOCIAL AND ECONOMIC CYBERNETICS

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Abstract. Unsuccessful attempts to apply technical cybernetics to the modeling and control of social and economic systems are due to the fact that we need different views of the systems approach, we need different cybernetics. It is proposed to use post-non-classical scientific rationality as a philosophical and methodological basis for the formation of adequate representations of social and economic cybernetics. The systems approach in post-non-classical scientific rationality turns out to be associated with the research and organization of "self-developing human-dimensional systems." Taking into account the specifics of the problematics of social systems control, we have proposed considering this class of systems as self-developing poly-subject (reflexive-active) environments in which the ontological bases for the convergence of hybrid reality (subject, digital and physical) are provided. Subjectness becomes the main system-forming factor, the main factor of systems approach. At the same time, the evolution of cybernetics is associated with the development of scientific rationality, with the ascent from classical cybernetics of the first order, to second-order cybernetics and post-non-classical cybernetics of the third order. A variant of the model of a self-developing reflexive-active environment, which is presented as a multi-level structure of the ideological, conceptual, technological level and level of implementation, is proposed. The proposed foundations for building social and economic cybernetics have attracted the attention of the international community of scientists focused on the creation of these areas of scientific knowledge.

Keywords: systems approach; social cybernetics; economic cybernetics; post-non-classical scientific rationality; third order cybernetics; self-developing reflective-active environments.

INTRODUCTION

Cybernetics has a wealth of successful experience in organizing the control of technical systems, which has allowed developing tools that are adequate to the specifics of control objects, largely based on mathematical methods and computer technologies.

When trying to use this experience for organizing the control of social and economic systems, various problems arose that convincingly demonstrated the inadequacy of technical cybernetics tools for this class of systems [1].

In technical cybernetics, the idea of consistency was adequate to its tasks. However, it turned out to be inadequate for social and economic cybernetics.

The development of second-order cybernetics ideas and approaches (Von Foerster) is associated with the expansion of ideas about systemic nature, with the inclusion of active and reflexive control objects in consideration. However, second-order cybernetics could not fundamentally overcome the causes of the crisis. What is connected, in our opinion, with methodological limitations in modeling the integrity of social systems.

We propose the consideration of a new approach to the presentation of a system based on modern ideas of the philosophy of science, based on post-non-classical scientific rationality [2].

THE BASIS OF SYSTEM FOR THE DEVELOPMENT OF SOCIAL AND ECONOMIC CYBERNETICS

The philosophical and methodological foundations could be the ideas of post-non-classical scientific rationality [2]. This rationality sets the four most important foundations of a systemic approach, focused on the harmony of the subjects of development.

The first subject is a methodologically sound joint presentation of subjects, means and objects in the processes of cognition and activity. The second one is the inclusion in the processes of cognition of social values and goals, along with intrascientific values, the establishment of harmony of the internal and external mechanisms of development. The third subject is an introduction to science of ethical regulators and fundamentally important links with culture. The fourth subject is an understanding of post-non-classical rationality not only as a specific type of scientific rationality, but also as a framework methodological construct that organically incorporates classical and non-classical rationality.

Systems approach in post-non-classical scientific rationality by V.S. Stepin is associated with the study and organization of "self-developing man-sized systems" [2]. Taking into account the specifics of the problematics of social system control, we proposed considering this class of systems as self-developing polysubject (reflexive-active) environments [3], which provide for the ontological basis for the convergence of hybrid reality (subject, digital and physical). The evolution of cybernetics is associated with the development of scientific rationality [4]. This gives grounds to consider the systems approach in social and economic cybernetics in the context of post-non-classical scientific rationality.

The problem of the crisis of the dominant type of civilizational development is connected with the post-non-classical understanding of the systematic and the system approach. In recent years, more and more attention on interdisciplinary scientific events has been paid to the challenges and threats generated by the specifics of technological civilization, the need to find a transition to a new type of civilizational development. The focus of attention is the problem of searching for ideas about the systematic and the systems approach adequate to the civilizational transition. In our opinion, the post-non-classical interpretation of a systems approach is adequate for searching and developing an image of a post-technogenic civilization, which may be a socio-humanitarian civilization.

It is fundamentally important to note that the concept of a systems approach in the search for new forms of civilizational development is associated with the basic values of human development. These are the values of conservation and development: of a person; humanity; biosphere; techno-sphere, in which the increasing role is played by digital reality.

It is these values that are organically interrelated and require a systematic approach for organizing the processes of goal-setting and the implementation of strategies developed on the basis of the basic values of human development.

In the technogenic civilization, the initiator and creator of which was the West, these values are practically ignored, as evidenced by reports of the UN and the Club of Rome, prepared in 2017 and 2018. In the technological civilization, the economic basis of which is capitalism, the values associated with the principle of profit maximization flourish. It is the futility of capitalism for the future of mankind that is justified in the aforementioned reports of the UN and the Club of Rome.

Technogenic model of climbing uncontrolled by mankind according to technological structures fits in well with the technogenic civilization. For Russia, which, due to a number of circumstances and prevailing realities, turned out to be hopelessly backward from the leaders of the transition to the VI technological order (NBICS), a promising potential option "to overtake without catching up" with the leaders of the technological race opens up. This is the transition to the VII socio-humanitarian technological order, becoming the leader of the socio-humanitarian civilization. This transition will also mobilize society for the intensive development of high technologies, coordinated with regard to the basic values of human development.

The planned transition to a socio-humanitarian civilization will be associated with the formation of the subjectness of human development. At the same time subjectness becomes the main system-forming factor.

THE BASIC MODEL OF THE SELF-DEVELOPING POLY-SUBJECT (REFLEXIVE-ACTIVE) ENVIRONMENT IS THE BASIS OF THE SYSTEMS APPROACH IN SOCIAL AND ECONOMIC CYBERNETICS

It is fundamentally important that the self-developing poly-subject (reflexive-active) environment is considered as a self-developing system and as a meta-subject. As a consequence, the third-order cybernetics paradigm can be represented as a "subject – meta-subject" [3].

The idea of self-developing reflexive-active environments was proposed under the influence of some interdisciplinary ideas and concepts. Philosophy gave the basic ideas of post-non-classical scientific rationality, on the basis of which the opportunity arose to integrate ideas and concepts of the humanities: ideas of the noosphere (V.I. Vernadsky), the concept of society as a social system (Niclas Luman), activity and subject-activity approaches (A.N. Leontyev, L.S. Vygotsky, S.L. Rubinstein, and others), research by Russian methodologists (G.P. Schedrovitsky, etc.), interdisciplinary ideas for the formation of social cybernetics (Stuart Umpleby), socio-humanitarian analysis of computer-aided design experience country control systems (V.E. Lepskiy) and others.

The model of a self-developing reflexive-active environment is presented by us through the multi-level structure of the worldview, conceptual, technological level and level of implementation [3].

Worldview level:
- values and meanings of harmony of the subjects of development;
- ethical norms and principles of organization of interaction of subjects;
- models of correlation and convergence of world outlook bases of various social communities.

Conceptual and methodical level:
- the subject-activity level (positioning of subjects, ontology of their activity and interaction);
- criterion level;
- the level of principles (the structure of the principles of organization of activities and interaction of subjects);
- methodical level.

Technological level:
- conceptual and technological;
- instrumental and technological.

Realization level (practical experience).

It is fundamentally important that the technological level is a link between the conceptual representations of the subject-oriented approach and the ideas in scientific support and practice of the established approaches (including the first and second order cybernetics tools).

Self-developing reflexive-active environment is a meta-subject that has invariant properties for various types of subjects: purposefulness (activity), reflexivity, communication, sociality, ability to develop.

Such an environment is fundamentally different from networks. This is the interaction of active elements that can be formed on the basis of natural intelligence (personality, group, etc.), artificial intelligence (agents) and the integration of natural and artificial intelligence.

The organization of the interaction of active elements with each other and with the environment is determined by a system of values, principles, ontologies, criteria, and specialized subject-oriented information platforms [3].

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JEL O 10 - Economic Development: General O 10

ENTERPRISE MANAGEMENT IN TURBULENT SOCIO-ECONOMIC ENVIRONMENT OF THE XXI CENTURY: BIOCYBERCORPORATIVE SYSTEMS AND INFRASTRUCTURE

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Abstract. The whole world stands today on the threshold of an entirely new historical reality which are defined by the processes of globalization and the formation of a new level of civilization in fact, the characteristic features of which are the global economy and unprecedented competition. Many enterprises of almost all countries of the world since the middle of 90-ies of XX century felt the effect of hypercompetition in practice, they are increasingly exposed to the cumulative effects of the previously isolated from each other competitive factors that contributed to the multidimensional, dynamic and aggressive competition. It is need to create a fundamentally new organizations and enterprises with possessing of hypercompetiveness which should be regarded as an adequate response to hypercompetition.

Keywords: Turbulent socio-economic environment; hypercompetition; hypercompetitiveness.

Actually, with the rapid development of the global economy 'modern enterprises, regions and countries turn in a completely new situation. The complexity and dynamic processes occurring at the same time suggest to make a conclusion of the formation of a turbulent socio-economic environment, which is characterized by so radical changes that "the rules and procedures with the help of which a policy carry out, obsolete and causing researchers lose any of paradigms or theories that adequately explain the course of events. [1] Of course the turbulence social-economic environment significantly increases during economic crises. However, a number of authors believe that this phenomenon is not only more fundamental, powerfully manifests and increases in times of economic crises, but is an integral part of modern international relations of the global model of governments. Due to current estimates is a modern international community will be in the "zone of turbulence" [2] another 15-20 years and in relation to the national economy of Russia in a research environment it is supposed to "turbulent decade" [3].

For the most characteristic features of turbulent of social-economic environment should include such a thing as hypercompetition [4], the hallmark of which is a multifaceted of interests of competing parties, dynamism and aggressiveness in behavior at both the international and national market.

Before management case of almost all businesses and organizations face the aim, who cannot be effectively solved using traditional management practices, the behavior of competition changed radically.

It is need to create a fundamentally new organizations and enterprises with possessing of hypercompetiveness which should be regarded as an adequate response to hypercompetition.

In fact, we are talking about smart (trainee) of the new formation which have the properties of self-regulation and self-advancing innovation in terms of existing real relationship between the organization and its external environment, in a state of turbulence. Strictly speaking, the idea of building intelligent (learning) organizations goes back to work Wiener, W. Ashby, P. Anokhin, A. Turing, von Neumann D., S. Beer, F. George, M. Arbib, J. Tsypkina, N.Amosov, Ivakhnenko and other scientists involved in the research and development of self-organizing and self-developing systems. The most important step in creating a trainee organization is considered to be the concept of creating cyber-corporation which are built through the using of model elements of J. Henderson (J. Henderson).

Marked works and [5-7] prepared the way for the formation of a "full-blooded" trainee organization of new formation based on three platforms: management-, 'cyber-and bio-platform. Such kind of organization may be called biocorporation and its generalized scheme shown on Fig. 1 [8,9].

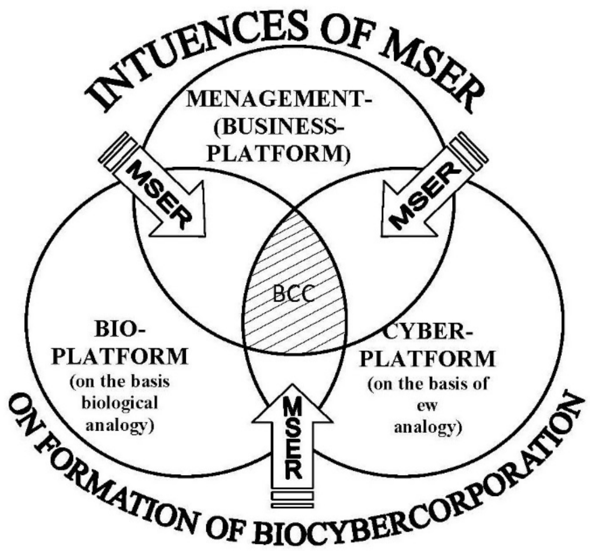

Fig. 1 **Formation of biocybercorporation**

BCC – a short name of biocybercorporation; ⟹
- influences of methodology system of enterprise restricting (MSER) on business-platform, cyber-platform and bio-platform in formation of biocybercorporation.

Management (business) platform of biocybercorporation (see Figure № 1) is formed on the basis of a conceptual installation to ensure managerial representatives of functioning reliable picture of the enterprise in the turbulent ecological and social-economic environment. The basis of the construction of such pattern is laid a universal base model life of organization as an open system, which serves the primary source for the development of aggregate models describing the operation of biocybercorporation with the interaction of complex multidimensional factors of external and internal environments[10].

The model presented in Fig. 2 allows us to imagine the organization as an open system (as an object functioning in external environment and interacting with other systems), thus creating the opportunity to study all the processes and phenomena which occur during the activity of organization, in conjunction with its surrounding to its full depth. In this case the key factors of the company which influence on external environment, according to the principle of stratification of the environment, distributed in three rings of organization surrounding (see Figure № 2):

1. Factors that connected with a constant fact of daily life of companies which have the dynamics of change; comparable to the dynamics of changes in the internal environment of the organization (suppliers, customers, competitors, market of workforce). These factors form a microenvironment of the enterprise (or the first ring around him), proceed in it most rapid and dynamic processes. The first ring of the enterprise of surrounding is actually a prototype of its competitive environment (microenvironment described tools and microeconomics).

2. Factors "in the global surrounding of organization," including, in addition to traditional classical components - politic, economic, social situation and technology well-known in the theory of management as «PEST-factors", and also includes legal field which regulates the activity of an enterprise in definite region of its location and this country. Factors "of global environment of an enterprise" form its macro-(or second ring of surrounding) in which the process is much slower (they are more inertial) in comparison with the first ring of surrounding (macro surrounding describes by instruments of macroeconomics).

3. Factors "hyper surrounding of organization" hypermedia, in which transformational changes occur at the level of world globalization processes (this encirclement displays the slowest processes comparable in terms of

changes which occur in them to evolutionary processes of social development). Processes in hypermedia are resisted difficult to modeling and description (it requires the use of toolkit which allows to determine the conditions of equilibrium and steady state of the whole of "system of systems" in general up to the level of geo-, hydro-, atmo-and biosphere).

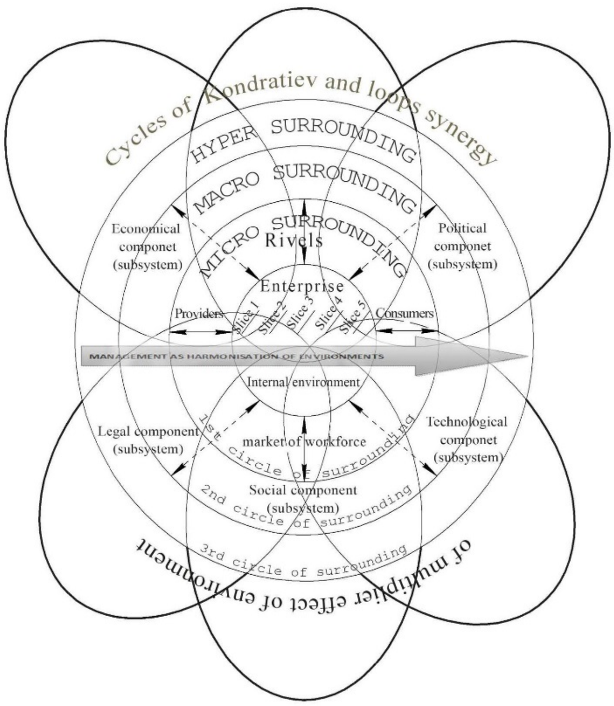

Fig. 2 **Basic model of life organization as an open system in turbulent ecological – social – economical environment (open model of life of organization):**
dashed two-edged pointer – interpenetration and interaction of all system models; continuous two edged pointer – influence of micro surrounding as for him-self and as for macro surrounding; 1,2,3,4,5 – slice of internal environment: 1 – institutional, 2 - personnel, 3 – production, 4 – financial, 5 – marketing.

Considered base model of life organization as an open system (see Figure № 2.) and its derivatives models allow with unified conceptual positions to build a range (aggregate system models) showing of functioning organizations in turbulent social-economic environment using "pictures (scenarios) of vision the future "[11]. This will ensure full compliance with modern research methodology semi structured and unstructured problems, which are characterized by a low level of accuracy and quality approach to the description of the postulated dependency (it makes ineffective aspiration of rigorous quantitative solutions).

Bio-platform of biocybercorporation (see Figure № 1) is formed the main purpose of realization the functions of the developed system of adaptation in turbulent ecological and socio-economic environment. Processes of learning and adaptation to biocybercorporation are based on biological analogy with highly organized living organisms. Moreover, for effective behavior in a competitive organization environment the main thing is implement of opportunities to improve and accelerate the creation, accumulation and use of knowledge on the base of analogs such qualities of highly living organisms such as ability, learning, knowledge and memory.

Cyber-platform of biocybercorporation (see Figure № 1) characterizes complex which practically realizes management functions of organization on a base of potential which laid in its management – and bio-platforms and forms a kind of «cyberskeleton» of biocybercorporation formed on the basis of new information technology.

To use biocybercorporation purposefully to integrate of heterogeneous goals and objectives of the structures involved in the production and commercialization of science and technology within national borders (small and large companies, universities, research institutes, industrial parks) which setting of legal, financial and social interaction. In other words, biocybercorporations can act as strategically significant integration of units of the national innovation system [12-13]. This role is actually formed by nucleation and logical preconditions for the formation of intelligent organizations dictated by the course of development of processes of globalization and global competition.

In essence, creating of biocybercorporation is an adequate response to the imbalance of socio-economic environment caused by these processes and phenomena, in result of which can be created favorable conditions for the stabilization of micro- and macro-economic of processes at a new level.

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SURPRISES OF SYSTEMS AND MANAGEMENT

ADLER YU. P.

Abstract. This paper deals with correlation between theory of systems and the management. Noted that emergence of systems that are ready to synergy, and fractality must have the significant influence on the strategy and the tactic of management. It is possible to make the positive impact on the business results. However, in practice it does not happen. It is hypothesized that the reason is fear of management to lose control. It is proposed to discuss this hypothesis

Keywords: Theory of systems, Goals, Emergenceness, Synergy, Fractality, Fear of Management.

«Wood may remain ten years in the water, but
it will never become a crocodile».
Congolese byword

General theory of systems exists for a long time. The first «modern» publication appeared in 1914. This was the «Tectology» by Alexander Bogdanov. He was ahead of time by 2-3 decades and was not recognized either in his homeland, in Russia, or aboard, although he published his book in Berlin, Germany. He died tragically, conducting himself a risky blood transfusion. He was a man of bright temperament, encyclopedic knowledge and active work in many fields [1]. Therefore, the Austrian biologist Ludwig von Bertalanffy turned out to be the actual creator of this theory [2, 3]. By his own admission, he was the first who expressed these ideas in public in 1937 at a seminar on the philosophy of science in Chicago, USA. But the outbreak of Word War 2 forced him to postpone it all. Only after the war he returned to this topic and his work [2] was one of the first. Almost immediately the rapid development of this direction began, which was accompanied by the rapid growth of «Operations Research» developed during the war in Great Britain [4], cybernetics [5], systems engineering [6], game theory [7], and a number of other related areas, for example, [8]. A more detailed bibliography can be found, for example, in Ref. [9].

I took your attention to these, in general, well-known facts, to proclaim that what will now seem to you as «surprises» has been well known long ago. Menegers manage organizations that can certainly be interpreted as systems, are often quite complex. They cannot manifest system properties. Meanwhile, the overwhelming majority of managers at any level cannot see them at close range. Why? I have no answer, but there is a hypothesis, and I invite the reader to discuss it.

Not surprisingly, there are lots of definitions of the term «system». It seems to me that the basis of such a definition is to put the property of the system. E. Deming believed that the main property of any system is existence of a goal: there is no system without a goal. From here follows: «A system is a combination of some elements (parts, subsystems, ets.) subordinated to a common goal.» This determines «the integrity» of the system. Every system has special properties. One of the important properties is indicated by the word «emergence», which essentially means that some properties of the system do not apply to its parts, and, above all, it refers to the goal. The presence of any goal as a part of the system, if it does not coincide identically with the goal of the system, always and inevitably leads to a decrease in the efficiency of the system, no matter how we express it. How does management work in this situation? It gladly transfers the balanced scorecard [10] to the organizations included into the holding, and even to structural units of one organization. It creates a meaningless artificial internal competition that can even destroy a business. Moreover, the management instills and maintains the KPI – system of individual indicators of employee performance, and this approach indicates a mechanistic Newtonian deterministic model of organization, the failure of which is beautifully shown, for example, in [11], and in numerous publications by E. Deming [12].

The meaning of the creation and existence of any organization is to take advantage of «the synergistic effect» that the total result of the work of a collective of people (team) is usually much higher than the sum of the results of the same people working individually [13]. E. V. Kondratiev uses the term « resonance» to describe this mechanism. When resonance condition arises, it seems to me that an important role is played by associative thinking, which is used, for example, by Japanese when searching for consensus using the «ringi» technology [14]. Of course, synergy is a great blessing, it provides the very possibility of the existence of human society. But at the same time, it creates obstacles to the «fair» wage. It is synergy that does not allow measuring the contribution of an individual to the common results. And management still loves piecework – an insurmountable barrier to quality products. And again it is leading to creating artificial competition, destroying moral and undermining business. «Fair» payment of the individual in collective labor does not exist. It remains subject to a contract between the employee and the business owner. In a joke they say that only the saints in icons are satisfied with the salary.

In the literature there is an idea that the systems have the property «fractality» [15]. The word «fractal» was coined in 1975 by Benoit Mandelbrot, who two years later published the book [16]. After that, the fractal, that is, structures whose complexity does not depend on scale, began to appear everywhere. It came to management. However, it is not clear to me how the emergence is connected with the fractality.

So it is clear that the properties of systems are important to use in management. The properties themselves, as we know, are pretty well understood. Their use in management is more or less clear. But with rare exceptions, they are practically not used in business management. Now you can discuss my hypothesis. The fact is that there are some universal obstacles to the widespread use of system features in management and it can be defined as loss of control, which means, as is commonly believed, the loss of management power. There have been many examples in the literature lately of what the adherence to system principles may lead to, but we will limit ourselves to just one, rather eloquent reference [17]. Everything I said above means that we all have a hard and long job ahead to change the management mentality. What do you think?

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SYSTEMS THINKING AND COLLECTIVE PROBLEM SOLVING PRACTICES

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Abstract. In most systems methodologies coping with "human" systems, a systems thinking is closely related to practices of solving complex, or "wicked" problems. From the time of A. A. Bogdanov and L. von Bertalanffy systems approaches had an attitude toward overcoming the disciplinary division of sciences, as well as the breaking of theory and practice, so they treated relevant problem situations as "systemic situations". In this paper we consider the typology of "western" collective problem solving practices (it is based on the System Of Systems Methodologies – SOSM) and specific features of the same practices in the Moscow Methodological Circle (MMC) as a representative of "Russian systems thinking". Peculiarity of MMC is that "systemic situations" are schematized in multi-position manner, which opens the prospect of collective problem solving as a multi-position organization of practices. In MMC these practices were implemented in the form of Methodological Seminars (MS) and Organizational-Activity Games (OAG). The model of conceptualization and resolving of systemic situations in these practices is Thinking-Activity Scheme.

Keywords: systems thinking, complex problems, systemic situations, collective problem solving, multi-position organization of practice, the Moscow Methodological Circle (MMC), Thinking-Activity Scheme

INTRODUCTION

In most systems methodologies coping with "human" systems, a systems thinking is closely related to practices of solving complex, or "wicked" problems. From the time of A. A. Bogdanov and L. von Bertalanffy systems approaches had an attitude toward overcoming the disciplinary division of sciences, as well as the breaking of theory and practice, so they treated relevant problem situations as "systemic situations". In this paper we consider the typology of "western" collective problem solving practices and specific features of the same practices in the Moscow Methodological Circle (MMC) as a representative of "Russian systems thinking".

SOSM AS THE TYPOLOGY OF "WESTERN" COLLECTIVE PROBLEM SOLVING PRACTICES

In 1984 M. Jackson and P. Keys have offered the System Of Systems Methodologies – SOSM [1] which then has been described and presented in various ways. In the book [2] SOSM represents also the typology of systems thinking. It includes four types of systems thinking in the "ideal-type" grid of problem situations or problem contexts:

- Type A: Hard Systems Thinking in wide sense (the problem context is Improving Goal Seeking and Viability);
- Type B: Soft Systems Thinking (the problem context is Exploring Purposes);
- Type C: Emancipatory Systems Thinking (the problem context is Ensuring Fairness);
- Type D: Postmodern Systems Thinking (the problem context is Promoting Diversity).

The grid of problem contexts is two-dimensional (see table 1): the "systems" and "participants" dimensions used to establish it. The vertical axis expresses a continuum of system types conceptualized at one extreme as relatively simple, at the other as the most complex. The horizontal axis classifies the relationships that can exist between those concerned with the problem context – the participants, or stakeholders – in three types: “unitary”, “pluralist” and “coercive”.

The first two columns of SOSM correspond to Peter Chekland’s distinction of Hard and Soft systems methodologies (see [3] – M. C. Jackson directly refers to this book), and to G. P. Shchedrovitsky's distinction of “System-1” and “System-2” [4]. In 2012 V. G. Maracha has paid attention to this circumstance and suggested putting the concept “System-3” in compliance to the third column, having united Jackson’s Type C and Type D in the uniform type of thinking [5].

This idea seems to be worth mentioning because coercive systems are almost always complex (more reasons see in [6]).

So we can consider “participants” axis of SOSM grid as the typology of “western” problem solving practices. And then, in essence, applied systems thinking of types B, C, D (second and third columns, i.e. “System-2” and “System-3”) is a process of collective problem solving which includes multi-position interaction and co-ordination.

“RUSSIAN SYSTEMS THINKING”: MMC AS A BIG PROJECT AND ITS GENERAL FRAMEWORK

Further we consider MMC as a representative of “Russian systems thinking”.

MMC was organized in USSR in the year of J. Stalin’s death (1953) and was led for more than forty years by G. P. Shchedrovitsky (1929–1994). Now it exists as the “Methodological Movement” and a few institutions associated with it. The specific approach of MMC is that “systemic situations” are schematized in multi-position manner, which opens the prospect of collective problem solving as a multi-position organization of practices.

If we consider the development of the Moscow Methodological Circle (MMC) as a big project we can determine some requirements to thinking which allows us to change the World [7]:

- holism and reflexivity in relation to the other approaches and types of thinking (in science, design, engineering, socio-cultural and law studies, etc.);
- practical orientation (thinking-activity connections, which uses systems approach as the means for organizing processes of resolving complex problems by multi-professional and transdisciplinary teams, etc.);
- reflectivity as practical orientation of thinking to itself, i.e. its capability to re-construct and re-direct itself;
- the “methodological turn” from thinking about systems as objects to organizing, performing and reflecting the process of systems thinking in practice.

The first feature/principle is systemic one, the second and the third are constructivist, and the fourth follows from Bogdanov’s “organizational point of view”. These general features and principles have their general framework: the idea of “methodological thinking” as universal and developing process of collective problem solving.

Moving in general framework of the idea of “methodological thinking” as universal and developing from 1953 MMC has generated three R&D programmes for research and development of thinking [8]:

- “Logical Researches of the Thinking” (LRT): thinking is considered epistemologically (as a process of generation of new knowledge) and as a process of operating with the signs replacing objects of thought;
- “General Activity Theory” (GAT) and “System-Activity Approach” (SA);
- “System-Thinking-Activity Approach” (STA) and “System-Institutional Approach” (SI) as its specific kind for social systems and knowledge [7].

THREE MMC PROGRAMMES AND CONCEPTS OF SYSTEM IN SOSM

Systems approach in MMC practice involves three concepts of system [7]:

- “System-1”: Natural “Thing” Systems;
- “System-2”: Human Activity Systems;
- “System-3”: Socio-Cultural Systems, or Systems with “Internal Sense” (e.g.

Institutions as a case of Systems with "Internal Sense" in SI Approach).

Three concepts of system within MMC have become results of the different programmes and correspond to different paradigms of systems thinking.

Positions of MMC concepts (and paradigms of thinking) in SOSM are presented in the table 1. It demonstrates that MMC as an intellectual tradition chooses not postmodernist (relativistic), but rather rational answer to the challenge of Postmodern situation. System-Thinking-Activity Approach (STA) is a systemic and thinking-activity constructivism.

Table 1

MMC programmes and concepts of system in SOSM

		Participants / Stakeholders		
		Unitary / System-1	Pluralist / System-2	Coercive / System-3
Systems	Simple	Type A	Type B	Type C STA, SI
	Complex	LRT	GAT, SA	Type D STA

Source: [6]

Now MMC systems methodology has three basic components which are the foundations of System-Thinking-Activity Approach (STA):

1) systems thinking (as "methodological thinking" described above);

2) Thinking-Activity Scheme (an intellectual construction called by "scheme" in MMC is a diagram linked to the certain model as its meaning) and moderation technologies;

3) Systemic 3D-Methodology.

THINKING-ACTIVITY SCHEME AS THE MODEL FOR CONCEPTUALIZATION AND ORGANIZING COLLECTIVE PROBLEM SOLVING PROCESS

Thinking-Activity Scheme (published in 1983) is the model for conceptualization, organizing and coordinating collective problem solving process. In this scheme thinking and practical activity are represented in the form of different "layers" ("Pure Thinking" and "Thinking-Action"), divided by a "Thinking-Communication" layer. Links between three layers of Thinking-Activity Scheme are mediated by Reflection and Understanding processes [9]. "Thinking-Communication" layer in Thinking-Activity Scheme provides collectiveness of Thinking-Activity and allows to govern it by the means of moderation technologies. We use them in order to apply STA-Approach to systemic situations from practice.

Moderation technologies are considered as the mode of communicative governance supporting adhocratic type of interaction and deliberative communication [6]. Using Thinking-Activity Scheme with the help of moderation technologies allows researchers and practitioners to bridge systems thinking and systems practice in moderated forms of events organization (seminars, "round tables", transdisciplinary conferences like ISSS etc.) and to do the same in process forms of workflow organization: project groups, foresight, Organizational-Activity Games (OAG), strategic sessions, staff games, civil juries, wisdom councils, etc.

Historically there are two forms of specific MMC systems practice: Methodological Seminar (MS) and OAG. Having originated as a form of discussions and within MMC, step-by-step MS became a form of collective thinking for discussing transdisciplinary problems and considering systems situations in the "here-and-now" mode. The systems approach was used and developed in MMC for organizing collective problem solving processes by multi-professional teams.

Finally, MS generated “a new way of organization and a method for developing collective thinking-activity” – OAG, invented in 1979 [9]. There are many papers which describe living experience of OAG (see references in [6]). As an intellectual technology OAG could be compared with the Syntegration Method (see: https://www.malik-management.com), but there are some difference in conceptual interpretation and technical details (duration, a number of participants, etc.).

Now Thinking-Activity Scheme is implemented in consulting, education, city and regional development, public policy, public expertise procedures, organizing of public-political communications, conflict resolving and mediation procedures. In future, it will be useful in international relations, cross-cultural interactions, global problems resolving, etc.

CONCLUSIONS

We consider “participants” axis of SOSM grid as the typology of “western” problem solving practices. And then, in essence, applied systems thinking of types B, C, D (i.e. “System-2” and “System-3”) is a process of collective problem solving which includes multi-position interaction and co-ordination.

As for MMC participants, in systems approach they were followers of A. Bogdanov. And as Bogdanov anticipated Cybernetics by N. Wiener and General Systems Theory by L. von Bertalanffy (System-1), MMC participants anticipated Soft Systems Methodology by C. W. Churchman, R. Ackoff and P. Checkland (System-2). Now the general framework of Universal and Developing Methodological Thinking is expanding to problem contexts of Emancipatory and Postmodern Systems Thinking (System-3). MMC participants aspire to make methodological thinking capable to cover all field of SOSM and to apply instruments of different systems methodologies creatively and critically.

Thinking-Activity Scheme allows MMC followers to build a communication bridge between systems thinking and systems practice. This scheme includes a set of principles for resolving systemic situations with complex problems by multi-professional teams, i.e. organize and co-ordinate collective problem solving process.

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JEL R1, O380.

IMPROVEMENT OF INSTITUTIONAL MECHANISMS OF UNCERTAINTY MANAGEMENT IN THE IMPLEMENTATION OF INNOVATION PROJECTS WITH STATE PARTICIPATION

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Abstract. The report examines the problems associated with the imperfection of the institutional mechanism for interaction of economic agents in the process of implementing socially significant innovative projects with state participation. These problems are caused by uncertainties arising in the process of planning, financing and monitoring the implementation of innovative projects and the imbalance of interests of business agents. The content of the independent responsible examination, allowing to balance the remuneration and responsibility of the expert communities, as well as the mechanism of its functioning, is considered.

Keywords: institutional mechanism, innovations, uncertainties, economic agents, responsible expertise.

The Russian Federation, is, in accordance with the Constitution of the Russian Federation [1, art. 7], is a social state, whose policy is directed, in particular, to the creation of conditions "... ensuring a decent life and free development of a person". This is manifested, in particular, in the fact that a significant part of social needs are realized within the framework of state initiatives related to the development of health care, education, sports, culture, leisure, social infrastructure, etc. The role of public authorities and management in their implementation includes:

• Definition of the goals and priorities,

• Analysis and selection of the alternatives,

• Financing, monitoring and regulation of the implementation process,

• Evaluation of the effectiveness, including rather remote consequences of implementing social innovations.

Any actual innovation, regardless of the institutional nature of the participants and the sources of funding, public or private, for their direct or indirect results, as well as the consequences, both near and far, contain significant uncertainties, sometimes leading to serious, sometimes catastrophic consequences. The collapse at 14-08-2018 of the Polcevera viaduct (the bridge of architect P Morandi, Genoa, Italy), built in 1967, which caused the death of about 30 and the wounding of dozens of people, was only one of the many high dramatic consequences of the phenomena.

As an uncertainty, we understand here the inadequacy of the a priori information about future results and consequences of the implementation of relevant innovative projects. With private financing, the coordination of interests and risk management has been solved rather effectively.

Quite a different situation we observe when the project is financing by the government sources. In these cases, the system is unbalanced in terms of interests. First, the investor - the state agency, unlike the venture investor, risks by not his own capital, but by the public one. Secondly, the decisions about the form, scope and other significant financing conditions are taken by government officials authorized for this, which, although limited by the rules of action, have a considerable degree of freedom in choosing alternatives. As a consequence, conflicts of interest may arise (and often arise), which may lead to inefficient use, waste of public capital, a decrease in the effectiveness of innovative investments, and attempts to corrupt civil servants involved in the distribution of state orders in this sphere. All the above-mentioned makes an evidence of a deep lack of perfection of institutional mechanisms of uncertainty management in the sphere of innovative projects financed on the basis of state orders, which is one of the urgent problems of our institutional development.

At least two significant circumstances determine the complexity of this problem. First, it is that the standard methods of risk management, based on the law of large numbers (LLN), are not completely adequate, due to the fact that A.Y. Khinchin and A.N. Kolmogorov conditions on independence and the identical distribution of a large number of random events for the uncertainties under consideration do not hold. Therefore, the search and application of methods based on the difference in the results of research activity in different scientific groups, schools in terms of depth, time of achievement, the degree of validity and accessibility for the scientific community is required. These differences increase the expert value of those scientific groups and schools that have further advanced in system modeling of processes related to the field of social innovation being developed. As the expert value of the group, we will understand the predictive value of its model of the expert innovation which concerns to the completeness of the criteria for achieving the goals and the accuracy of estimates by this model of Benefits, Costs, Opportunities and Risks in the sense of, for example, [1].

The second source of complexity of the problem under consideration is that the interaction of the subjects of the process is unbalanced in terms of interests, which can reduce the effectiveness of innovation. Consider the characteristics of the main agents in this process.

The initiator of the innovation:

• Level of awareness of the problem of innovation: the largest,

• Interests: financing of innovation, achievement of the declared effect, public recognition and its economic consequences,

• Attitudes towards benefits and opportunities: a tendency to overstate,

• Attitude to costs and risks: the tendency to understate,

• Responsibility for failure of the project or failure to achieve the expected results: mostly moral, except for cases of misuse of the project funds.

The state body which is planning and financing the innovations (the person or persons making the decision - a decision maker (DMP)):

• The level of awareness of the problem of innovation: derived from the initiator of innovation and, possibly, from the expert community,

• Interests: compliance, even formal, with existing directive documents, legislative and other normative acts, organizational and financial strengthening of the position of the state body in the management system, medium-term - achievement of the declared effect, public recognition and its economic consequences, long-term - is absent,

• Attitude towards benefits and opportunities: neutral or a tendency to overstate,

• Attitude to costs and risks: neutral or propensity to down,

• Responsibility for failure of the project or failure to achieve the expected results: predominantly moral, with the exception of cases of connivance or promotion of misuse of project funds

The society (groups - users of innovation and, at the same time, taxpayers who finance them):

• Level of awareness about the problem of innovation: derived from all direct participants in the project,

• Interests: the fastest and most effective implementation of all social results announced in the project with the rational use of the resources allocated to the project, the medium-term - achievement of the declared effect, long-term - is absent,

• Relation to benefits and opportunities: neutral or absent,

• Attitude to costs and risks: neutral or absent,

• Responsibility for failure of the project or failure to achieve the expected results: none.

Thus, consideration of the relation to the project of its actors shows the imbalance of this system, at least in its following parts:

• Direct interest in the effective implementation of innovation is available only to the passive participant of the system - the consumers of innovation, among active participants this interest is secondary, giving priority to financing for the initiator or compliance with the norms for the state agency (DMP),

• Both the state agency (DMP) and the initiator are not responsible for the non-success of the project and the economic incentives for its successful implementation.

These circumstances led us in [3] to the concept of an independent responsible examination (IRE), which was further developed in [4].

This concept can be realized through independent responsible expert communities (IREC), which is a scientific research institution combining the functions of a systemic scientific and technical expertise, self-insurance of its scientific reputation, insurance of risks arising from the experts' -conclusion of uncertainties and stimulation of the expert community, depending on the quality of the submitted expert opinion. The historical predecessor of IREC can be considered, of course, with some stretch, the custom, observed by designers and bridge builders, to become a bridge at its commissioning, which symbolized the complete trust of the creators to the quality of their creations.

Let's consider the basic positions and construct-elements of the mechanism of functioning of IREC. Uncertainty here acts as a measure of ignorance that is eliminated in the process of research; IRE, as one of the methods for managing uncertainties, along with others (acceptance, transfer, reduction), requires public costs, which are "a payment for diminishing the uncertainty". This fee, as well as the cost of the innovation project itself, which is a part of, acts as the net costs of society "for progress" and it forms the estimated cost of innovation. Since the value of the IRE is the accuracy of the peer review, which can only be evaluated only ex post, the effective IRE mechanism can be if the payment of the IRE service would be carried out, at least in a significant part of it, first, after the implementation of the main objectives of the project, and, secondly, in direct dependence on the accuracy of the expert evaluation. The reserved part of the IRE payment before the completion of the project acts as a guarantee fund of the project, placed in highly liquid, low-risk financial instruments. Of course, this scheme works if the project is implemented. In those situations where the project is rejected (or the decision is moved to a later date to reduce uncertainty), a more complex scheme should be applied, which can be considered later.

Further, the concept of IRE, in accordance with the principle of responsibility, provides for making a guarantee deposit, preferably multiple of IREC remuneration. This deposit is made either at the request of the state agency - DMP, or at the initiative of the IREC itself, and it may be used in three ways. First, as a part of the project's guarantee fund (see above). Secondly, it uses for averaging the results of the IREs of individual IRECs in the decision-making process (the multiplicity factors are used as the weights, since they express the IREC's confidence as its forecast and the level of its responsibility for this quality). And finally, it can be used as a tool for encouraging IREC for the accuracy of the forecast (in accordance with the coefficients of the multiplicity of the winners).

The result of the IRE is the portfolio of responsible expert opinions (RECs) submitted by the participating experts of the IREC, and the government agency as an DMP should make a decision to implement or not the project, which bases on a collection of generalized BOCR indicators (see above), possibly equipped with a metric. While there is no retrospective of the implemented solutions that can be used to establish the quality rating of the IRECs, the only basis for the decision is the average expert evaluation of the project, weighted by the volume of guarantees provided to each IREC. In the future, the total quality rating of each IREC should be used as an additional weighing factor. This rating is in inverse relation to the normalized deviation of prognostic parameters of the projects from the actual for all the projects evaluated by the IREC. After determining the average expert evaluation of the project, the After determining the average expert evaluation of the project, the DMP makes a decision on its basis, whether to implement or postpone the implementation of the project in question.

After completion of the planned project implementation period, the actually achieved project parameters are compared with the estimates made earlier by each IREC, and the rating of the IREC is determined for this project. The main purpose of it is the distribution of the payment from this fund among the IRECs for the quality of their RECs.

Let's consider the sketch scheme of the functioning of the proposed mechanism with the following simplifying assumptions:

• The project is non-alternative, it is either realized or rejected (postponed for the future),

• There is a metric on the set of parameters that determine the value of the project, that allows us to u order un the unique way its estimates,

• Government agency - the DMP has no right to reject in its decision the generalized opinion of IRECs.

In this version of the mechanism, only assessments of the quality of expert opinions are possible for establish (correct) the IRECs ratings and for encourage them for the quality of these estimations. It is also possible to obtain accumulated assessments of the overall quality of the REOs of all the IRECs. However, the assessment of the quality of by the state body (DMP) in this model is not possible because it involves the role of simple implementation of generalized opinion of all IRECs involved in the process of examination For assess quality of DMP we need more complex models, the consideration of which is not the subject of this paper. Possible assessments of the quality (ratings) of REOs of individual IRECs for different ratios of generalized project estimates and the actual effect of this project are presented below (see Figure 1).

Within the framework of this model of the mechanism, there are two significant differences when, in accordance with a positive generalized estimate, the project is realized, but with a fundamentally different practical result: the actual effect is positive (1) and negative (2).

In case 1, the mechanism provides for part of the collected guarantee fund to be used to pay for the expertise and promotion of IRECs that gave the most accurate predictive estimates, the other part of the guarantee fund can be used both to cover unforeseen project costs, and to form a cumulative guarantee fund, to compensate for the uncertainties of other, erroneously implemented projects.

In case 2, in spite of the erroneous implementation of the project due to the unavailability of the generalized expert evaluation, part of the guarantee fund should also be used to pay for the expertise and promotion of the IREC, which provided accurate (in this case, negative) forecasts. The rest of it should be used to compensate losses from the implementation of the flawed project, with the possibility of attracting for these purposes also the funds of the cumulative guarantee fund.

In both cases, the IRECs ratings for this project are added to the cumulative ratings of each IREC, and new cumulative assessments should be used in arranging forex examinations of future projects to determine the weight of the relevance of the IRECs and the norms of their insurance coverage.

It seems that the proposed sketchy model, with all its conventionality and incompleteness, contains the potential for the formation of a full-fledged mechanism for interaction of economic agents in the planning and implementation of innovative social projects, and possibly a wider profile with public participation.

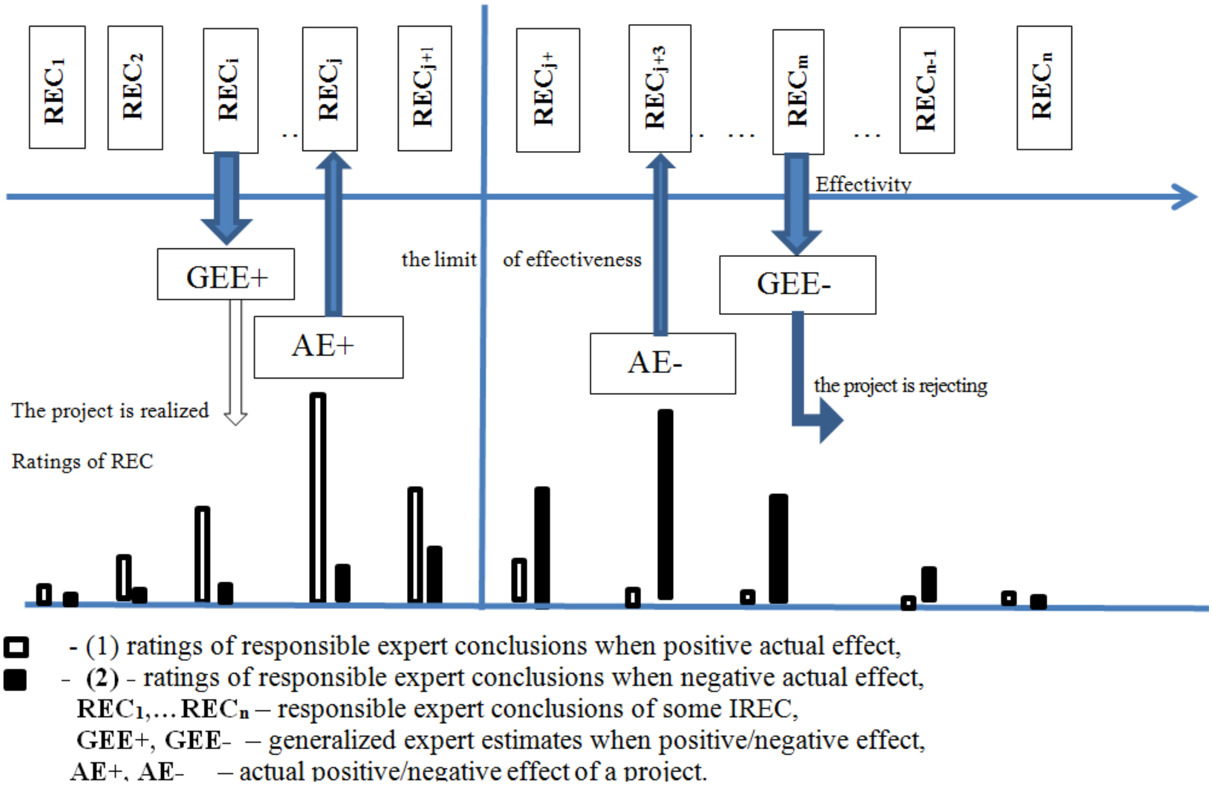

Fig. 1 **Individual and generalized expert assessments related to the actual effect as the basis for ratings of examinations**

Source: design of the author

For transforming the sketch model into a workable version, it is necessary to solve at least the following tasks:

• to formulate for each class of innovations a fairly representative list of uncertainties, possibilities and risks that are significant for this class, as well as the time period within which they can manifest themselves,

• to find the way of forming a metric in the space of the quality characteristics of the projects under consideration,

• to generalize the model for the case of alternative projects of similar purpose, which presupposes selection for the implementation of a better alternative.

These tasks will be the subject of further consideration.

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JEL D29

SYSTEM PARADIGM AS A BASIS FOR SOLVING INFORMATION MANAGEMENT TASKS IN AN INDUSTRIAL ENTERPRISE

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Abstract. In the article the enterprise information system of an industrial enterprise is considered from positions of system economic theory.
The difference between the automation process and digitalization process using information systems is shown.
Enterprise information system components are defined in the object, environment, project and process systems.
Consequences of imbalance of the information management subsystems are described.

Keywords: information system; system economic theory; digitalization; automation.

The transition from production processes automation to their digitalization creates opportunities for transformation of obsolete enterprise management practices as well as the application of new approaches and the formation of new entities. With automation only a partial representation of the economic processes of production in the information system occurs, a significant part of the enterprise activity in this case has no digital footprint. Digitalization, in its turn, allows to reflect production activities as close as possible, creating the potential for the application of system economic theory to the "digital twin" of an enterprise as an economic system.

If we assume that all digitized entities are information, then it turns out that the enterprise sets management tasks that are inextricably linked with information and defined as information management tasks. There are three components of information management: enterprise management with the help of information, information management as a separate entity and management of the process of digitalization.

The basis of the digital economy is the models of economic, technical, natural and social systems presented in digital form. Since the economic system of the enterprise is reflected in digital form through the use of an information system consisting of information subsystems, the need for a systems approach to information management is determined. G.B. Kleiner, who is author of the theory of space-time systems, synthesized the system economic theory which is ideally suitable for the management of digitized information about the economic activity of the enterprise. To implement the systems approach to information management, it is necessary to solve two tasks: the first task is the structuring of enterprise systems in the form of allocation of information subsystems as management objects, the second task is a system grouping, which can be solved using the space-time theory of systems as a base [3, 4].

The first task of the systems approach is solved through the structuring of information subsystems of the enterprise. Each information subsystem reflects the management of the enterprise in its field of activity, at the same time in such systems is the management of the information itself, and the links between these subsystems allow us to consider their integration into the overall system, that is especially important in the digitalization of the next aspect of activity. As solving the second task, it is proposed to classify each information subsystem, that is used in the manufacturing enterprise, as an object, environment, project or process system.

It is proposed to include the information systems of production management of ERP class (Enterprise resource planning) and the information systems of warehouse management – WMS (Warehouse management system) to the object subsystem. This is due to the fact that the production that defines the enterprise is limited by the space from which the finished product is produced, on the one hand, and is not limited by the time on the other, because production activity exists throughout the life of the enterprise.

It is proposed to include the information systems of customer orders and demands management – CRM (Customer relationship management), information systems of supply management – SCM (Supply Chain Management) as well as information systems of staffing – HRM (Human Resources Management) to the environment subsystem. This is due to the fact that customers, suppliers and potential employees are not limited by the space, on the one hand, and are not limited by the time on the other, because their activity isn't less than the life of the enterprise.

It is proposed to include the information systems of development of new products and their production technology – PDM (Product data management) to the project subsystem. This is due to the fact that any project of new product development is limited by the time, on the one hand, and limited by the enterprise space on the other.

It is proposed to include the information systems of budgets planning and execution, asset valuation, management of mutual settlement with contractors and other systems that are united by the concept of FM (Finance management) as well as systems of work with information of a legal nature to the process subsystem. This is due to the fact that financial mechanisms are almost always focused on a limited period of time – month, quarter, year, and laws have time to change several times during the life of the enterprise on the one hand, are not limited by the space of the enterprise on the other, because they store the data and guidelines of the enterprise outside its physical space.

Previously, a model of a corporate information system of a manufacturing enterprise, that shows rational connections between its segregate information systems, was developed [5]. As a solution to both tasks of implementing a systems approach to information management the model of corporate information system grouped according to the system paradigm is presented in fig.1.

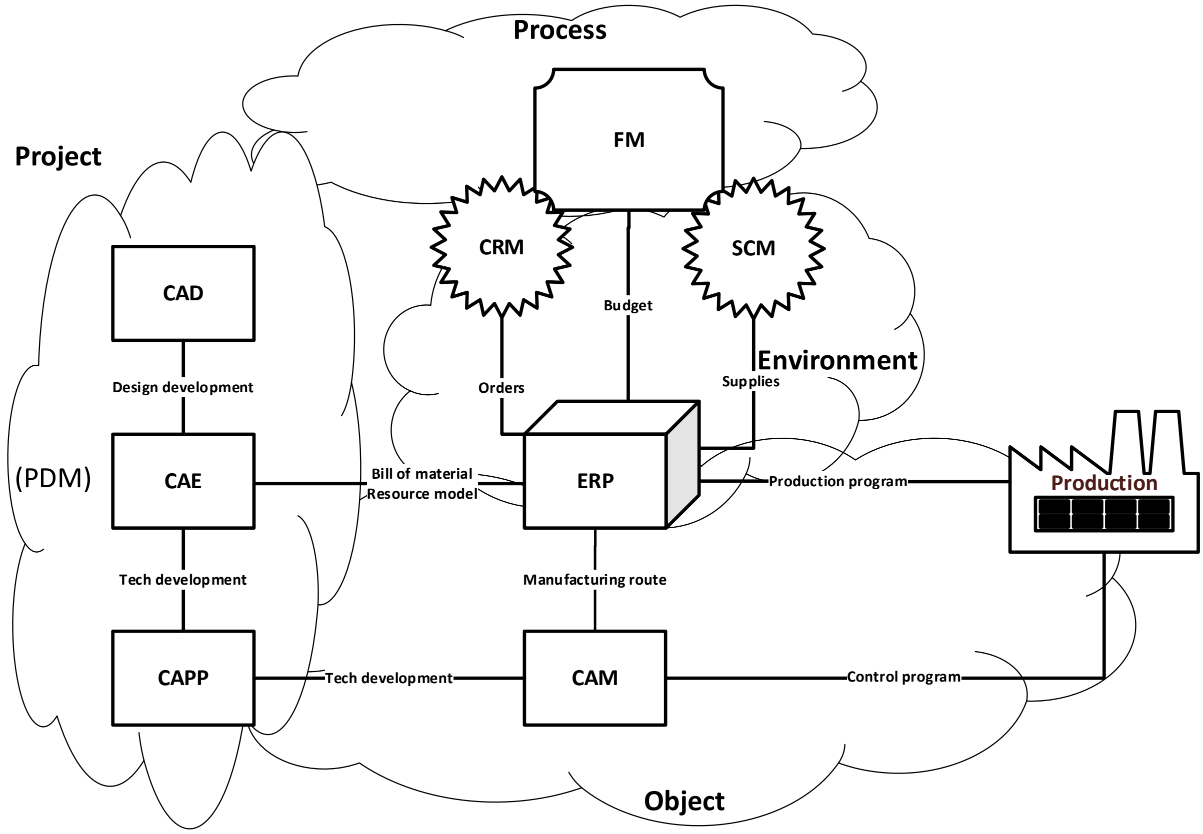

Fig. 1 **The systems approach to corporate information system of an industrial enterprise**

The project system implements design and technological developments on the basis of the time resource provided by the object system in the form of allocation of time boundaries during the initiation of development projects. The activity of time use by the project system is manifested in the form of design and technological documentation that is used in production. The activity of the object system is provided by orders which are received because of the space resource of the environment system in the form of the customer orders, purchase orders and the labor market. As a result of the order completion, the object system produces a specific product that transfers into the environment system. This transfer shows the intensity of space use. The time resource of the process system is determined by the financial period within which the financial management of the enterprise is conducted. Mutual settlements with the elements of the environmental system, that are carried out during the financial period, determine the activity of using the time resource of the process system. The process system, in its turn, provides the tools, methods and design technologies, that are formed outside the space of the enterprise, to the project system, that is limited by space, through the project financing. The intensity of the space use by the project system is manifested in the form of creation of intangible assets, the importance of which to maintain a stable state of the economic system of the enterprise is growing in the conditions of digitalization of the economy.

Thus, taking as a basis the representation of the related subsystems [4, 6], the corporate information system can be represented in the form of a tetrad, that is shown in fig. 2.

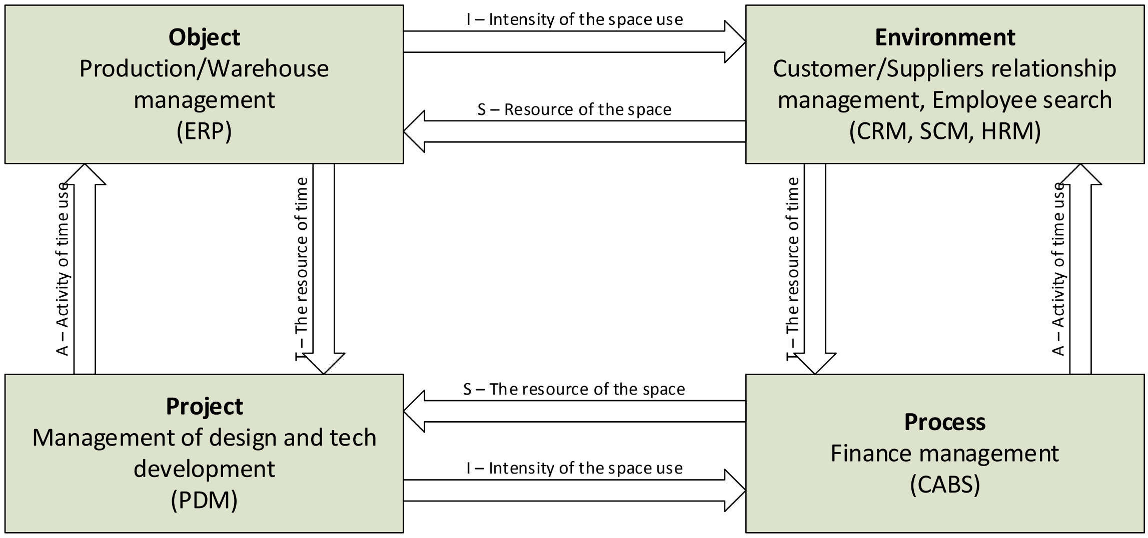

Fig. 2 **The tetrad of the enterprise information system**

The problem of performance of the information system in the digital economy can be an imbalance within the tetrad of the information system. The imbalance is defined in the unequal relationship of the components of the tetrad [7]. The main reason for the imbalance is the lack of information subsystem of any type, or the lack of an orderly process of management of the relevant activities. Part of the imbalance may be caused by a mismatch between the elements of the information system and the activities of the enterprise. The mismatch will not allow to digitize the activities in the information system with sufficiently fullness.

Thus, it can be concluded that the work with information using the system paradigm is an actual approach to help industrial enterprises to move from the automation of management processes to the digitalization of such processes, and, consequently, to adapt to the conditions of the digital economy. In order to facilitate and increase the efficiency of the process of digital adaptation, special attention should be paid to the balance of information subsystems, balance indicators should be determined and at the same time implementation and operation should be managed at the strategic level.

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JEL C6

NCREASE IN EFFICIENCY OF FUNCTIONING GOSUDARSTVO-BIZNES-GRAZHDANE SYSTEMS IN THE CONDITIONS OF DIGITAL ECONOMY

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Abstract. The model of structure and structure of complex social and economic system "State-Business-Citizens" in conditions of digital economy is considered.
Theoretical bases and practical recommendations on increase of efficiency of functioning of this system are resulted
Recommendations are given on the creation of favorable organizational and regulatory conditions for the effect development of institutions of the digital economy with the participation of the state, the national business commu and civil society.

Keywords: digital economy, system, efficiency, government, business, citizens.

In many scientific works The State — Business Citizens system is considered first of all from a position of social and political responsibility of business. The available scientific foreign and Russian concepts, reflect various parties of process of interrelation of this difficult and multiple-factor system [3,5].

The continuing extensive discussions about where action of the free market relations comes to an end and state regulation of the economic relations and what volume of the state intervention in economy says that now any of the states of the world couldn't create optimum model of functioning and development of The State — Business Citizens system begins.

Practice shows that during the periods of economic growth the state intervention in questions of business has to be minimum and vice versa - during the periods of economic downturn and crisis, state regulation of economic and social problems has to be maximum [1,4].

Many domestic and foreign scientists offer models of interaction of the power, business and society [2]. However these models allow to study and predict only the separate parties of the difficult mechanism of political, social and economic interrelations and interdependence in The State — Business Citizens system.

The existing global trend in development of digital economy and in general digitalizations of society allows not only to accumulate a big array of data, but also to have an opportunity to build multiple-factor difficult models predicting their behavior at change of external and internal factors, and definition of their optimum state.

These achievements allow will come very close to very important national objective – to mathematically describe and construct reliable model of functioning of our society in parameters of The State — Business Citizens system.

For determination of efficiency of functioning and development of this system it is necessary to construct model of structure and structure of system and to set criterion function.

At creation of model of structure of the considered system it is offered to proceed from the following:

three subsystems (the State, Business, Citizens) are considered;

each subsystem consists only of those elements which have at least one relation with an element of other subsystem;

each element of a subsystem has unambiguous property.

Subsystem elements "State" are:

the existing system of federal, regional and local authorities;

the current legislation in the area of social, pension, economic, town-planning, land, tax, customs, budgetary, bank spheres, public and private partnership, currency and tariff regulation, licensing and allowing activity;

policy in the field of foreign economic activity;

migration policy;

fundamentals of foreign policy of the state.

Subsystem elements "Business" are:

the existing system of branches of economy, their specific weight in GDP and RVP, implementation geography;

the existing system of property and corporate management of business;

the existing system of export - import;

the existing structure of small and medium business, their share in GDP and RVP.

"Citizens" are subsystem elements:

the existing age and sex structure of the population;

the existing structure of the working and not working population;

the existing structure of the attracted foreign manpower.

The model of structure of The State — Business Citizens system represents structure of the relations between elements of subsystems. Each relation (interrelation) is set by a certain mathematical dependences, many of which are already established and have scientific recognition.

It should be noted that in dependence on the set target task, the concrete model of structure of system is formed. It allows to reduce time and resources for finding of an optimal solution.

The type of the criterion function used in each case is defined depending on the counted output parameter and an array of initial data.

Research objective of The State — Business Citizens system is definition of a set of the output economic parameters influencing development of business and life of citizens, for example:

rates of taxes on business, income and property, including citizens;

export and import customs duties;

passive rates of proceeds of credit;

tariffs for housing and communal services;

goods prices and services;

level of the salary and monetary allowance;

social payments and providing, including pension.

Besides, the system of state regulation of business processes and society is important:

currency and customs regulation;

antimonopoly regulation;

allowing and license activity;

level of freedoms of citizens (words, religions, meetings, movement, etc.).

At each subsystem "State", "Business", "Citizens" are aimed, not always these purposes coincide.

Increase in efficiency of functioning and development of system, ensuring its stability and stability, requires creation, before everything, the optimum regulatory legal base.

By means of development of digital economy receiving the most reliable and exact basic data for mathematical modeling of all state and business processes is possible that in turn will allow to increase efficiency of interaction and interrelation in The State — Business Citizens system.

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JEL L20

MULTILEVEL HIERARCHICAL MODELS AS A METHOD OF CONSERVATION OF INTEGRATED REPRESENTATION IN THE STUDYING OR ENGINEERING THE SYSTEM

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Abstract. The problem of preserving the integrity of a complex system during the procedure of decomposition, dividing into more observable components that can be better understood and modeled, is considered. The concept of preserving the integrity of the system when dividing it into components is one of the basic principles of the system analysis. The implementation of this fundamental allows to work at different levels of models of complex systems, while maintaining a connection with the overall objectives of the system through the application of system theory methods. Traditionally the group of methods for the construction of a tree-visible hierarchical structure reflecting the connections between the elements of the system is used. However, the lack of a hierarchical structure is that the horizontal links in it are "broken", since the components of the same level are in a state of "rivalry". Therefore, it is proposed to apply stratified models.

Keywords: system, system analysis, stratum, structure, systems theory, integrity

The one of the basic principles of system analysis, that helps to investigate problems with great initial uncertainty, is the fundamental nature of division of a complex system into more visible components that are more convenient to comprehension and modeling. The difficulty of such division lies in the fact that a researcher can lose the whole idea of a system.

Figuratively, this idea can be illustrated by a quotation from I.V. Goethe, cited in [1]: "Wishing to study a living object, so that a clear knowledge of it was obtained, the scientist first seizes the soul, then dissects the subject, and sees them. Yes, it's a pity, their spiritual connection has disappeared meanwhile, has been carried away".

In the first method of system analysis PATTERN (pattern – template, target; abbreviation PATTERN means Planning Assistance through Technical Evaluation from the Relevance Number), this "dismembering" of the general problem was proposed to be done by constructing tree-like hierarchical structure – a "tree of goals", and by distributing the obtained sub-goals and problems between scientific collectives that are able to investigate these problems.

Already in the first examples of application of systems theory and system analysis methods to managing the design of complex products the research and design processes were presented in a form of related stages. It helps to maintain the integrity of processes at the stages of research, design and product development.

This experience was transferred to the study of systems in the field of organizational management, as well as to the field of information systems management. However, for such objects the stages of project works most often cannot be described by a simple linear sequence of events, i.e. cannot be represented as a directed graph. Such structures could be well described using arbitrary graphs with breaks and feedbacks, in which the stages were located either horizontally or vertically, in analogy with the formats adopted in the theory of algorithmization and programming, but without strictly observing the rules for the design of algorithms [e.g., 2, 3].

As technical complexes and organizational systems became more complex the new forms of structures for representation of the project task organization were offered. For example, it was suggested to present the structure in the form of a two-dimensional matrix [2].

In the theory of hierarchical systems developed by M. Mezarovich structures like “strata”, “layers”, “echelons” were described. The stratified representation of a system assumes that the system is specified by a series (“family”) of models. Each of these models describes the behavior of the system from the point of view of the corresponding level of abstraction (which is called a “strata”). This approach allows to solve a problem of finding a compromise between preserving a holistic view of a complex system and detailing the description of its components [4].

The simplest example of a stratified description of the system, given in [4], was a map of a computer device in a form of two strata: strata of physical operations (at the lower level) and strata of mathematical and logical operations (at the upper level).

In a stratified form, one can also imagine the problem of text modeling: letters $\rightarrow$ words $\rightarrow$ sentences $\rightarrow$ paragraphs $\rightarrow$ text. In this case, the rules for converting elements of one level to another (synthesis or, conversely, “disassembly” of the text) can be introduced. Such rules are used in the development of analytical-synthetic text processing systems and artificial languages, they are also used in automation systems design.

Another example of a stratified description of a system proposed in the period of the theory of systems formation in our country was given by Yu.I. Chernyak [5], who singled out the levels of abstraction on which the designers of the system consistently work: from the philosophical (theoretic-cognitive) description, i.e. concept of the system, to its material embodiment. Such a representation helps to understand that the same system at different stages of cognition and design should be described by different means, in different “languages”: philosophical or theoretical-cognitive language is used for verbal description of the concept; research language in a form of models of all kinds helps to understand better and reveal the design of the system; project language is used for technical project, for the development and presentation of which mathematical calculations and schematic diagrams may be required; engineering language (language of constructors) is utilized at the stage of making design drawings and accompanying documentation; technological language is a language for technological maps, standards and other technological documentation; material implementation (system implementation) is the stage at which the language describes parts, blocks, assembled product or a whole system created, the principles of functioning of which are reflected in the relevant normative and technical and regulatory documents (operating instructions, regulations, etc.).

The stratified view can be used as a tool for successively enhancing knowledge about the system: moving from top to bottom along the hierarchy of strata allows one to detail the properties of the components of the system; while moving along the strata from the bottom up one could obtain clearer the meaning and significance of the entire system. However, it is practically impossible in complex systems to explain the purpose of a system as a whole knowing only the properties of a lower strata elements. For example, as noted by R. Akoff and F. Emery in [6], the study of the structure and properties of separate organs of a human body will not allow us to understand how the organism is functioning as a whole, and especially such approach will not give an idea of what a person is like as a social -biological system. On the other hand, in order to properly understand and implement the overall design of the system, it is necessary to implement the underlying strata.

Russian scientist F.E. Temnikov illustrated the idea of the system specification on each level of the system as shown in Fig. 1, although the term “strata” was not used at that time.

The process of studying the system could be started from a stratum of any level. In the process of research new strata can be added, and the approach to stratification can change. It is possible to use a special description and modeling language at the level of each stratum, but the system exists until the representation on the upper stratum, that is the conception of the system, is not changed. This conception ("general plan" of a system) should not be destroyed when the system properties are uncovered on each subsequent stratum.

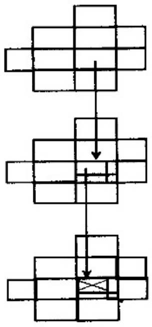

Fig. 1 **The stratified representation of a system proposed by F. E. Temnikov**

Source:[7, c. 53]

When presenting the enterprise management system, the strata can correspond to the existing levels: 1) management of technological processes (actual production process) or management of the production service; 2) the system of the enterprise organizational management. These spheres could be placed in the model in parallel, divided into sub-goals and tasks that will lead to the formation of a tree-like hierarchical structure of goals and functions. But in the hierarchical structure the connection between the components of the same level is practically lost, while it is possible not to lose the horizontal connections in the structures of the "strata" and "echelons" types suggested by M. Mesarovic.

The stratified representation was used to form the structure of the functional part of the Automated Control System of the Volzhsky Automobile Plant (AVTOVAZ), when the number of subsystems became too large to form the usual "tree" structures of the functional part of an information system [7].

Different principles could be used for determine strata. For example, the definition of a system implementing a system-target approach [8] could be taken into account. In this definition the object is not "broken up" into elements, that is, it does not break down, but is represented in the form of enlarged components:

S def = <Z, STR, TECH, COND, N>,

where Z = {z} means a set (structure) of goals; STR = {STRpr, STRorg, ...} means the set of structures that implement the goals (for example, for a socio-economic organization STR is an industrial structure and an organizational structure, etc.); TECH = {meth, means, alg, ...} means technologies (methods, tools, algorithms, etc.), implementing the system, ensuring its existence and functioning; COND = { CONDex, COND in} means conditions of the system existence, i.e., factors affecting its creation and functioning (CONDex are external conditions, CONDin are internal conditions); N means "observers", i.e., persons who make and execute decisions, structuring goals, adjusting structures, selecting methods and tools for modeling, etc. This definition can be supplemented with the components "environment" (SR) and "time interval" Δt.

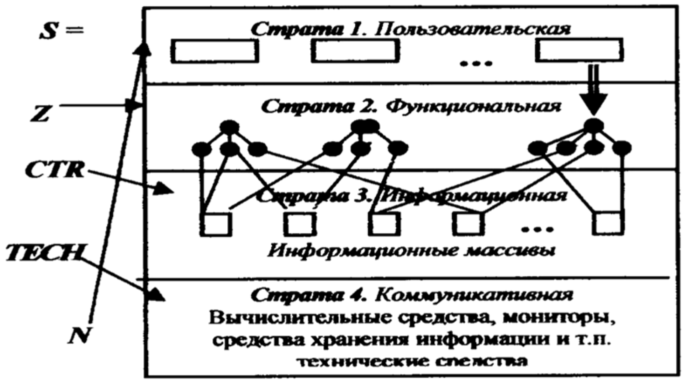

Fig. 2 **The stratified structure of the information and control complex**

Source:[8]

The definition given above helps to start the exploration of a complex object, preserving its integrity. For example, the structure of the information and control complex of the organization was developed with the support on this definition (see Fig. 2).

Conclusion

The article substantiates the usefulness of a stratified representation of complex systems for preserving a holistic view of them in the course of their decomposition in the process of research or design

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JEL

THE APPLIANCE OF AN OPEN SYSTEM IN THE PROCESS OF SOCIO-ECONOMIC ORGANIZATIONS MANAGEMENT

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Abstract. The article covers the concept of open systems. The specific feature of these systems resides in their ability to develop consistently at the expense of material and informational interconnection of system elements with the environment. As a result of this interrelation new and more complicated elements are formed. These elements comprise the basis for the complete system development. The foundation of open systems development and self-organization is composed of its "active" elements that are able to generate and implement innovative ideas. The article highlights the rationality and efficiency of open system methods appliance in the process of socio-economic systems management factored in its complicated inconsistencies between the individual as an active element and the overall society.

Keywords: objective laws of systems theory; managerial control; open system; system analysis; systems theory; management

Introduction

In an effort to comprehend the living systems principles of functioning and development L. von Bertalanffy suggested the concept of an open system and organismic approach.

K. Bouldin's classification system considers social systems above the biological ones. In accordance with recapitulation law of E. Gekkel – F. Muller social systems pass all development stages, but in social systems a new regularities and behaviors algorithms are appearing at the top levels of system hierarchy in the correspondence with A.M. Butlerov researches.

In the same time, the socio-economic systems (SES) management uses the fundamental methods and principles of the system automatic control for the lifeless closed systems: the programmed control, compensation (proactive) control, control with feedback and their combinations, it is possible but not sufficient for the efficient management in the socio-economic open system.

Therefore, it is proposed to investigate the feasibility of using the concept of an open system in managing socio-economic organizations

1. L. von Bertalanffy's open system concept

L. von Bertalanffy describes the open system model using the example of biological metabolism process [1, c. 41]. In open systems some materials are going constantly from outside into the system where they participate in different chemical reactions, which are named as "metabolism".

Final products of these processes are extracted from system – "catabolism". Thermodynamic regularities appear in the open systems as distinct from closed ones (isolated from space). They seem paradoxical and constructional to the Second Law of Thermodynamic, which leads the general sequence of physical events to the entropy enlargement.

The same processes exist in open systems because of energy and information correlation with the surrounded space. Actually, the informational exchange is the basis of the socio-economic system development.

In accordance with Bertalanffy, organismic approach to the open system, in contrast to closed, can reach in special conditions the state of the "mobile equilibration", when the system structure remains constant. In contrast to ordinary equilibrium the mobile one exists in the conditions of continual moving of the material, energy and information in the exchanging processes.

Before Bertalanffy time, the organism was considered as a system, which reacted only on external stimulus to keep the current state of system. Bertalanffy takes into consideration not only external stimulus but also internal activity as a source of development, that he considers the organism as a spontaneous active system. Bertalanffy concept shows "The organism is in state of mobile equilibration of its chemical components and its cells".

Then in accordance to R. Akoff [1] on the level of alive organisms only a "system on the whole" can be purposeful, but independent purposeful systems elements are not desirable because it can lead to the uncontrolled development of separated components of organism (type of development of cancerous tumors, polyps or other formations not consistent with the concept of the organism as a whole). That is why in normally functioning organism the purposes of elements have to be under the whole system purpose.

In the same time in the socio-economic systems separate elements are purposeful as well as the whole systems, this fact leads to the issue of solving the contradictions between active elements and the whole system. Methods, approaches and means of Bertalanffy open system model realization are problematic for time being, that is system development model, "which provides the conditions ("reactions" – in Bertalanffy biological model) for the production high levels complication components" and for keeping the mobile equilibration state. Still it is not clear if this problem can ever be solved. But for the concise open systems, like socio-economic, there are many researches, devoted to solving the problem of contradictions between the different levels of organizations and its active elements.

2. Subsystem interaction model

The living system model in biology is conditionally hierarchy organized system with some relatively independent subsystems: circulation of blood, respiration, stomach and so one.

These subsystems themselves also have complicated organization. It is shown in medicine researches that these subsystems have not direct interrelations, which could be dangerous for normal organism functioning,

These facts make problematical using the structures with horizontal contacts in the socio-economic systems of M. Mesarovich "echelon" or "system central control" kinds, which can be useful in special cases, but can lead also to dangerous consequences.

It became obviously thanks to Hruschev (Russian leader) economical reforms in USSR of 60th. Decentralization of national economy have led to the strengthening of horizontal correlation between regions and generation of the regional economic control centers – "sovnarhoses", which entered to contradictions with high levels of national governmental hierarchy – sectoral ministries, Counsel of ministry and CK KPSU. Finally, these reforms were stopped.

When investigating the possibility of applying the network-centric and sub-sided principles of management in the activities of society, the state, etc., when managing territorial entities, the economy of the country, special attention should be paid to the essence of these management principles: "Solve problems as local as possible and as global as required". It means that the tasks of management can be solved at the level of organization, where it is the most effectively [7]. But signification and complexity of these tasks have not to be in contradictions with the purposes and tasks of the system in whole [8].

3. Application of the laws of the theory of systems for the management of sustainable development of organizations

The concept of an open system and the regularities of the theory of systems, explaining the fundamental features of such systems and complementing this concept, also make it possible to study the problems of sustainable development of socio-economic systems.

The entropic-negentropic processes manifest themselves ambiguously. On the one hand, negentropic tendencies, realized in the form of innovations, are the basis of development, but at the same time they destabilize the system – “creative destruction” according to J. Schumpeteru [10] and V. Sombart [6]. And entropy tendencies, considered as a manifestation of disorder, on the contrary, stabilize the state of the system because the minimum energy state, to which the entropic processes lead, is the most stable.

Understand these contradictions helps the patterns of the systems theory – the regularity of integrity (emergence), hierarchical ordering, self-organization, which allow us to assess the degree of manifestation of entropic and negentropic tendencies in the system [4].

On the basis of his information approach, A.A. Denisov [5] introduced comparative quantitative estimates of structures from the point of view of the degree of integrity

$\alpha = - Cv / Co$,

and the coefficient of use of the elements as a whole

$\beta = Cc / C$,

where C is the system information complexity estimate $C = J \cap H$; J – information of perception; H – information essence (potential); Cs, Co, Sv - system, own and mutual complexity conformably.

Researches A.A. Denisov showed that any developing system is in between the state of absolute integrity and absolute freedom of elements. $\alpha + \beta = 1$.

Integrity provides stability, freedom – the development of systems.

At the same time, the increasing of the integrity degree and suppression of the freedom of elements is provided not only by regulation “from above” in hierarchical systems, but also by strengthening the coherence that limits the freedom of elements in social networks. At present, this is realized and manifested as “communicative totalitarianism”.

Thus, already manifested phenomena and processes indicate that it is necessary to manage the sustainable development of socio-economic systems using the systems theory laws. To study the problems of sustainable development are introduced: system categories – “freedom”, “manageability”, “stability”, “inertia”; measures of “stability margin”; types of stability - adaptive stability, stability of substitution; mechanisms for ensuring sustainability - spatial, temporal [3, 9].

Main conclusions

Thus, based on the reviewed state of the concept of an open system, it can be concluded that the most important problem at present and future times remain: the modeling of the open (alive) systems with a taking into account complicate behavior of its active elements in the processes of information and material exchange inter and outside.

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REFLEXIVITY IN SOCIAL SYSTEMS: THE THEORIES OF GEORGE SOROS

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AN EARLIER VERSION OF THIS ARTICLE WAS PUBLISHED IN
SYSTEMS RESEARCH AND BEHAVIORAL SCIENCE 24, 515-522 (2007)

Abstract. George Soros's reflexivity theory connects ideas in cybernetics with economics, finance, and political science. This paper briefly provides an introduction to Soros's version of reflexivity theory and describes some applications in economics and finance. Soros's approach to economics is based on different assumptions about information and human behavior. His approach to finance is more holistic than most current work in finance. He does not emphasize mathematical models but rather sees finance as a human player game with himself as a participant. The paper concludes that Soros's work is a very important contribution to and expansion of contemporary social science.

Key words: equilibrium theory, reflexivity theory

Definitions of Reflexivity

Reflexivity occurs in social systems when an actor observes and thinks about his or her actions and their consequences and then modifies his or her behavior. More generally "reflexion" is defined as the return of light or sound waves from a surface, the action of bending or folding back, or an idea or opinion made as a result of meditation. (Stein, 1968) "Reflexive" is defined as something turned back on itself, a relation that exists between an entity and itself. "Self-reference" in mathematics indicates a statement that refers to itself, for example, a set that contains itself. Such statements lead to paradox, a form of inconsistency. In the informal fallacies self-referential statements are considered as a poor form. However, a social scientist who formulates a theory of a society in which he or she is a member is making self-referential statements. An investor who makes trades that alter price is engaged in a reflexive process.

Given the self-referential nature of social systems and financial activities, how is it possible to create a non-paradoxical, logically consistent theory? Stated differently, should traditions concerning the FORM of arguments limit the SCOPE of science? Or, should the subject matter of science be guided by curiosity and the desire to construct explanations of phenomena? Cyberneticians have historically chosen subject matter over form of argument.

In recent years at least three theories of reflexive processes have been created.

- Heinz von Foerster, beginning in 1974, advocated including the observer in the domain of science. He called this line of inquiry "second order cybernetics." (von Foerster, 1974)
- Vladimir Lefebvre proposed the existence of two systems of ethical cognition and called the activity of selecting the appropriate

ethical system for the occasion one form of "reflexive control." (Lefebvre, 1982)

- George Soros described both economic and political systems as being composed of individuals who are actors as well as observers. (Soros, 1987)

Soros's theory of reflexivity is now increasingly known in the systems and cybernetics community. In the traditional social sciences Soros's theory is known and used by people in finance more than by economists. Soros uses a participatory, not a purely descriptive theory of social systems. Soros studied with Karl Popper at the London School of Economics. He has worked to implement Popper's idea of "open societies" in many countries around the world. Soros uses Popper's idea of conjectures and refutations" to guide his investments and social interventions. Soros points out that in social systems there are two processes – observation and participation. The natural sciences require only observation.

Ways to Describe Systems

It is useful to note that social science disciplines describe systems using different basic elements (Umpleby, 1997).

- Variables are used by disciplines such as physics and economics. Physicists measure mass, length, time, velocity, acceleration, pressure, temperature, etc. Economists measure variables such as price, savings, income, growth rates, and return on investment.
- Ideas, including beliefs, values, and assumptions, are the subject matter of philosophers, psychologists, and cultural anthropologists.
- Groups are the focus of attention of sociologists and political scientists.
- Events are the chief concerns of fields such as computer science and history and law. Computer scientists describe sequences of operations, for example retrieval, addition, storage. Historians and legal scholars describe systems in terms of key events, for example wars, elections, and reform programs.

Classical scientific theories operate in the realm of variables and ideas. That is, variables are defined and measured and relationships among them are proposed and tested. Although most work in economics describes social systems in terms of variables, Soros uses all four methods – variables, ideas, groups, and events. See Figure 1. Hence, Soros's analyses of social systems are more holistic than purely economic analyses. Reflexivity is the process of shifting back and forth between description and action.

For Soros it is important to understand the "bias" or perception or preconception of the various actors in a social system. He feels that bias is the main driving force in historical processes. He assumes that ways of thinking influence events. For Soros cognition means that perception is a function of the situation. Action means that the situation is a function of perception. Combining perception and action yields reflexivity.

To illustrate reflexivity theory Soros (1987) provides several examples – the currency market the conglomerate boom, Real Estate Investment Trusts, the venture capital boom and collapse, and the credit cycle. Consider the conglomerate boom. Soros describes a high-tech company with a high price to earnings (P/E) ratio that begins to diversify. It buys consumer goods companies with high dividends but low P/E ratios. As earnings of the conglomerate improve, the price of the company rises. The higher stock price means greater ability to borrow. The conglomerate borrows to buy more consumer goods companies. Earnings per share continue to grow. Investors eagerly buy more stock. Eventually people realize that the character of the company has changed and a high P/E ratio is not justified. Price then falls to more closely match the character of the company. Figures and tables in Umpleby (2007) show how the conglomerate boom can be described using variables, ideas, groups, and events.

Implications for Finance

Most academic work in the field of finance currently involves building mathematical models. Although behavioral finance is a growing part of the field, this subfield tends to emphasize limits on rational behavior. Soros in contrast regards finance as a multi-person game involving human players. Whereas behavioral finance focuses on decision-making by individuals, Soros is concerned with the behavior of large social systems.

The work of Markowitz (1952) is widely used by financial managers. It is based on mathematics and statistics. It assumes a tendency to market equilibrium. The focus is on historical data. Reflexivity theory, on the other hand, is not as often used by financial managers. It is based not only on economics but also psychology and national policies. It assumes market disequilibrium. The focus is on the future decisions of investors and policy makers.

Soros uses the same theoretical point of view when analyzing political systems as he uses in economics. He looks for gaps between perception and reality. A large gap means the system is unstable. When people realize that description and reality are far apart, legitimacy collapses. An example in politics was glasnost or the policy of openness regarding information, which destroyed the legitimacy of the USSR Communist Party.

Although most of Soros's investments are in conventional investment instruments, he also looks for short term positive feedback situations, which will yield rapid growth, for example the conglomerate boom, a credit cycle, or a high-tech bubble. He also looks for instability preceding collapse caused by a gap between perception and reality.

Implications for Economics

Economic theory is based on several assumptions about information and about human behavior. For example, information is immediately distributed to everyone. Each person seeks to maximize personal profit. Human beings behave rationally. When asked whether they really believe such assumptions, economists reply, "These assumptions allow us to solve problems. If you don't make these assumptions, then you can't do anything." (Waldrop, 1992, 142) Although behavioral economics is becoming more widely accepted, the situation in economics might be called a "far from reality condition."

One might think this new theory would attract great attention. It is more general than the previous theory because it can be applied to political and social systems as well as to economics and finance. It is more detailed than the previous theory because it explains how markets do or do not go to equilibrium. And it enables better predictions, as illustrated by the superior record in financial management.

What would economics look like if beliefs in perfect information, rationality, and equilibrium were replaced with bias, interaction between cognition and participation, gaps between perception and reality, disequilibrium, and boom and bust cycles? See Table 1.

Soros's theories expand finance and economics to include the perceptual bias of participants. He also suggests a way to anticipate major political changes. Reflexivity theory provides links between cybernetics and economics, finance, and political science. Reflexivity, which can be thought of as positive feedback between cognition and participation, can be found in other social science fields as well.

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JEL M11

FORMATION OF THE CONTROL ENVIRONMENT AS AN ELEMENT OF SYSTEM APPROACH TO MANAGEMENT OF THE COMPANIES WITH THE STATE PARTICIPATION

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Abstract. In article features of activity of the companies with the state participation which play a serious role in economy of Russia are considered. Application of methods of system approach for formation of the control environment and ensuring efficiency of control procedures is proved. The carried-out analysis of a condition of the control environment of management of the companies with the state participation has allowed to reveal the main problems in this area. One of them is the condition of standard and legal base in which there is no regulation of the mechanism of internal control for the commercial organizations. The carried-out analysis Russian norm - tivno-legal base has revealed similarity of system characteristics of internal control and internal financial control. On the basis of assessment of features of activity of the companies with the state participation factors of formation of the control environment in the considered economic subjects are defined. The conclusion is drawn on multi-purpose installations of system of internal control which can't be limited only to indicators of economic efficiency (profitability).

Keywords: companies with the state participation, control environment, system approach, external control, internal control.

Introduction. The efficiency of activity of the companies with the state participation must be under constant control of the state as they act not only conductors financially - economic policy, but also solve many social problems. Productive work of the specified economic subjects is the key not only sustainable development of the companies, but also welfare of an essential part of the Russian society.

Many companies with the state participation occupy exclusive situation in the market, and the prices and tariffs for socially significant goods and services depend on the level of their costs.

In this regard formation of the uniform concept of external and internal control in the considered organizations is represented a problem which solution demands system approach.

Target reference points of formation of the control environment. A basis of system of external and internal control is the control environment. Her state is a necessary condition of effective management of economic subjects. As one of elements of the control environment in a control system of the companies the condition of the standard and legal base defining requirements to results of their activity and organization-but-methodical bases of control activity performs with the state participation.

Since 2015 the Government of the Russian Federation has approved the system of indicators for assessment of effective management of the state property and formations of statistical observation including 64 indicators. The new system has succeeded earlier carried out monitoring of public sector of economy. An opportunity to carry out the analysis in a section of shouting-generations-legal forms of the enterprises of state property belongs to advantages of new system. Shortcomings are difficulties with measurement of a share of the state in economy that complicates assessment of effectiveness of activity of the enterprises with the state participation.

The peculiar feature defining features of the control environment of the companies with the state participation is obligatory carrying out external financial control. According to Art. 265 of the Budgetary code of the Russian Federation the purpose of the state (municipal) financial control is ensuring compliance with the budgetary legislation of the Russian Federation and other regulations regulating the budgetary legal relationship [1]. Considering activity of economic subjects with the state participation, it is necessary to emphasize that the purposes of the state (municipal) financial control of their activity must be expanded. They must include ensuring effectiveness, profitability, efficiency of activity of the considered organizations.

The purposes and order of the organization of internal financial state control have found reflection in the Methodical recommendations of the Ministry of Finance of the Russian Federation about implementation of internal financial control [2]. In them the organization-economic mechanism of internal financial control at his carrying out budgetary funds by chief managers (administrators) is installed.

However, similar clearness is absent in the installed mechanism of internal control for the commercial organizations to which the companies treat with the state participation.

Concepts of internal control and internal financial control for the commercial organizations haven't received disclosure in acts. It complicates the work on carrying out internal control which is obligatory according to Art. 19 of the Federal law "About Accounting". In Information of the Ministry of Finance of the Russian Federation of PZ 11/2013 "The organization and implementation by the economic subject of internal control of the made facts of economic life, conducting accounting and drawing up the accounting (financial) reporting". In the document it is noted that "internal control is directed to obtaining sufficient confidence that the economic subject provides efficiency and effectiveness of the activity, including achievement of financial and operational indicators, safety of assets; reliability and timeliness of accounting (financial) and other reports; observance of the applicable legislation, including at commission of the facts of economic life and conducting accounting" [3].

Thus, at the legislative level in the Russian Federation only the state (municipal) financial control with division on external and internal has received accurate fixing. These definitions are reflected in the Budgetary Code and concern the sphere of the budgetary legal relationship.

The analysis of the Russian standard-but-legal base allows to speak about big similarity of system characteristics of internal control and internal financial control. The purposes of internal control and internal financial control for the organizations of a public sector and other sectors of economy are similar the fact that they are directed to observance of the established standards, rules and procedures. Control actions must prevent deviations from the established rules and procedures and not to allow distortions of reporting data. Internal financial control is aimed at observance of standards and procedures at implementation of expenditure of budgetary funds that is quite natural, considering orientation of this type of control.

Factors of formation of the control environment in the companies with the state participation. When forming the control environment of the companies with the state participation it is necessary to consider that they are special participants of the economic relations [4]. The analysis of specifics and conditions of activity of the specified economic subjects has allowed to allocate the factors defining formation of their control environment.

So, as an important factor scales of activity of the companies perform with state participation. An essential part of GDP falls to their share, considerable tax revenues from revenues of the budget of the country, regional and local budgets. Work in these companies has captured many thousand collectives. The profit of state companies for 2016 has made 12% of the total size of financial result [5].

The companies with the state participation treat socially significant economic subjects to which implementation of social functions of the state is assigned.

The prices both tariffs for socially significant goods and services, so and the rate of inflation – the major macroeconomic indicator depend on the level of costs of the companies with the state participation.

Many companies with the state participation are the large structures which often are vertically integrated with the complex organization, existence of subsidiaries and affiliates. The difficulty of management of such subjects of holding type imposes special requirements to statement and efficiency of internal control.

The companies with the state participation are recipients of budgetary funds and are subject to internal financial control by the rules established in the Budgetary code of the Russian Federation. In this regard concerning them the integrated system of control aimed at providing achievement of purposes and key indicators of activity and allowing to use economically and productively budgetary funds [6] must be developed.

Summarizing, it should be noted need of integration of internal financial control and external state control for the companies with the state participation. Point the similar functions of bodies of external and internal financial control consisting in assessment of reliability and efficiency of functioning of control systems to it.

The companies with the state participation need to carry out independently statement and the organization of system of internal control. Despite incompleteness of the regulatory base on this question, as the purposes of internal control not only compliance with the law, but also achievement of efficiency and effectiveness of activity of the economic subject are defined. Due to the mnogoaspektnost of target installations of the companies with the state participation the efficiency and effectiveness of their activity can't monotonously be defined and be estimated only indicators of economic efficiency (profitability).

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JEL C44, C51, C68, C72

SEVERAL MODERN METHODS TO EVALUATE THE PUBLIC EFFICIENCY OF SOCIAL STATE PROGRAMS

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Abstract. In the article the separate modern methods of estimation of social effectiveness of the use of programmatic-having a special purpose approach are examined for development and realization of the government programs in a social sphere. Corresponding methodology of estimation of efficiency of the government social programs (projects) offers on the basis of the conducted analysis, step-up validity of making decision in a social sphere in the conditions of uncertainty.

Keywords: socio-economic system, social effectiveness, state social programs, Pareto optimality, population

For the aims of this research the national social sphere can be presented as a scale and complex macro-system consisting of row of interacting and interdependent industries, each of that presents the separate socio-economic system in a general view [1]. In turn on a macro-level the frames of society possess a structure (formed by legal institutes) and are in the continuous co-operating with the elements of the economic system, which is totality of all economic relations realized in society. At the same time a social sphere is component part of society on the whole. Similar intercommunication and interdependence complicate management processes, because take place both internal and external the effects expressed in the various consequences of the accepted strategic decisions.

Functioning of the complex socio-economic systems is related to the multicriteriality processes of state regulation of both social sphere on the whole and its separate constituents, and determines corresponding processes in society. Socio-economic processes, in turn, form certain reality the dynamics of that carries unforeseeable, elemental and out of control character at times, that is possesses the signs of uncertainty. Under a uncertainty understood out-of-control or poorly controlled external and internal factors, that are the determined or casual sizes, it is considered in relation to that the area of possible values or class of possible laws of distribution is known only, and some statistical descriptions are absent.

It is necessary to mark that in modern terms, state regulation of social sphere in the conditions of uncertainty comes true with the use of programmatic-having a special purpose approach, supposing realization of the government social programs (Programs) and projects. From one side, in the context of socio-economic development under Program it is possible to understand a "economically reasonable plan and (or) project, containing the complex of events, interconnected by tasks, terms of realization, performers and resources, and instruments adjusting of social sphere, providing the achievement of priorities and aims" [2]. On the other hand, project - it is determined as a "complex of possible actions (works, services, administrative operations and decisions), providing the achievement of certain goals (receipt of certain results) "[3]. It is accordingly possible to assert that the social programs are projects of the state in a social sphere. Therefore, on the real moment, questions of development of methodology of effectiveness of state projects (Programs) are actual in a social sphere, and also quality and quantitative methods of estimation of the indicated projects.

In the in scientific creations sanctified to the estimation of effectiveness, and in the methodical documents of world institutes [4] offered approach to determination of socio-economic effectiveness, according to that she "reflects accordance of expenses and social results of project to the aims and social interests of his participants, including society or separate community groups" [3]. The indexes of social effectiveness "take into account the assuming cost measuring of consequence of realization of investment project for the examined public system, plugging expenses and results in contiguous areas, in supposition, that all results of investment project drawn on by this public system and due to her resources produced all her expenses necessary for realization of project" [3].

Further, taking into account going near determination of socio-economic effectiveness of N. Kaldor [6] and J. Hicks [7], a "transition from one state of the socio-economic system to other increases a commonwealth, if those members societies that win in such transition are able to compensate a loss those, whose position gets" worse. Thus, being base on positions of moral economy [4], we will mark that satisfaction of totality of vital necessities of separate categories of population comes true through the grant of social guarantees, for example in the cases of realization of vital risks (to old age, illness, temporal disability,, etc.). Distributive mechanisms the states, using principles "taxation is social guarantees" and/or "account of vital risks are social guarantees", can be the system method of creation of optimal terms for forming of situations of equilibrium (for example, according to Nash [8], according to Berge [9], or hybrid) as complex structure-forming processes in the social sphere.

At the use of the game-theoretical going it is determined near the estimation of social effectiveness of Programs (principle of Pareto [10]), that "every change that brings losses nobody, and is of some peoples the use (by their own estimation), is an improvement" [11]. It follows from this that effective are all those changes in a social sphere, that does not do damage to every member of society, and assist the increase of his welfare. Using the above-mentioned determination of effectiveness, it is possible to set forth the criterion of optimum on Pareto, for example, as the state of social sphere (complex socio-economic macrosystem), at that value of every separate index, characterizing the system, it can`t be improved without worsening other. According to this principle, as criterion of increase of welfare of population, "motion toward an optimum maybe only at such allocation of resources, that increases welfare, at least, one man, doing damage to nobody other" [12].

Social effectiveness of state projects in a social sphere (Programs) determined by more traditional in modern practice methods [13]:

or by the direct way of calculation of size of the expected clean integral discounted effect (analogue of expected NPV) in case of possibility of such calculation;

or by an indirect way from informative data of comparison of the arrived at values of major social indicators with their normative legitimate or desired values.

Thus the Program realized in a social sphere will be effective, if the corresponding expected calculation effect is non-negative. The size of the calculation expected value in this case is determined on the basis of the well-proven theorems of existence and unicity of functionals, possessing necessary properties, exogenous set axiomatically, for example, requirements of continuity, monotony, addictiveness and transitivity.

Thus, the methodology of social effectiveness of the application of the program-target approach in the social sphere can be based on a synthesis of the above approaches and three possible methods for evaluating the effectiveness:

a) on the basis of the associated linear programming tasks;

b) on the basis of the principles and methods of systemic evaluation of the effectiveness of investment and innovation projects;

c) by using systemically interconnected cost expert estimates based on social, environmental, criminological and other factors.

The aim of development of the indicated methodology is increase welfare of population on the basis of general system and game-theoretical methods of estimation of corresponding effects in a social sphere in the tasks of management by the complex socio-economic systems in the conditions of uncertainty. Combined their use will allow to promote validity of processes of making decision in a social sphere in the conditions of uncertainty, including on the basis of the use of criterion of the integral expected effect.

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JEL

PROCESS-ORIENTED MANAGEMENT ACCOUNTING AS AN INFORMATION ENVIRONMENT FOR ENTERPRISE MANAGEMENT

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Abstract. The article describes theoretical aspects of a process-oriented approach to enterprise management. Main, accompanying, managerial and developmental business processes as a classification of business processes characteristic for modern enterprises is disclosed. The structure of the process approach to management and systems of process-oriented management accounting are considered. The main advantages and disadvantages using process-oriented management accounting as an information decision-making environment at all levels of enterprise management are listed too.

Keywords: process approach, management accounting, management of the organization, management system, business processes.

Modern enterprise management is becoming increasingly risky in the context of the growing influence of a rapidly changing and unpredictable business environment. It means that it´s necessary to focus management's attention on the investigation of new opportunities in order to adapt the company and quickly respond to the outer changes. All the processes related to solving basic management tasks: defining the organization's goals and creating the necessary economic, organizational, technical, technological, social, psychological and other conditions for achieving the established goals become more dynamic and require flexible development and substantiation tools.

In this regard, the management of enterprises constantly tries to figure out what business processes are taking place inside, what are the costs and the level of efficiency; which business processes must be supported and strengthened, and which are worth weakening or even eliminating. As in practice, one of the possible solutions of problems is the application of process-oriented approach to enterprise management and implementing management accounting [1].

At the same time, process-oriented management accounting plays an important role acting as an information environment. Each company manager needs to have stable access to the information environment, the purpose of which is to provide company's management with relevant information when making and developing adequate managerial decisions. Thus, process-oriented management accounting is one of the key methods for ensuring effective enterprise management.

The purpose of the article is to analyze the effectiveness of the process-oriented approach to enterprise management. For this we will need to make following steps:

• investigate theoretical aspects of a process-oriented approach to enterprise management;

• highlight the classification of the main processes observed in the framework of modern business;

• develop a process management approach and a process-oriented management accounting system;

• list the main advantages and disadvantages of using process-oriented management accounting as an information environment for managing an enterprise.

The process approach is a set of actions to management, where enterprise's activities are its processes. In order to manage it effectively, it is necessary to control each process.

For this reason, it is necessary to take into account the main classification of processes within each organization [2]:

• main processes (production, sales, etc.);

• accompanying processes (delivery, information processing, etc.);

• management processes (administration, etc.);

• developing processes (innovation, development, etc.).

In general, the process approach to management including all its elements and steps can be displayed in Figure 1.

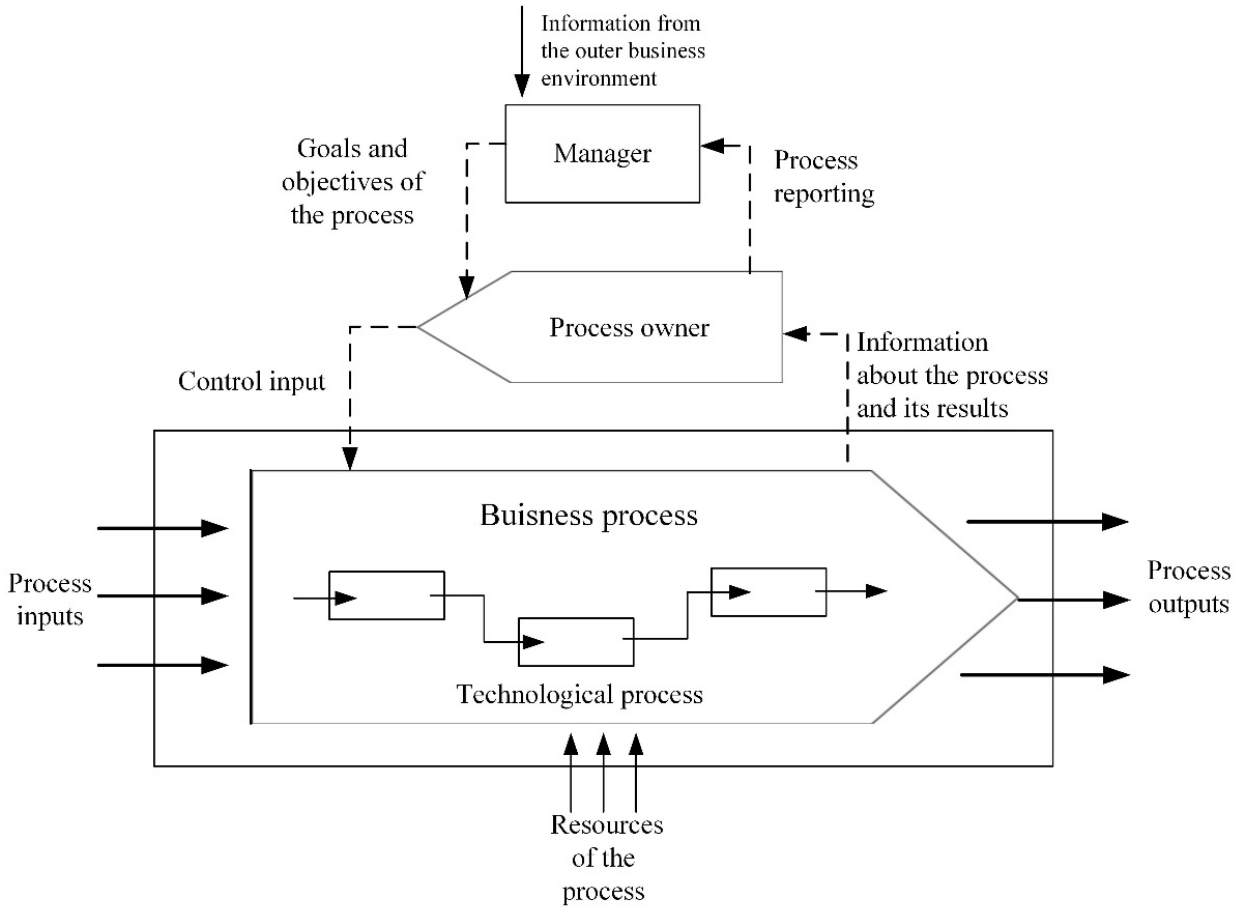

Figure 1. **Conceptual model of process-based management**

Source: made by author basin on [3]

As shown in fig. 1, the key elements of the process approach are the inputs and outputs of the processes, as well as the business processes (I), which receive resources and convert them into a finished product. The feedback between the subjects of the process is also important. It is represented in the form of two contours:

• the first circuit (II) is operational (communication is carried out through the owner of the process, which has a controlling influence on the business process itself);

• the second circuit (III) is strategic (communication is carried out through the head of the enterprise (according to data provided by the owner of the process), which, in turn, sets the goals and objectives of the process.

The management of business processes as an approach to managing a company implies the need to improve both a separate process in particular and the system of processes in general. The process approach to management assumes the presence of such mandatory elements to describe business processes as the motivation system, the rules, the owner and key performance indicators (KPI).

Basing on a process-oriented approach new management techniques and methods are spread, such as a balanced scorecard, business process engineering, operational risk management, cost management method - ABC-ABB-ABM, IT-technologies, management quality, etc. [4].

It is possible so to identify the main advantages in a process-oriented approach for an enterprise:

• focus on the quality and outcome of each process;

• close interrelation of processes in various operations;

• liquidation of unprofitable business processes;

• continuity of the management process;

• reduction of production costs and increase in the profitability of the company's business [5].

After analyzing the positive aspects of the process approach, we can outline the following facts: managers using this tool are trying to solve problems associated with a low level of enterprise management; the excessive influence of human factors and the absence of the expected reduction in production costs.

Despite this, there are some drawbacks observed in process-oriented management accounting:

• qualification level and professional competence of employees at all levels of production are a key factor in the efficiency of the entire company;

• management of mixed functional capabilities of working teams occurs;

• differences in the functional abilities of employees lead to a misunderstanding between different teams and within them.

Comparing the process approach with others (functional, project), it is worth noting that with the help of the first, an enterprise gets the opportunity to reduce its costs, eliminate unprofitable processes and focus production on quality and performance. These characteristics confirm the choice of the management system towards a process-oriented approach to enterprise management. However, the implementation of the process approach requires certain efforts and skills. In this regard, it is necessary to approach this issue with a willingness to cardinal changes, develop a plan for introducing a process approach, provide training for the company's employees in the theory and methods of the process approach, describe all business processes of an enterprise (what resources are necessary for their implementation, what processes are interconnected how long it takes to complete tasks in a process, etc.). When determining the responsible persons of a process, it is necessary to take into account such aspects as the provision of information with them, as well as in what form the reporting on the process and the frequency of its submission will be provided. In this regard, you should pay attention to CALS technology (Continuous Acquisition and Life cycle Support), using that you can provide system information support. Using these technologies, information is provided in the form of distributed databases containing information about the production environment, products, resources, and processes of an enterprise. This is relevant when it comes to structuring large amounts of information. With the help of these technologies, it is possible to eliminate paper documents from practice and implement electronic document flow, which will significantly speed up the work and efficiency of processes, as well as ensure the relevance, availability, correctness and safety of information. The concept of CALS involves a consistent and continuous change in business processes, improving the development and design, production and operation of the product.

The application of the process-oriented approach has become more ambitious due to the development of management automation and the emergence of the possibility to use new information technologies, the development of which improves the management accounting process. The massive us of various high-tech computer equipment has become the main focus of such improvement.

One of the largest US companies Walmart uses a process-based approach to management, occupies a leading position in the Fortune 1000 rating in 2018 [6, 7]. From this point of view, the management system built on the principles of the process approach is quite effective and efficient.

Summing up the work, it is necessary to identify the key tasks that are pursued by modern Russian companies when using process-oriented management accounting:

• formation of information on the costs and results of individual processes and types of company activities;

• calculation of products, works and services in the context of various stakeholders;

• control over the effectiveness of individual processes and activities of the company;

• evaluation of the effectiveness of business process management and the activities of a team of process managers;

• analysis of the effectiveness of the resources used;

• analysis of non-compliance with the established quality of business processes and activities;

• formation of an effective system of process-oriented management structure.

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JEL 330.341.2

A SYSTEMATIC APPROACH TO SOLVING THE PROBLEM OF LACK OF COMPETITIVENESS OF THE RUSSIAN MANUFACTURERS IN THE SHIPBUILDING INDUSTRY

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Abstract. The reasons of non-competitiveness of domestic shipbuilders, as well as related problems are considered and the ways of their solution are proposed by means of system mechanisms of interaction of participants with the help of a single information space of investment project selection.

Keywords: shipbuilding industry, non-competitiveness, information space of choice, system mechanisms of interaction

Introduction

In recent years, Russia has seen a constant decline in shipbuilding production, an increase in the import of ships and a decrease in their exports, which is reflected in table 1. Considering the competitiveness at the industry level, it is necessary to take into account the known approaches to its assessment [1].

The non-competitiveness of civil products of the shipbuilding industry is caused by the influence of a number of negative factors.

Methods

The system analysis showed that these factors are manifested in the process of interaction of the parties involved in the construction of new vessels [2, 3, 4] (see Fig. 1).

1. The traditional practice of concentration of the domestic shipbuilding industry on military orders does not allow the industry to sufficiently develop the civil segment of shipbuilding.

Table 1

Indicators of the shipbuilding industry for 2014-2017

Indicators	2014	2015	2016	2017
The number of ships built in total, units	252	200	168	150
including civil fleet	132	113	103	86
Import of shipbuilding products, billion dollars	1,42	1,25	2,00	2,37
Export of shipbuilding products, billion dollars	0,73	0,62	0,63	0,55

Source: on the basis [3]

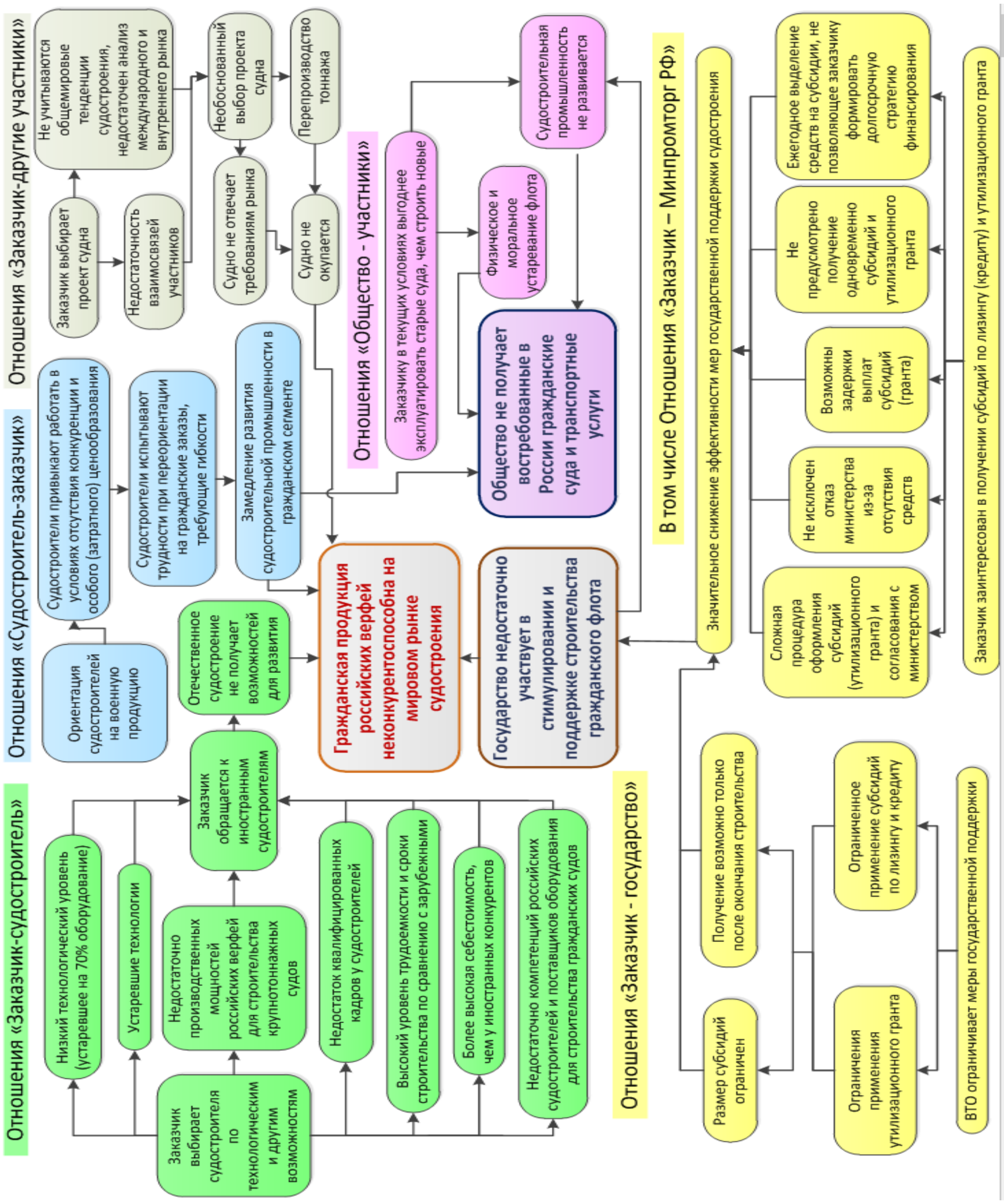

Fig. 1 **Factors leading to non-competitiveness of Russian civil shipbuilding on the international market**

Source: compiled by the author

2. Russian customers make orders for new vessels mainly in South Korea and China (90%), and much less at domestic shipyards (10%) [6].

3. Outdated technologies and high deterioration of equipment (according to experts, 70% [7]) multiply increase the

complexity of shipbuilding production, its cost and production time.

4. The existing production facilities do not allow the construction of large-capacity cargo ships.

5. The industry is experiencing a shortage of qualified production and engineering personnel, there is an obsolescence of competencies due to backward technologies and equipment. The age of the staff is above average (not enough young professionals).

6. Investment in the development of production facilities is carried out mainly by the state, mainly in the military segment of shipbuilding, other sources of investment are involved in small.

7. Innovation is slow and insufficient.

8. Dependence on imported components and weak development of import substitution.

9. Fragmentation previously established in the Soviet Union relationships, failure of new information linkages between economic actors in shipbuilding.

10. Government involvement in the management and support of the industry does not bring the expected efficiency.

These and other factors are presented in Fig1 indicate the need for systemic changes in stakeholder relationships in the shipbuilding industry. They are expressed in the construction of systemic mechanisms that determine the interaction of stakeholders. Studying the nature and frequency of problems at the stages of the life cycle of an investment project, it should be recognized as the most effective application of system mechanisms at the pre-investment stage of the investment project [8].

To select an investment project, it is advisable to form a single information space in which the interaction of the customer, the project organization, the shipbuilding enterprise and other parties interested in the project would take place.

Currently, there is a unified information system (hereinafter-UIS) of procurement on the official website www.zakupki.gov.ru ahhh! EIS can serve as an information space for selecting an investment project in the shipbuilding industry. On this site provides information about procurement, which the is a separate unit for the research, the experience-but development work "evaluation Criteria of bidders".

When forming criteria in EIS the rules established by the Federal law of 05.04.2013 N 44-FZ "about the contract system in the sphere of purchases of goods, works, services for ensuring the state and municipal needs" shall be observed [9]: 1) the quantity used for determination of the supplier (contractor, contractor) criteria of an assessment shall be not less than two; 2) at least one non-cost criterion of an assessment of applications of participants shall be established; 3) at least one cost criterion should be established for the evaluation of applications of participants [9].

Results

The customer shall establish selection criteria taking into account the interests of all parties involved in the project. For this purpose, it is proposed to use the generalized selection criteria "satisfaction", "efficiency", "effectiveness", established by the international quality standards ISO 9000 [10], the structure of which includes indicators of multi-criteria selection, deciphering each generalized criterion.

Provides information that is passed between participants in the EIS, with-holds the following information: 1) description of the situation of investment; 2) determining the approach of the customer in accordance with the type of situation, multiobjective choice; 3) determine preferences of the customer in terms of satisfactoriness, efficiency, effectiveness; 4) the preferences of customer in a list and ranking of indicators; 5) alternatives [11].

The practical application of these requirements will ensure the transparency of the investment project selection and coordinate the actions of all stakeholders.

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УДК 338.242.2
JEL

INFORMATION ASSURANCE AS A KEY FACTOR OF MANAGERIAL DECISION MAKING

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Abstract.
In modern conditions, information assurance of managerial decision making by users is quite extensive. The main scientific task to be fulfilled is to ensure the system consistency of the collected data. There is a need to develop criteria and requirements for the composition and structure of information on the activity of for-profit enterprises so that users could make sound managerial decisions.

Keywords: information, managerial decisions, quality of information, criteria and requirements for information disclosure, reporting, systematization of available information, system consistency of collected data.

Despite the numerous publications dealing with the information assurance of managerial decision making, collecting adequate and consistent information which contributes to the whole picture of the activity of an enterprise continues to remain a burning issue. It takes managers a lot of their working time to find the needed information. Statistics prove that the volumes of the information needed for the management of business processes become practically twice as much every 6-8 years, though, as it used to be before, there is still a lack of the high quality information needed to make managerial decisions. Managerial decision making, however, requires sound, specific and well structured information about the object to be analyzed.

In any for-profit enterprise the information assurance is quite extensive and the management information collection system is complex. Nowadays the volumes of the processed information tend to increase, the interconnections in information flow are becoming more complicated and information redundancy is growing amid the lack of high quality information for sound managerial decision making. This all causes problems in the use of information in the management of business processes of for-profit enterprises, considerably determines the possibilities of the analytical grounds of managerial decisions and, ultimately the success of the operation of a company.

It should be noted that “low quality” information determines “low-quality” managerial decision a priori. The “quality of information” (irrespective of directions and objects of analysis) is often associated with its reliability, trustworthiness, sufficiency and objectivity.

The managerial decision making by external users is often based on the data of accounting (financial) statements. Due to accuracy, actuality and adequacy, they demonstrate the actual availability and state of the properties and the sources of their formation as well as the reliability and stability of the components of the financial result and determine the quality of the managerial decisions made from external users’ point of view.

Many scientists and experts recommend to evaluate the quality of an accounting (financial) statement by controlling and tracking the logical and information interconnections of the data provided by various accounting and statistical report forms. The first factor influencing the quality of a managerial decision made regardless of direction and object is the accuracy of compiling the analyzed documents (including reports). Therefore, before making managerial decisions it would be prudent of the analysts to: evaluate the fullness, actuality and trustworthiness of the economic information provided in the analyzed documents; consider the changes which occurred in the accounting policy, accounting estimates of an enterprise and the relevant regulatory landscape. When conducting the analysis, very often various kinds of the used information adjustment, its aggregation, in particular, are needed, and it means that the second factor influencing the quality of the decisions is the reasonability of the applied analytical procedures and methods. Before proceeding with conclusions, one should make sure of the reasonability and accuracy of the applied methods.

It should be remembered that limiting the information assurance to the data provided by an accounting statement narrows the efficiency since it leaves beyond consideration the fundamentally important factors needed for the objective estimation of an enterprise's activity and dealing with its sectoral affiliation, the state of its external environment, including the market of material and financial sources, tendencies of the stock market and a series of other significant factors. The neglect of these factors may lead to ineffective managerial decision making.

Therefore, the order of collection, technology, accuracy and algorithm of the information processing as well as the scheme and interconnections of information flows have an essential impact on the reasonability and efficiency of managerial decision making. The paradox is that despite the huge quantities of the accumulated information, in reality in terms of provision of managerial decision making there is a deficiency of important information. Another paradox consists in the inconsistency of the information about various aspects of an enterprise's activity, since being accumulated separately in different information bases, it is collected by different business units of the enterprise and processed with different software products. The result is the losses of the significant data connections and very often of logical connections too.

However, economic information about the activity of companies, especially of the public ones, is needed not only by the managers, but also by all the interested persons. According to Federal Law № 39-FZ "On the securities market", the list of the information assurance is not limited to only the data of accounting. This law distinguishes disclosed information (information to which activities aimed at its disclosure have been applied) from publicly available information (information which does not require any privilege for access to it and eliminates the need for its disclosure).

The disclosure of information by an issuing company at the securities market alongside accounting information (a quarterly report, consolidated financial reporting) includes communications about the essential facts, i.e. the data which in case of their disclosure, would have a significant impact on the value or quotation of the issued securities. In particular, the Russian law stipulates quite a wide range of these data which includes 49 units.

The strictest requirements for information disclosure are imposed on joint stock companies as they are considered the most complex and progressive legal entity type of a juridical person. The list of the requirements for information disclosure is given in the Directive of Bank of Russia of 30.12.2014 N 454-П "On the information disclosure by issuers of issue-grade securities". Besides the information to be disclosed in accordance with the Federal Law "On the securities market", this directive extends the list of the data to be disclosed by adding to the scope of obligations of a public joint stock company an obligation to disclose: an annual report; the charter and in-house documents; data on affiliated persons; the decision on the issue (additional issue) of the securities; the notification of signing a shareholders' agreement by shareholders; the notification of the intention to fill a lawsuit for contestation of a decision of the shareholders' general meeting, for compensation of the incurred losses, for cancellation of a deal o application of the consequences arisen from the cancellation of a deal.

The requirements regarding the information disclosure by the issuers are interpreted by exchange systems more widely than in the relevant Russian law. If we take a look at the requirements set forth in the listing of "Moskovskaia Birzha" Public Joint Stock Company, we may see that they are subdivided into three levels on the basis of their significance degree. Predominantly the listing makes reference to the requirements of the Russian legislation including the regulatory acts of the Central Bank of the Russian Federation concerning the information disclosure.

As a supplementary requirement for the information disclosure by the issuers there is the compilation and publication of reports in compliance with International Financial Reporting Standards or other internationally recognized standards. It should be noted that for the first level issuers this requirement is set forth with respect to three closed financial years, for the second level issuers – one year whereas for the third level issuers there is no requirement of the kind at all. Besides, there is an obligation of respecting the corporate management requirements by the issuers.

And here an obvious question arises – are there many companies which meet the requirements concerning the information disclosure and set forth by the relevant Russian law and exchange systems? It turns out that compared to the total number of Russian large and medium-sized for-profit enterprises the number of the companies in question is laughably small: first level common stock issuers – 43 enterprises, second level issuers – 29 enterprises, third level issuers – 151 enterprises. In total there are 223 issuers, and this evidently demonstrates that the goal and tasks declared to create an international financial center are not fulfilled yet.

This all proves the necessity of systematizing the information available on the activity of an enterprise. Since the documentation of an enterprise's activity plays a great role in the systematization of information flows of an enterprise, it is important to present the specificity of documents circulation too.

To our mind, first of all, a particular attention should be paid to the source information which is originally provided in any business document (for example, when performing a business activity). Each source document generates an information flow. If during the compilation of a source document some valuable information is missed, it might never be replenished later. This means that an opportunity of making a rational managerial decision will be missed. Therefore, it is important to conduct an analysis of the so-called source documents according to the analytical sufficiency for the research of an enterprise's capabilities. As a result, all the sources documents recording the facts of the business activity, documents confirming the performance of the activity in accordance with the given internal regulations as well as the other documents recording any kind of source information should be analyzed.

One of the crucial problems nowadays is the inconsistency of the data provided in accounting (financial), fiscal, management and business accounting and reporting (one of the significant drawbacks of the widely used method of collecting and consolidating the information). Among the causes of this problem there are trivial errors committed by coworkers, wrong interpretation of calculation methods, inconsistency of the guidelines on how to fill in a reporting form, etc.

Certainly, it is prudent to strive to create in for-profit enterprises a unified information space which would be based on the source accounting documents, contracts with business partners and other sources of source information. In an ideal world a principle of introducing any information only once but in such a manner as to let it be available and useful to all potential users in for-profit enterprises should be complied with.

The development of information technologies, various kinds of accounting and control allowed to create huge information databases on the activity of enterprises. Scientific areas dealing with large databases (Bigdata and Datemining) have been evolved.

The main scientific task to be fulfilled consists in the provision of the system consistency of the collected data. This will require the development of criteria and requirements for the composition and structure of information on the activity of for-profit enterprises so that users could make sound managerial decisions.

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JEL M15

DIGITAL TECHNOLOGIES OF INTELLECTUAL COLLECTIVE ACTIVITY

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Abstract. Digitalization of the economy leads to an increase in the share intellectual activity and primarily collective activity in the enterprises. In the digital economy business success will depend on the effectiveness of collective intellectual activity organization. The work is devoted to the analysis of technologies of collective activity organization using digital communications. It is showing the differences of these technologies from crowdsourcing, which is the basis of the systems of ideas management. Digital technologies of intellectual collective activity include competence metrics, take into account differences in analytical and creative abilities of people, require of digital support of cooperation and creative motivation of participants.

Keywords: Collective intelligence, digital communications, crowdsourcing

Introduction

As organizations adopt digital technologies that reduce the share of routine operations, intellectual work becomes increasingly important in their activities. If earlier non-standard tasks that require new ideas were stayed only for the management of organizations, today such tasks are lowered to lower levels of management. For example, many large modern banks have already created entire departments engaged in digital transformation of business. Dozens or even hundreds of employees of these banks participate in various discussions related to business development, the introduction of new information technologies, the development of new products, etc. Moreover, with the introduction of knowledge management systems in the activities of enterprises and organizations, even ordinary business processes require employees to increasingly use creative and intellectual competencies.

Intellectual activity in the field of innovative development of modern organizations requires collective efforts. Finding unique solutions, and at an accelerated transformational processes rhythm, requires collaborations between staff members, either through projects or through research activities. However, despite the fact that creative and intellectual activity in a modern enterprise is often associated with the introduction of new, including digital technologies, directly in the organization of collective intellectual work, digital technologies are used very poorly. Today, various messengers, public and corporate social networks and chats, e-mail and group video and telecommunications are mainly used for the organization of collective intellectual activity.

In the literature is quite well researched and described [1] network projects (such as Wikipedia, Linux, etc.), in which large communities of specialists work. In the field of corporate activities, research is usually limited to the most widely used network tools of the "community of practice" [2]. However, there is no research on what digital technologies should be in General to support collective intellectual activity. Such technologies are called collective intelligence technologies [3], and they involve primarily an increase in the productivity of intellectual work in group work. This work is devoted to the description of collective intelligence technologies.

Methods

To identify the main characteristics of digital technologies necessary for the effective organization of creative intellectual activity, a comparative study of group work using network messengers and chats was conducted. One group used the messenger just for communication of its participants, and the other group used it within the given algorithm of work and with the use of the competence model. The nature of group work (involvement of all participants, uniformity of work in time) was compared, which allowed to identify the role of the use of given processes in communications and competence metrics. This method was used in [4].

In addition to the study of work in groups, mathematical models of collaboration of experts were built both within groups and in the division of labor between the two experts. The mathematical model of the group of experts takes into account the competence metric and allows you to calculate the effective group IQ. Expert collaboration models allow to evaluate the effect of combining experts with creative and analytical skills, as well as the effect of the use of peer review in collective work.

Results

A comparison of the work of two groups of experts who performed research work showed that experts who used a network messenger as usual communications among themselves, worked very unevenly over time. Communication between them arose spontaneously, as a rule, after initiation of discussion by one of the participants. In addition, the involvement of participants in the network communication was also very uneven, some experts did not participate in the discussions, and some – on the contrary, occupied most of the communication "ether". In the group of experts, the tasks between which were distributed according to their competencies, and the algorithm of joint work was clearly spelled out, communication in the network was much more uniform, since it was initiated not so much by the participants as by a given process. Similarly, the involvement of participants was also more uniform, there were no those who did not communicate with colleagues.

The calculation of the mathematical models of collaboration of experts showed that the productivity of group work can be increased significantly by taking into account the competence of experts. At the same time, each of the participants can show both outstanding performance indicators, if he has narrow unique competencies necessary for solving a group task, and smaller indicators, than he worked alone. Models of group work of experts showed the possibility of reducing the time of solving the problem several times with the right combination of an expert with creative abilities and an expert with analytical capabilities. At the same time, the time of using an expert with creative capabilities is many times lower than the time of using an analyst, which makes it possible to talk about the need for more analysts in group tasks. Evaluation of the effectiveness of the use of peer review in group intellectual tasks shows that this kind of collaboration can increase the quality of the problem, if the solving has a time limit.

Discussion

The obtained results allow us to draw conclusions about the characteristics of digital technologies necessary for the effective organization of creative intellectual activity. First of all, for the organization of intellectual activity should be used competence metrics, which includes not only the subject knowledge of experts, but their propensity to creative or analytical work, the ability to work in a team, management skills, etc. A very important characteristic of collective intelligence technologies is the relationship between the stages of the problem solving process and the model of participants ' competences. In fact, this means that the technologies of collective intelligence are significantly different from crowdsourcing technologies, in which the processes of solving problems are not related to the competencies of the participants.

It is very important to combine experts with analytical and creative abilities in time. It is advisable to entrust the formulation of the problem and the search for ways to solve it to an expert who has creative abilities, and it is better to entrust the work to an expert who has analytical skills. At the same time, it is very important in intellectual activity to use in the last stages of solving the problem of reviewing, which allows you to complete the work with rock and higher quality. Thus, the division of competencies is important not only from the point of view of the division of tasks in the expert group, but it is also important to build a phased solution of problems. Digital technologies of collective intelligence should allow the correct distribution of work in the group.

It should be noted that digital technologies of collective work do not mean digital communications. They should make it possible to properly organize the division between experts in the group and in the sequence of the decision, but the communication between experts can be carried out both using electronic means of communication (e-mail, messengers, network chats) and in personal communication. The main condition for the effectiveness of collective intellectual work is trust between the participants, which requires information transparency of all collaboration tools. In intellectual activity, creative motivation is much higher than in other activities, and increasing efficiency using digital instruments for teamwork increases motivation. Thus, the effectiveness of the use of digital technologies in collective intellectual work by increasing motivation will be even higher.

The paper describes the main General characteristics of digital technologies necessary for the effective organization of creative intellectual activity. Of course, further more detailed study of such characteristics, the study of existing examples of their implementation in the activities of organizations is required.

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JEL E 42

CRYPTOCURRENCY AS A NEW ECONOMIC REALITY OF THE SOCIO- ECONOMIC SYSTEM

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Abstract.
The relevance of the research is determined by the fact that innovative technologies have made corrections to the existing ideas about the day. The goal is to consider the crypto currency as a new economic reality of the socio-economic system in terms of the objects, subjects and types of transactions conducted on their basis, with an emphasis on assessing the practice and prospects for applying crypto-currencies in the emerging digital economy. The tasks are to investigate the role and place of the crypto currency in the modern economy, taking into account the transformation of the form and mechanisms of money turnover in the era of widespread use of information networks, the spread of computer technology. Methods: the evaluation is conducted on the basis of SWOT analysis of the advantages and risks of using crypto currency in the monetary sphere, the payment industry and the banking business. Result - advantages (strengths) and weaknesses of both the creep-goods and the technologies of its creation and transfer are formulated. Perspectives: the possibilities of using at the level of micro- and macroeconomic processes in the national economy are shown.

Keywords: money, financial innovation, crypto currency, the digital economy

Today they talk a lot and write about the Crypto currency as a really "new reality". At the same time, the need has arisen for its ostensivnom its definition, i.e. directly indicate the object or phenomenon being determined. The attempt to define a virtual currency is ostensively, in our opinion, connected with the definition of money within the framework of institutional theory. Institutions in this case are understood to be certain formal (enshrined in the rules of law) and informal (generally accepted) rules or behavior stereotypes that contain information about collectively accepted rational decisions. Instituts, possessing property of cognitivesti, i.e. ability to mental perception and processing of external information can be formed initially on an informal basis in the form of an agreement between people (and this is true of the emergence of the crypto currency in the market), but in the future, if they acquire mass character and prove their rationality, as a rule, fixed in a formalized form, acquiring the status of formal regulations and behavior stereotypes [1, c.130-133].

Recognizing the logical construction of the "construction" of money as an institution, we note that the formation of both an informal and a formal institution of money is based on the development of economic relations. Money can not appear as informal institutions (and virtual currencies, including creep-commodities, are appropriate to consider in this way) without forming a certain level of economic relations. We believe that the emergence of virtual money, including crypto-currency, is due to the process of technological development, which is part of the overall economic development.

But the explanation of the appearance and handling of virtual currencies, including crypto-currencies, does not allow them to be used in the practice of economic turnover without including them in the "legal field".

At the moment, there is no single approach to determining the nature of virtual currencies both between different jurisdictions and within the same jurisdiction, which is expressed in the absence of "closed" definitions of the virtual currency. The existing set of definitions allows, within the limits of one jurisdiction, in relation to various types of legal relations arising in connection with the turnover of virtual currencies, to refer the latter to "private money", a payment facility, a financial asset [2], a commodity, property, property law, etc.

The analysis revealed the following features of the crypto currency and its turnover, which are essential for determining its status: transactions are irrevocable and P2P ("re-to peer" - from the client to the client) is carried out; information about transactions is publicly available; the emission of crypto currency is decentralized; a finite number of currencies are known in advance, and the creation of each new block is accompanied by the solution of an increasingly complex mathematical problem, which artificially limits the rate of growth of the supply of currency; in respect of the crypto currency, there is no problem of restricting liquidity even when developing the entire amount of the crypto currency, since the currency unit is divisible into smaller parts; Crypto currency is not anybody's obligation, it is not secured, and its value is based only on the expectations of the market players (ie while it acts as an informal institution of money); crypto-currencies are used by an unlimited circle of persons for committing transactions for the purchase and sale of goods and services, payment for works, as well as for investment purposes.

The analysis showed that the crypto currency payment function is performed on the basis of its following properties: high liquidity, which allows it to be used as a means of circulation, payment and accumulation, the ability to create and transfer using the advanced technology of the register of information blocks (block), the possibility of using an unlimited range of persons when making transactions.

A distinctive feature of the system of turnover of bitcoins is the absence of the mechanism of re-emission, which would allow one or other bitcoins to be withdrawn from circulation. In this regard, it is not possible to re-issue defective bitcoins (for example, bitcoins that arrived in favor of addresses that have been lost access) in this system.

As noted above, the creep-goods as an informal institution appear at a certain level of economic and technological relations and arise on their basis. Strictly speaking, the state, as a joint economic entity, economic entities (business) and the public must come to an understanding of the need to use crypto-currencies in their activities, to realize the prospects for their use. Only if all participants in the economic activity are aware of the possible ways and forms of using the Crypto-currency in circulation, the establishment of the Crypto-currency will coincide with their awareness as an informal institution, after which it will become necessary to consolidate them as a formal institution.

Otherwise (for example, if the state refuses to recognize crypto-currencies), the role of money as an information guide will be distorted, the behavior of economic agents, the population, their motivation will objectively violate established norms and prescribed regulations, e. in the case of obtaining certain "benefits" from the use of crypto currency, economic entities will still strive to use it.

It is expedient to make a decision on legalization of crypto-currency on the basis of SWOT-analysis. SWOT analysis of the advantages and risks of using crypto-lute in the monetary sphere made it possible to identify the following advantages (forces) in the crypto currency, the technologies of its creation and transfer, and the possibilities of using it at the level of micro- and macroeconomic processes in the national economy: crypto currency is used by an unlimited circle of persons when making transactions; It is defined as a means of conversion, applied analogously to the language in certain communities; a finite number of currencies is known in advance, and the creation of each new block is accompanied by the solution of an increasingly complex mathematical problem, which artificially limits the rate of growth in the supply of currency; performs the function of a means of payment on the basis of its high liquidity, which makes it possible to use it as a means of circulation, payment and accumulation; there is no problem of restricting liquidity, even when the total amount is being developed, since the currency unit is divisible into smaller parts; is produced and transmitted using the advanced technology of the register of blocks of information (block); the decentralized mechanism for the circulation of the Crypto currency is controlled by peer-to-peer participants in the peer-to-peer network, hence the independence from risks (including credit risks and liquidity risks); transparency of the turnover mechanism, all elements of which are under the control of a large number of independent entities; the breakdown of the operation of the mechanism of rotation, due to the low probability of simultaneous failure of all the sub-projects; adaptability of the turnover mechanism to changes in the external environment, which is due to the independence of the subjects of the mechanism in terms of changing their behavior under the influence of external factors; non-dependence of emissions on political preferences and economic views of the subjects of the system, which allows one to consistently adhere to the economic model embedded in the emission algorithm; openness of information on transactions and their volumes; transactions are carried out by P2P ("re-to peer" - from the client to the client) and are irrevocable.

The shortcomings (weaknesses) of the creep-goods, technologies for its creation and transfer are as follows: in no jurisdiction does not have the status of a legal tender; does not have a full set of signs of real currencies; is not anybody's obligation, is not provided with anything, its value is based only on the expectations of market players to convert to other currencies or to implement exchange directly for goods and services; there are risks of a state that does not control the export of capital abroad; the personal data of the parties to the transaction may be hidden, which makes it possible to use it for criminal purposes; transactions are carried out by P2P ("re-to peer" - from the client to the client), which limits their universal distribution, as participants must be assured of the good conscience of the parties.

The revealed advantages (forces) allowed to formulate a number of opportunities that the national economy will receive, subject to the legalization of the crypto-currency. For the government, these opportunities are as follows: stimulating the development of national jurisdiction, innovative technologies that accompany the development of the crypto-currency market (in particular, the use of blocking technologies in various industries); a new tool for attracting investment; the source of income to the national budget from entrepreneurial activities related to the turnover of crypto-currencies and trade; sales to enterprises involved in the mining of virtual currencies, public services in the electric power industry; means of creating new jobs, the potential leadership of the state in the use of new technologies in the financial sphere.

For the population and business, the use of crypto-currencies has the following possibilities: the source of income generation in connection with the use of crypto-currencies (at present, the means of circulation, payment and accumulation, investments), mining, participation and attraction of capital through ICO, operations on the stock exchange; a new format for the transfer of funds, which, due to the absence of banks as intermediaries, significantly reduces the amount of fees for transactions and increases their speed; the ability to conduct settlements with a much greater degree of confidentiality than with the use of fiat currencies; in the integration with the technologies of smart contracts and other technologies on the platform of blocking, as well as with the technologies of the Internet of things, creates new opportunities for business and consumption of goods and services; exchange of virtual currencies to the currency of foreign countries that is not available for purchase in national jurisdiction or through a virtual currency can be purchased at a more favorable rate; activity on mining as a way of self-employment of citizens.

In addition to new opportunities for business and the public, the use of creep-goods also carries significant risks. For the state in use crypto-currencies there are following threats: use for the purposes of laundering (legalization) of the incomes received by the path; use for the purpose of financing terrorism and other forms of criminal activity; fraudulent transactions in order to evade taxation; uncontrolled export of capital from the country.

As threats to business and the population, it can be noted that operations with the crypto currency as a subject of exchange, settlement operations, and also as an object of investment activity are inherently risky; there is a possibility of involvement in criminal schemes because of a low level of financial literacy; legislative insecurity in the absence in most countries of legislative regulation as an object of investment, as well as the uncertainty of using as a means of payment.

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JEL O21, P11, P21, P41

SYSTEM BASIS FOR FORMING THE STRATEGIC PLANNING METHODOLOGY IN THE CONTEXT OF THE INTRODUCTION OF DIGITAL MANAGEMENT TECHNOLOGIES

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Abstract.
Purpose: Definition of the system basis for the formation of strategic planning in the context of the digital transformation of the national economy and public administration.
Methods: System, logical and content analysis, theoretical and empirical foundations of methods and models for coordinating the interests of participants in strategic planning in the conditions of the formation of the digital economy.
Results: The publication presents a description of the basis for the systemic transformation of the overall paradigm for managing strategic development in the digital management environment as a result of assessing changes in the characteristics of the initial management information, the capabilities of computer and communication equipment, the requirements for management personnel, and the format of organizational interactions in the construction of information and analytical management systems.
Discussion: One of the promising directions in the development of strategic planning in the digital economy can be universal digital platforms.
This work was supported by the Russian Foundation for Basic Research (project № 18-010-01151)

Keywords: System analysis, digital technologies, development management, methodology of strategic planning.

INTRODACTION

At present in the general process of reforming the system of public administration in the Russian Federation there are several key vectors. They affect all subjects of the country's socio-economic space regardless of their spatial and functional position, their place in the hierarchy of governance. In our opinion, such "universal" drivers of institutional transformations are the processes of searching for and creating an effective national model of development management in the frame of a digital transformation of the information society. At the same time, many new problems arise in the study of the regularities of the evolution of the content and mechanisms for managing social and economic processes in the context of digitalization of the public landscape.

Nevertheless to date the sufficient experience has been accumulated in the implementation of the norms and tools of the emerging strategic planning system in the activities of state and municipal government bodies [1, 2, 3,4], which allows to assume the inevitability of further reform of this management institution. In this regard, studies aimed at summarizing the first results of the formation of a national system of strategic management and developing sound proposals for its transformation are of special importance, including taking into account the new technological prospects associated with digital technologies in management.

METHODOLOGICAL AND INFORMATION BASES OF RESEARCH

The search for a national model of strategic planning (SP) is in the focus of the interests of scientific research of both Russian and foreign scientists [1, 4, 5, 6, 7]. This activity has been intensified especially since the zero years and not least under the unprecedented onslaught of new technological opportunities provided by digital technologies.

Outstanding specialists in the field of informatics and computer technology, mathematics and mathematical modeling pay special attention to the potential opportunities of the digital economy [6, 8, 9, 10, 11, 12].

The main sources of the actual material for the study were the official data of the Ministry of Economic Development (http://www.economy.gov.ru), FIS SP GASU (http://gasu. gov.ru/stratplanning), the Russian Federal State Statistics Service (http://www.gks.ru), as well as websites of a number of international organizations: UN (http://www.un.org), The World Economic Forum (http://www.weforum.org), OECD (http: // www. oecd.org), The World Bank (http://www.siteresources.worldbank.org) and a number of others. The processing of information on the subject of the study, as well as the opinions of practitioners and experts was conducted using system analysis methods, semantic, logical and statistical analysis of data.

EXPERIENCE IN APPLYING THE SYSTEM OF STRATEGIC PLANNING IN CONDITIONS OF DIGITAL TECHNOLOGIES: PROBLEMS AND SOLUTIONS

In the course of the research, the author identified the key difference between the current stage of the diffusion of digital technologies and the management of social and economic systems from previously introduced tools and automation systems of organizational activities in the forms of computerization and informatization.

Today we are witnessing the transition to a comprehensive information and technological support for the performance of government functions and processes in the context of the overall digital transformation of the information society. The composition of these functions and processes is expanded and deepened within the framework of a single digital platform for public administration. They qualitatively integrate with managerial and operational tasks.

Analysis of the transformation of the general development management paradigm allows us to note the features of building the information, analytical, software and technological components of automated information systems at the state level. This is due to the change in the following characteristics:

- *initial information* (accumulation of heterogeneous information through the channels of statistical and management reporting, collection and analysis of sociological information, including direct questioning of users on the composition and quality of public services, as well as expert assessments);
- *capabilities of computer and communications equipment* (exponential growth in processing and data transfer rates, the global trend [8, 9, 10], according to Gartner: CAGR of an average speed of general-purpose processor operations is about 23%, and of data traffic volumes - 56%);
- *requirements for management personnel* (the complexity of the objects and processes of management of organizational systems, the increasing uncertainty of the conditions and parameters for making management decisions, the aggravation of global competition for the use of all types of material and intellectual resources fundamentally changes the content and nature of management activity, the volume and complexity of information and analytical work is substantially increasing [13]).
- *format of organizational interactions* (transition to a model for building centers of administrative and analytical competencies; a

combination of a process and a functional approaches to the construction of development management structures on the basis of project offices with flexible communication schemes for solving complex management tasks by phases, spheres and levels of strategic planning [14]).

The system basis for the formation of the strategic planning methodology should be based on the principles of the complexity and integrity of building an effective mechanism for the strategic management of socio-economic development. The rationale for the concept and structure of the updated methodology requires the consideration of the state and trends:

- *organizational support of public administration* (transparency of functioning and service orientation of support for interagency and interregional interaction in terms of phases, spheres and levels of social and economic development and ensuring national security);
- *information support for public administration* (integrated data warehouses of federal, regional and municipal levels with a fully functional interface for authorized users of specialized departments of strategic planning in the executive branch);
- *computer support of public administration* (distributed high-performance centers for storage and processing of data, data networks);
- *analytical support of public administration* (methods and technologies of data mining, predicative analytics, artificial intelligence for substantiation and development of management decisions).

In the context of the goals and objectives of the study, the system basis for the formation of the strategic planning methodology in the context of the digital transformation of the economy and management can be defined as the integration of the following concepts:

- *sustainable development* (new metrics of social progress);
- *new public administration* (the main focus on the results of the implementation of the entire range of public policies and programs);
- *network economy / economy of relations* (flexible dynamic technological chains of value creation);
- *e-government* (a transparent mechanism for interaction between government, society and business);
- *Big Data* (the sphere of means and technologies for collecting, accumulating and processing large volumes of heterogeneous information);
- *Data Science* (analytical and algorithmic methods of analysis and processing big data).

DISCUSSION

Thus, characteristics of the Russian socio-economic space allowed defining the conceptual basis for improving the methodology of strategic planning. The system for designing long-term national development plans should be complemented by a mechanism to ensure the balance and consistency of their elements and parameters, taking into account the capabilities of automated public administration systems. Further development of the concept and structure of the strategic planning methodology should outline integration of analytical tools on the basis of complexes of heterogeneous models of analysis and combination of potentials and development priorities of interacting social and economic agents of different levels of management. This implies further development of a unified digital platform for strategic planning in the Russian Federation.

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JEL B40, B59, Y80

PREREQUISITES FOR THE CREATION OF THE UNIVERSAL ALGORITHMIC SPACE OF DIGITAL ECONOMY

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Abstract. Fundamental obstacles to the full globalization of the digital economy are being identified. The reasons of their occurrence are analyzed both at the level of deep properties of information environments in which run economic processes, and at the level of logical bases of computer-networking architectures of the Global Computer Environment (GCE), used now for digitalization of the economy. The ways of elimination of the revealed reasons on the base of the general model of universally programmable and cyber-secure distributed computing are shown. In the growth of this theme the architectural principles of the new class of mass universal network computers with non-microprocessor architecture are offered, which open possibilities of formation in aggregate resources of the current GCE of the universal algorithmic space of the digital economy.

Keywords: digital economy, human informational universality, the algorithmic universality of computers, global computer environment, global information strongly connectedness, the model of distributed computing, computers with non-microprocessor architecture, universal algorithmic space of digital economy.

Introduction

Social progress is determined by the levels of development of economic relations, structures, systems and processes that are carried out in self-organizing modes through social information space of human brainwork. In the past, the main driving force behind economic processes remained unique intellectual and communicative capabilities of Homo Sapiens in a part of the universal processing of information.

With the advent of mass computers and the global computer environment (GCE), the situation is changing radically. Property of algorithmic universality of computers interrupted the historical monopoly of man for universal processing of information. The aggregate computational, functional, and system-forming potential of the rapidly growing billions of universal computing devices connected by networks opens up prospects of forming for a digital economy the global and universally programmable infrastructure. Such infrastructure has its roots in the depths of the GCE and is capable in the unprecedented conditions of global informational strong connectedness and the growth of streams and volumes of information to ensure a radical increase in the efficiency of the economy.

However, there are fundamental obstacles in this way. The paper presents the results of the analysis of the reasons for their occurrence both at the level of properties of information environments in which economic processes take place and at the level of logical bases of computer-network architectures of the GCE currently used for digitalization of social and economic systems. The ways of eliminating these causes are shown on the basis of the model of seamlessly programmable distributed computing and the new class of universal computers with non-microprocessor architecture, which opens up the possibility of forming the universal algorithmic space of digital economy in the GCE.

Disproportions in the Development of global computer environment [6-10]

Global digitalization began in the 80s with the mass production of PCs. In the 90s, this process received the net-extension in the global space WWW. Since then, the world produces more than 99% of the information in a globally distributed form in digital forms and accumulates in the network resources of GCE.

The logical basis of the WWW has become the hypertext model. Not possessing the property of functional completeness (algorithmic universality), from the three types of base actions with information - storage, transfer and processing underlying any information processes, it had provided globalization of only two - storage and transfer. Such disproportion made possible the spontaneous forming in the GCE of an unprecedented phenomenon of global informational strongly connectedness (“everything affects on everything and at once”). This phenomenon disrupts the balances of current mechanisms of sustainable development.

In the absence of a general model of globally distributed computing that defines uniform rules for universally programmable processing of information in heterogeneous GCE resources, most of the growing volumes of information remain unprocessed (the crisis of “overproduction of information”). This leads to a spontaneous increase in the number of uncontrollable degrees of freedom in socioeconomic systems, which is one of the main reasons for the growing instability of the world social system.

The property of global informational strongly connectedness has spontaneously arisen in a market economy and rapidly, without prior assessment of the consequences, expands its sphere of influence. This property totally and rigidly formats the information activity of the human environment and social information space of human brainwork, as well as information processes of functioning and development of socio-economic systems.

Revealing and overcoming disproportions is impossible within the framework of existing computer-network architectures based on microprocessors, as well as the existent software technologies and methods of digitalization of the economy based on them.

Deep Problems of Digitalization

One of the main problems in the development of socio-economic systems are the biological limitations of the throughput capability of persons and of a social information space of them brainwork in a part of the algorithmic processing of information.

Under the conditions of the human monopoly on informational universality, methods and structures of managing social and economic processes at all times were building in anthropocentric architectures. In connection with the advent of computers and the mass expansion of the GCE into various spheres of life, additional opportunities arise that, in their development potential, are able to free the social information space of brainwork from the routine of algorithmic processing of the growing flows and of volumes of information in aims of sustainable development. This requires a transition from the monopoly of anthropocentric management architectures to bicentric architectures of a balanced combination of the advantages of the universality just as human and so computer intellect. Such a transition requires scientific understanding of the similarities and differences in the properties of the universality of man and computers, as well as their projections into the social information space of brainwork and into the area of distributed computing in the GCE.

It should be noted that, despite the growing instability of the world economy and the social system as a whole, such a transition has not yet become a hot topic of science. In the absence of historical precedents, science is not ready for a system-holistic perception of the strongly connected world social system. In the lack of a general, the scientifically based picture of a changing world, the course of development determines the chaos of market competition by means of commercial promotion of growth in number, complexity, and cost of the "zoo" of heterogeneous technologies, which demand a difficult detection of advantages and verifications of unpredictable consequences.

In this context, the absence of motivated optimism in the forecasts of “development” of both the traditional economy [1] and the digital one [2] is entirely appropriate. An analysis of the ups and downs of the Nasdaq index throughout 20 years in comparison with the fantastic success of the mass production of computer components during this period provides unflattering explanations of the very modest effect of the digitization of the world economy. In [3] it is shown that since 2000 the average annual growth of the index was less than 3% in a year. During this period, the technical progress of computer components had been from hundreds to tens of thousands of percents. As a result, the growth of the index compared with the increase of computer components is hundredths and thousandths of a percent.

Why does the world market in fact “ignore” computer progress and respond to the growing coverage of societies by computer networks not by a new jump in the development of the global economy, but latest crises and increasing instability? Perhaps the main reasons are as follows:

• heterogeneous GCE does not have the system-holistic, functional completeness and cybersecurity properties necessary for controlling the sustainable development of systems in conditions of global strongly connectedness;

• the existing models of globalization social and economic systems do not take into account the objective laws of development of the GCE, which does not allow to effectively use the immense potential of GCE for the holistic solution of strongly connected problems of sustainable development.

The symptoms of the growing incompatibility of computer progress and existing models of digitalization of the economy, noted in the paradox of R. Solow [4], are gaining global proportions. The reasons are not in the weakness or absence of any technology. They are hidden in the self-organization properties of complex systems.

Evolutionary Roots of Economy

The problems of the digital transformation of the economy are connected with the laws of evolutionary self-organization. In applied to live systems, they are formulated in the Darwinian triad - "heredity, variability, selection." The self-organization of living matter began with the formation of the universal information space of genetic information, which became the basis for the embodiment of the Darwinian triad.

In [5], the particular importance of information in the development of live matter is shown. Organisms and systems of them are considered as biological information machines. The Darwinian triad explains their progress in the course of interaction with the natural environment and with each other, from the implementation of the simplest narrow-profile structures and functions of processing information to complex ones. The genus of Homo Sapiens has become the "top level" of the evolving a great many generations of informational "bio-machines." The distinguishing feature of Homo Sapiens is the acquisition of the unique property of the information universality and the associated social information space of brainwork. It was the first jump to new evolutional levels in the growing of hierarchy of information spaces, and the first information space, which had exited the bounds of the direct action of genetic information.

Structural and functional biodiversity of information functions is fixed at the molecular level of codes of genetic information. Development cycles in the biological contour of genetic inheritance require a change of many generations. The social information space of brainwork bypassing the genetic space has opened up faster channels for the development of information structures and functions. The development of information, freed in the social information space of brainwork from the inertia of the "biophysical" shells, has accelerated by many orders of magnitude [6].

The first product of this evolutionary jump was the information spaces of the simplest labor relations. From them grew the self-organizing economic space in which the sustainable development of social systems takes place. The technosphere and the information space of technogenesis have also become the product of the evolution of information in the social information space of brainwork. Despite the absence of connection with genetic information, technogenesis, as a product of the development of the social information space of brainwork, "borrows" the attributes of biological evolution. First, the principle of a material embodiment of a variety of complex specialized structures and functions is repeated. Secondly, which is very important, the result of the growing diversity of complex specializations in both cases is the achievement of the universality property. This is the universality of man (in the living embodiment) and the algorithmic universality of computers (in technical implementation).

It is appropriate to assume the hypothesis about the fundamental connection between ascending evolutionary levels in systems of different nature and their general target orientation towards achieving one of a possible property of information universality. The embodiment of the Darwinian triad in universal information environments/spaces requires manipulations not with a material substance "burdened" by the laws of conservation of mass and energy, but with non-material information codes. "Material," energy and time costs of information manipulations are orders of magnitude less than biotechnical ones.

The formation in the GCE of the universal algorithmic space of digital economy opens up the newest evolutionary level of expansion the variety and intellectuality the functions of managing/control sustainable development.

The Model of Distributed Computing and the Non-microprocessor Architecture

The hypertext information space WWW for almost 30 years continues to be the base for the expansion of GCE spheres of influence. In the absence of the general model of universally programmable computing in the heterogeneous GCE, the exponential growth of flows and volumes of weakly formalized information, unsuitable for deep algorithmic processing aimed at managing the sustainable development, becomes the global factor in the destabilization of social and economic systems.

The main obstacle to the formation of the general universal model of distributed computing in the GCE is the extreme heterogeneity of computer and software platforms, forms of data presentation and programs.

Algorithmic digitalization currently uses distributed information processing systems in network architectures Grid, (Cloud + (Fog + (Dew)) and Peer-to-Peer. Such approaches implement various methods of integrating heterogeneous resources of GCE, therefore require solving multivariant integration problems. Their combinatorial complexity is the insurmountable obstacle to the increase in the size of systems. In this case, system-technical complexity and the cost of their implementations are growing too quickly, becoming unacceptable.

The disadvantages of such approaches are size restrictions, narrow specialization, high system-technical complexity and cost of operation, conservatism. In principle, they cannot ensure the full-scale use of the algorithmic potential of the aggregate resources GCE for solving the whole variety of strongly connected problems of the digital economy.

In [7-9], the new approach to the organization of distributed computing was proposed, which allows eliminating the root causes of the continuous reproduction of the heterogeneity of the GCE. This approach is based on the general model of the universally and seamlessly programmable distributed computing, built [7] by the mathematical generalization of the classical model of universal computers by J. von Neumann. On this basis, proposed principles for creating the new class of mass universal computers with non-microprocessor architecture [8]. By "zeroing out" the reasons of the heterogeneity and combinatorial complexity of integrating GCE resources, this architecture ensures the seamless and cyber-secure spreading of property the universal programmability from internal resources of computers to an arbitrarily large number of computers connected by networks. This opens the ways to the formation (with minimum expenses) in the aggregate GCE resources of universal, mathematically homogeneous, seamlessly programmable and cyber-secure algorithmic space of distributed computing and network-centric control for solving of the variety of digital economy tasks [10]

About the Universal Algorithmic Space of Digital Economy

In the absence in GCE of the unified universal algorithmic space, technologies for building narrow-profile systems, such as Blockchain, Big Data, Deep Learning, etc., are used to solve problems of the digital economy. They oriented on the high-cost integration of heterogeneous GCE resources (see above). It fundamentally limits system-forming capabilities in growing of scale such solutions. Initially every of such approaches is not algorithmically universal and system-holistic. They are used to solve particular classes of digital economy's problems.

The practice of decades of GCE growth shows [1-4] that numerous generations of narrow-profile, systemically fragmented technologies for digitization of the economy do not provide the expected system-wide effect (paradox of R. Solow [4]).

The conception of multilevel evolutionary processes assumes that the transition to qualitatively higher levels of development occurs through the development of many generations of narrow-profile solutions after the appearance of elements with the universality property. The universality provides the basis for the following information space, in which there is a jump in the acceleration of evolutionary processes.

In the context of the interdependent development of the GCE and digital economy, this new space will be the universal algorithmic space with the additional property of cyber-trusteeship given to it. This feature is now partially implemented by Blockchain software technologies in an extremely heterogeneous GCE, composed of billions of computers with microprocessor architectures. Such architectures with their cumbersome baggage of highly complex system software, are becoming increasingly vulnerable to unauthorized interference. Such software implementations cannot be considered as a full-scale solution of digital economy problems.

The proposed model of universal distributed computing, which can be implemented in mass network computers with non-microprocessor architecture [7-9], opens up possibilities for forming universal, mathematically homogeneous, seamlessly programmable and cyber-secure algorithmic space of digital economy in the aggregate resources of the GCE [10]. In such algorithmic space computers with the non-microprocessor architecture at the hardware level ensures efficient and secure execution of the system functions of control by distributed computing with an account of the growing demands for reliability, cyber-security, and cyber-trusteeship.

Within the framework of the new system-forming qualities of the proposed digital economy space, the possibility of creating the universal digital platform for fiat money systems opens up.

This will allow government structures to create a system-holistic alternative to the growing anarchy of crypto-currencies. The universal digital platform may become the key foundation for the full-scale integration of the all variety of narrow-profile systems of the digital economy, as well as viable branches of the traditional economy.

Conclusion

The problems of the formation of the universal algorithmic space of digital economy have deep roots in the objective laws of multi-level evolutionary self-organization of complex systems. With exhausting of the system-forming potential of the current level space, which supports the processes of self-organization, a jump into the information space of the next level with new principles and rules of self-organization is performed. The paper shows the general nature of the evolutionary-jumplike development of socioeconomic systems. In this work, for the first time the internal laws of the development of the GCE, which occurs total influence on social and economic systems, are taken into account. The implementation of the universal algorithmic space of digital economy in GCE is the jump to the new level of systemic self-organization.

The subject of further research is an in-depth analysis of the patterns of formation and development of the digital economy and the system-holistic interpretation of the Darwinian triad in its multi-level ascent along the vertical of the considered information spaces of the implementation of processes self-organization.

In the absence of an understanding of the fundamental laws of the development of the GCE, the threats of losing control over super-powerful informational factors of the destructive impact on the world social system are rapidly growing. This is the dark side of the systemically unbalanced growth of the diversity of technologies and the unprecedented challenge to modern science, which does not possess the methods and means of full-scale system-holistic integrating the knowledge produced.

To respond to new challenges, it is a necessary embodiment in the GCE a universal noospheric space of knowledge formation and their holistic integration for the development of sustainable development technologies. The implementation in GCE the universal algorithmic space of the digital economy is the next step in that direction.

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JEL G32

THE CRYPTOCURRENCY PENSION MECHANISM FOUNDATIONS

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Abstract.
Purpose: To propose a digital model of the pension system of an industrial enterprise, in order to ensure sectoral economic resilience.
Method: The system is based on a wide application of the company's local crypto-currency, specially designed for these tasks, with its accrual to registered pension accounts.
Result: A part of the social tension caused by the government reform of the pension system is being removed. The potential of corporate culture is growing, through retaining valuable employees for the enterprise. Qualitive relationships with loyal customers are developing. Conclusions: Economic resilience at the level of a single industrial enterprise can be ensured, among other things, by introducing a specific crypto-currency pension mechanism into the perimeter of the enterprise.

Keywords: economical resilience, cryptocurrency, pension system

Pension reform in Russia is extremely unpopular, but it also is a long overdue measure. The implementation of this reform is due to the constant deterioration in the ratio of the number of pensioners and the economically active population of the country, with the country's stagnant GDP. The increase of the retirement age by 5 years, at the same time for men and women, causes the expected shortfall of income on the side of pre-retirement age people, totaling about 750 thousand rubles for the pre-retirement period. The loss of these incomes will have a painful effect on pre-retirees (PR). Today, the PR is a new legislatively introduced category of people, since the same benefits as in traditional pensioners are beginning to be distributed in the PR according to the draft reform.

And, at the same time, Russian businesses have strong opportunities to partially compensate PR losses as a result of the reform, thanks to the newly emerging crypto currency opportunities on the market. Such opportunities can be implemented within the framework of a captive pension crypto fund specially created within the framework of the enterprise. Captive pension funds of enterprises are not new; for example, in the US (the so-called IRS-program), the company makes regular deductions in favor of employees for specialized accounts, and then purchases of "long-playing" securities are made from these accounts. Upon dismissal, the employee receives severance pay in the form of a package of liquid securities, which he then disposes of at his own discretion.

In our case, the formation of the pension programs of the enterprise should begin with the rapid compensation of PR of a number of falling revenues. For example, if the enterprise's PR number is 200 people, and 5 to 8 thousand rubles are allocated to compensate for the drop-out income per month (payment of utilities, electricity, medicines, etc.), so the corresponding pre-pension contributions will be from 12 to 19.2 million rubles a year. This is a solid amount that the enterprise has to earn, for example, by the third-party mining crypto currency.

Suppose that an enterprise has installed and operates a crypto farm with an installed capacity of 1 MW, and one crypto currency (for example, ZCash) is running. If, hypothetically (for a calculated example), the mining terms are considered unchanged throughout the year (although, in fact, the laboriousness of mining is increasing steadily), then this farm is able to generate 5,800 coins per year. According to the terms of August 2018, one coin of ZCash costs about $ 150 or about 10 thousand rubles. Accordingly, the gross income from mining is, excluding transaction costs, approximately 58 million rubles a year.

The main variable operating cost is the power consumption for mining. There is no reason to purchase electricity for mining from the external city network, this electricity will cost 5.5 rubles per kW*h and more. It is much more interesting to adapt the source of autonomous power supply for these purposes. For example, when using a 1.2-megawatt Caterpillar (USA) gas propulsion plant, the cost of electricity production is about 2.4 rubles per kW*h. In this case, if the farm works 365 days a year and 24 hours a day, then the electricity costs for its operation will amount to about 21 million rubles a year. And, thus, we have gross margin for the mining project at the level of 58 - 21 = 37 million rubles a year. Assuming that a third of the marginal profit is directed to cover the payments of the PP, and the remaining amount - creates a net cash flow to cover the initial investment costs for the mining project, the simple payback period of the project of the mining center will be 6-7 years, which, according to current economic conditions is too much.

Much more promising is the option when it runs its own crypto currency, issued by an enterprise or an ecosystem formed around the enterprise. Here is a well-known effect of seigniorage. For example, if the cost price of making a 100-dollar bill is about 7 cents, then the rest of the world's covered goods and services for the whole world economy is the seigniorage assigned by the issuer of the reserve (not provided with material values) reserve currency by the US state. Not a bad profit for the US Federal Reserve! As Freken Bok said to her cat in the Russian cartoon about Karlsson: "Matilda! Crooks are shown on the TV! Am I any worse? "(c).

If we repeat this trick and "print" the crypt at the starting low energy intensity, then the company can fill its pension fund with a low-cost crypt, and then place it on the ICO (Initial Coin Offering), or in the Russian law (if by that time the first reading laws on digital assets will be adopted in the final version), or in foreign law, through the foreign representation of the enterprise. For example, according to this scheme, tokens of the Kazan venture fund Pulsar were issued. In both cases, pre-retirement payments will be implemented not by the enterprise itself, but by that part of the financial market that is oriented towards the release and turnover of the crypto currency.

The key success factor for such an ICO is the success of market-making efforts that third-party players undertake to maintain the rational course of the released crypto currency, in accordance with its continuously growing energy intensity. For example, in September 2018, the energy intensity of a ZCash coin is 1500 kWh per coin, or about 4 thousand rubles spending while industrial mining. Once a coin is traded at 10 thousand rubles and has acceptable liquidity, the gross margin of operations is 60%. This is approximately double the traditional marginal profitability for world industrial companies.

And if you mine your own crypto currency at the starting capacity of 35-50 kWh, then marginality will approach the same when you issue a cash 100-dollar bill and make up about 99%.

Naturally, the development of the idea of financing PR by means of crypto-mechanism is also developing in relation to the enterprise as a whole. Employees can open individual pension accounts and charge a crypt there. The amount of accruals, of course, varies depending on the importance of the position of the employee in the company, his current compensation and accumulated experience. When the pre-retirement age is reached, the accumulated deposits for the employee are thawed at a rate of 20% per annum. Thus, the program of retention of perspective employees at the enterprise is developed.

In conclusion of the report, it should be noted that no local measures to improve the financial well-being of PR, which can be undertaken by individual companies, will not replace the strategic efforts of the state, which should be directed to the development of fundamentally new financial technologies. The share of the global capitalization of the Russian corporations is 2% of the world, while Russia is located on 1/6 part of the land of the planet Earth and has the richest resource potential, in terms of explored and unexplored reserves. It suggests the idea that to increase the economic stability of the country should focus on the issue of its own country currency - the Russian cryptoruble. And by the same crypto-payer to pay pensions of PR, covering the falling incomes of the corresponding households. Such an approach would testify to the achievement of the Russian Federation of genuine financial sovereignty.

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JEL E6, E20, F41, F43

PUBLIC INVESTMENT STRATEGY: IMPLEMENTATION OF SYSTEM ASPECTS

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Abstract. The article discusses the reasons for the economic decline in Russia, accruing systemic entropy, threats and risks in the implementation of the investment policy of the state. The author suggests possible avenues of exit from a crisis situation

Keywords: public investment policy, entropy, managing chaos in the economy, systems approach, modernization.

Introduction

The emergence of crises in the economy is associated with insoluble contradictions that have accumulated in the world and national economy, which are philosophical, civilizational and social characteristic. The crisis is almost always associated with the transition from one state of the system to another. In the field of civilization, the changes fall onto soft values, elitogenesis, nationhood; in the field of philosophy the transformation of quantity into quality alterations takes place; the economy is going through the transformation of one formation into another; the society and social medium have the supersession of worldview and axiological (paradigm, family, traditions, ethics) customs, which are pivotal for the perception and everyday life of human beings (culture, education, upbringing, science, demography, healthcare).

Background and hypotheses

Economic studies the problem of ensuring reproduction processes in the economy through the implementation of investment policy and its mechanisms have shown that today there is no single universal mechanism for its effective implementation. It is considered, that the causes of crisis phenomena in the investment sphere lie in the sphere of the cyclical nature of the economy, its administrative, legislative or institutional and economic regulation.

At the same time, characterizing the state of scientific elaboration of the problem of implementing investment policy in the system aspect, it should be considered in line with such scientific areas as the theory of the cyclical nature of the economy (Tugan-Baranovsky M.I., Kondratiev N.D., Kuznets S.S., Keynes J. M.), a systematic approach to the description of processes occurring at the macro and microeconomic level of management (Bogdanov A.A., Kleiner B.G., Polterovich V.) the entropy approach of economic financial and budgetary cycles (Slutsky E.E., Phrigoghin I., Prangishvili I., Rogoff K., Obstfeld M.) approach from the standpoint of economic growth (Bazarov V.A., Domar E., Harrod G., Ramsay F., Neumann J. Von, Rostow W., Glazyev S.Y.)

Discussion

The transformation of social, political and economic relations that can be traced as the dominant sectors of social production change — agricultural, industrial, financial, digital — gives ground for a hypothesis about the formation of entropy (chaos) when moving from one sector to another. The explanation of this process is given on the basis of the expert approaches that have now been established in studying the causes of crises, which may be cyclical, stochastic, or controllable [1, p.134-188], [7, p.15-31]. We distinguish two directions for the occurrence of such crises along the lines. First, the global economic direction is determined, in our opinion, by a combination of factors, among which are the following. The first factor is global competition. This period is characterized by a change in the balance of power in the world economy, the spread of new technologies (information, nano- and biotechnology). The Russian economy, due to its weak strong dependence on fluctuations in the global hydrocarbon and raw material markets, speculative capital markets, low innovation and resource efficiency, was unable to take advantage of global competition, and therefore not able to respond quickly to changes in the external environment.

The second factor is the use of sources of export-raw material type of development based on fuel and raw materials exports and the release of goods for domestic consumption due to the additional loading of production capacities under conditions of an undervalued exchange rate of the ruble. The third factor is connected with the tendencies in the reduction of state activity and the departure of the state from regulatory issues, as well as the creation of quasi-market institutions that demonstrate trends of economic backwardness, but not development. As they say in such cases - the cemetery also grows, but does not develop. It is obvious that the basic geo-investment strategy of the new millennium is the redistribution of world resources and the generation of a new world order in the interests of one or several states, which carries with it a different kind of entropy (elements of chaos). There will never be a fair economic equilibrium here, as confirmed by equilibrium studies in the distribution of resources [2, p.31, 34].

A feature of the modern world culture is the financial sector, which is currently developing autonomously in the third sector, public administration and non-commercial financing, pumping resources, labor, financial and temporary from the industrial and agricultural sectors. For the Russian economy, which operates in conditions of low investment demand, the unfavorable financial and economic condition of the industrial sector, cuts in state financing for the social sector, construction, and the agro-industrial complex of the country, the current systemic tasks are becoming - ensuring the efficient use of public investment, efficient management of equity stakes of the state.

In this regard, there is no way to avoid noticing a number of assumptions and hypotheses, among which one can single out a macroeconomic hypothesis. It is related to performance, savings rate and interest rate. That is, the assumption that a country will more easily transfer a period of entropy (chaos), if it has a high rate of savings and a stock of capital, which will stimulate factor productivity there is a place to be. Under the cumulative factor productivity, we will understand the release for 1 hour of work. An example is post-war Japan, in which the savings rate was higher than in the USA. Productivity growth in Japan’s industrial sector helped strengthen the yen in the postwar period. According to the world institute of companies McKinsey (1993), labor productivity in Japan in the automotive sector was 16% higher than in the corresponding US industry.

In this situation, there is an increase in output due to additional capital, which stimulates other factors at a constant and, accordingly, increases output per hour of operation - this is for the manufacturing (traded sector). In our opinion, and according to scientists, macroeconomic regulation, structural and trade policies affect the transition from one phase of development to another also [2, p.271-283]. High labor productivity is associated with high wages in the industrial sector. Labor potential in Russia is used in reproduction processes with an unprecedentedly low efficiency. This is a strategic problem that requires the priority attention of the state. World experience confirms that public and private capital will not invest money in scientific and technical progress in conditions where low-paid labor can be used. The second direction is system-political character. According to this version, the crisis is caused by the gradual loss of the fundamental properties of the system – adaptability and sustainability. The effect of a loss of adaptability is a breakdown of feedback in decision making. As for the sustainability of management, it is based on a broad public consensus in the choice of goals, ways and means of modernizing society, on adapting to the changing external and internal conditions of the state's development.

The investment process depends on financial and economic stability. One of the manifestations of such is the stability of the national currency. As a whole the stability of the national currency depends on a number of factors, including the policy of the Reserve Funds. An important part of the system of strengthening the currency is financial and credit discipline. The exchange rate, if considered as a source of economic growth, should become a valuable currency for savings and savings. The investment policy is interconnected with the state financial policy. It manifests itself in the system of forms and methods of mobilization of financial resources, their distribution between social groups of the population, sectors of activity and regions of the country, in financial legislation in the structure of revenues and expenditures of the state budget.

Over the course of an effective financial policy, state investments should be made in key sectors of the economy and measures should be taken to attract capital from domestic and foreign private investors, as well as loans from international monetary and financial organizations. It can be argued that the main participants of the investment activity (process) in any country are: the state and economic entities (legal entities and individuals), and each of them can participate in the investment process, both on the demand side and on the supply side investment resources.

The main objectives of state regulation in the field of formation of effective demand on the course of investment development (security) can be as follows:

-reorientation of production to domestic demand and a reduction in the share of imports in its structure;

- maintaining a stable level of social spending, since it is they that largely form massive demand;

-wage reform, which should ensure the growth of its real content, covering the expenses of the population of housing and communal services and the social sphere;

-tax reform, which should play a stimulating role, but not just fiscal;

–go upping savings and per capita incomes.

Findings

The high degree of entropy (chaos) and risk at the state level when making investment decisions on the choice of mechanisms and tools determined the general mainstream of economics based on Western economic theory. Developing and regional powers have been proposed, or rather imposed, "their own economic models and the mao-regulators inherent in them," including the liberal model, which is the essence of the monetary model. The countries implementing these models are Latin America, Central Eastern Europe, have high rates of inflation, unemployment, low per capita incomes, and low economic growth. Such models are based on scientific paradigms in order to more effectively manage the world consciousness of the sattelite states, such as "information economy", "new economy", "economy of happiness"[3].

What is the way out for Russia? The "strategic response of Russia" can be a doctrinal management model based on the following principles:

-holism (integrity) worldview, formed in society;

-The new architecture of cybernetics of public administration, territorial administration, population management.

The theory of chaos is very interesting and has a very wide range of applications: from the “theory of controlled chaos” in the political sphere to the theory of chaos in complex dynamic systems, which include the state economy. In particular, according to I. Prigoghin:“... the accumulation of nonlinearity creates not only chaos, but also the order from the chaos of elementary processes, and in other circumstances leads to the destruction of the same order and ultimately to the emergence of a new coherence another bifurcation "[4].

Other views reflect a kind of existentialism in the approaches to identify and eliminate entropy (chaos) in dynamic systems, to which we can include both the whole state, the economy of a particular country, and the microeconomic system-enterprise (Bogdanov A., Slutsky E.E., Kleiner G. B., Polterovich V. M., Buzgalin A. V., Sulakshin S. S.).

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JEL H21, L86, O32

AUTOMATION OF TAX ADMINISTRATION WITH THE HELP OF THE INTERNET OF THINGS: PROS AND CONS FROM THE POSITIONS OF ECONOMIC EFFECTIVENESS

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Abstract.
The Internet of Things (IoT) offers unprecedented opportunities in the field of automation of tax administration, thanks to which the technical devices of users (individuals and organizations) will independently transfer information to the tax authorities and receive from them relevant information - while the person (both as a user and as an organizer -controller) will be completely eliminated from the tax administration process. However, this raises the problem of ensuring the economic efficiency of automation of tax administration by using the Internet of things. This work is devoted to a thorough study and search for a solution to this problem. The paper carries out qualitative research on the basis of the method of logical analysis (analysis of cause-effect relationships) and the method of modeling socio-economic processes and systems. As a result, the example of modern Russia shows that automation of tax administration on the basis of the Internet of things is a contradictory measure of economic reform leading to various consequences for stakeholders. The state will take advantage of their growth in federal budget revenues at low costs of creating artificial intelligence and its subsequent use (these costs will be comparable to current costs for tax administration). However, entrepreneurial structures and consumers will incur additional costs. This is likely to lead to a decrease in the volume of solvent demand in the economy and a decline in business activity. To avoid this, risk management of the automation of tax administration based on the Internet of things is recommended.

Keywords: automation, tax administration, Internet of things (IoT), economic efficiency.

Introduction

The Internet of Things opens unprecedented opportunities in the spheres of automation of tax administration, due to which technical devices of users (individuals and companies) will independently pass information to tax bodies and receive current information from them – at that, human (as user and as organizer and manager) will be eliminated from the process of tax administration. However, there will arise the problem of provision of economic effectiveness of authomatization of tax administration with the help of the Internet of Things. This work is devoted to comprehensive study of this problem and search for its solution, as well as determination of expedience of authomatization of tax administration with the help of the Internet of Things from the positions of economic effectiveness.

Materials and methods

The essence of the process and necessity for tax administration are emphasized in multiple works of modern scholars, which include (Dale, 2018) and (Olivares, 2018). Opportunities and perspectives of application of the Internet of Things for optimization of economic activities, including state regulation of socio-economic systems, are discussed in (Bures et al., 2019), (Lopez-Castaño et al., 2019), (Kuila et al., 2019), and (Guidi and Ricci, 2019).

The performed content analysis of the existing works showed that the topic of authomatization of tax administration with the help of the Internet of Things has been studied fragmentarily. In previous studies, we determined wide perspectives for optimization of tax administration on the basis of new information and communication technologies (Gashenko et al., 2018) and (Gashenko and Zima, 2017).

However, the Internet of Things is a specific technology that goes beyond the limits of evolutional digitization, as it envisages usage of artificial intelligence. That's why we deem it necessary to study the problem of authomatization of tax administration with the help of the Internet of Things. Because of the absence of statistical data due to the Internet of Things being in the process of development, we perform qualitative research on the basis of the method of logical analysis (analysis of causal connections) and the method of modeling of socio-economic processes and systems.

Results

As a result of studying the process of tax administration on the basis of the Internet of Things, we compiled the following conceptual model (Figure 1).

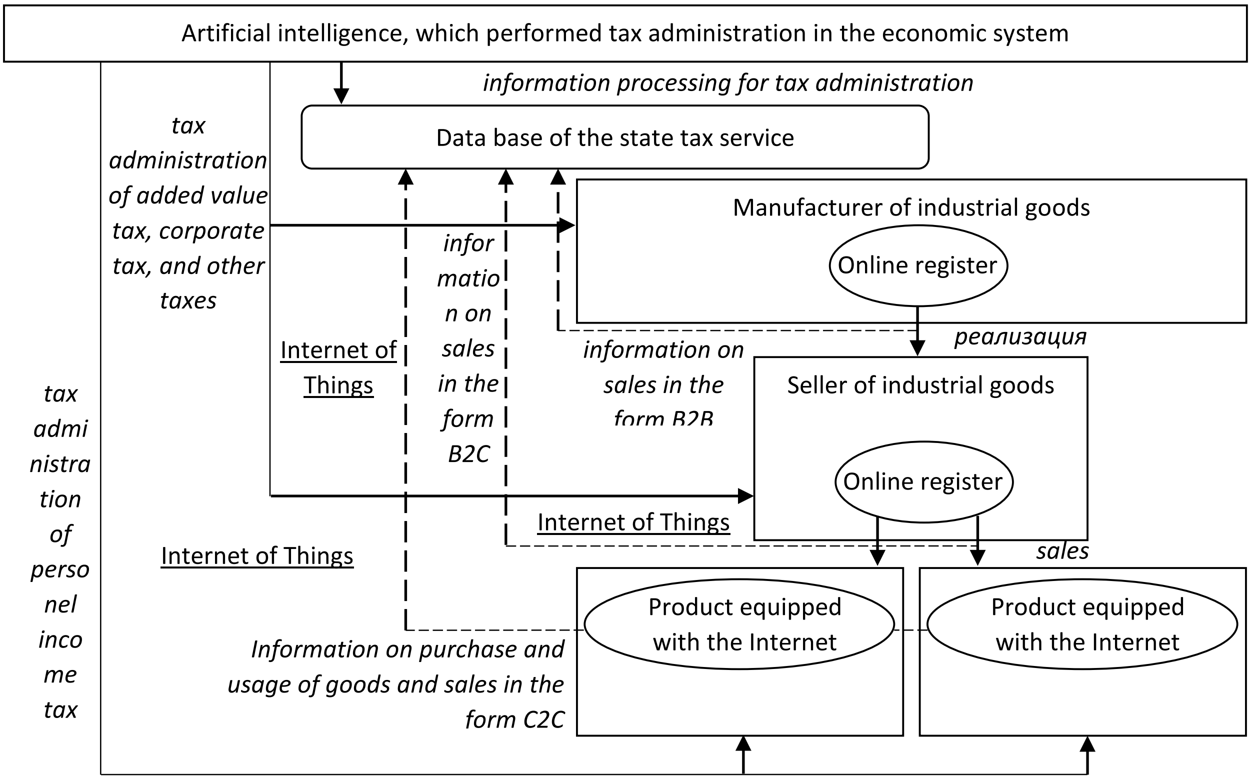

Fig. 1 **The model of automatized tax administration on the basis of the Internet of Things**

Source: compiled by the authors.

Figure 1 shows that artificial intelligences will be able to fully replace human as a subject of tax administration in the long term. At that, information goes to the data base of the federal tax service automatically.

By the example of industrial goods, this process has the following form. Manufacturer of industrial goods sells the goods to another company that is at the next stage of added value chain and performs this economic operation via online register, which, without human participation, transfers information into the data base of the federal tax service via the Internet of Thins on sales in the form B2B.

After that, the seller of industrial goods, when selling the goods to consumers, performs this economic operation via the online register, which, without human participation, transfers information into the data base of the federal tax service via the Internet of Things on sales in the form B2C. Then consumers use the goods that are equipped with the Internet and these goods pass information automatically into the data base of the federal tax service via the Internet of Things on purchase and usages of goods and their sale in the form C2C.

Artificial intelligence, which performs tax administration in the economic system, automatically processes information from the data base of the federal tax service and conducts tax administration of added value tax, corporate tax, and other corporate taxes, as well as tax administration of personal income tax. Due to this, reduction of the volume of shadow economy by 30%, as compared to the 2018 level, will be achieved.

In view of the fact that at present (2018), according to the estimates of specialists of the International Monetary Fund, the volume of shadow economy in Russia constitutes 38.42% of GDP (Medina and Schneider, 2018), positive result from authomatization of tax administration on the basis of the Internet of Things, related to de-shadowization of Russia's economy, will constitute RUB 37.73 trillion (98.2*0.3842). Development of the Internet of Things is conducted in modern Russia as a technology within the Program "Digital economy of the Russian Federation". The volume of financing of this program during the period of its implementation is set at the level of RUB 3.6 trillion (Tadviser, 2018).

Comparison of results and expenditures showed high effectiveness of authomatization of tax administration on the basis of the Internet of Things in modern Russia: 37.73/3.6= 10.48. Therefore, this process is expedient from the positions of economic effectiveness for the state. However, for economic subjects authomatization of tax administration on the basis of the Internet of Things will be related to growth of expenditures. Thus, entrepreneurial structures will bear additional expenditures due to purchase and usage of online registers that are equipped with the Internet of Things, and consumers – due to forced purchase of more expensive industrial goods that have to be equipped with the Internet of Things.

Conclusions

Thus, it is shown by the example of modern Russia that authomatization of tax administration on the basis of the Internet of Things is a contradictory measure of reformation of economy, which leads to various consequences for interested parties. The state will gain advantages from growth of revenues of the federal budget with low expenditures for creation of artificial intelligence and its further usage (these expenditures will be compatible to the current expenditures for tax administration).

However, entrepreneurial structures and consumers will bear additional expenditures. This could probably lead to reduction of effective demand in economy and decrease of business activity. To avoid this, it is necessary to develop and implement the strategy of risk management of the process of authomatization of tax administration on the basis of the Internet of Things. This strategy should be developed in further studies.

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JEL B41

REVERSIBILITY PROBLEM: THE ESSENCE BEING DESIGNED DESIGNS THE DESIGNER OF DIGITAL ECONOMY

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Abstract. Relevance, purposes, tasks. **Global collective "designer" of the Present**, including digital economy – constantly raises degree of artificiality of the habitat. Numerous subjects of various levels of sociocultural community interact not systemically in competitive, collaborative, network way. Business converts the extending front of science into complication of global community. The totality of innovations is uncontrollable, emergent, gains properties of **secondary naturalness**. The "Designer" accustoms to "digital jungle" which continuously becomes more and more complicated in the mode of the **catching-up understanding**. Human being tries to catch up, but can't overcome the lag in principle. The lack of stationarity of the environment bears impresses of historically developing activity of the "Designer". The last can be presented as a result of reconstruction of activity of his virtual opponent – the collective "Subject of History". He exists in his own "lagging behind" time and continuously participates in designing of the "Designer" of the Present by means of an ideological resource. The "shift" is defined by a time interval during which the results of activity of the "Designer" gain quality of secondary naturalness. The relic essence of "the Subject of History" wanders in the structure of sociocultural community from one level to another.
The work purpose – creation of explanatory model of the totality of processes afore-named. It intends for parrying of regressive influence of "the subject of history", in particular the **double bind** (G. Beytson's term) menacing to sustainable development. System approach and the concept of methodology of steady reproduction of cultural unit are used. The result of work is transition from the concept of the active environment to the concept of the wandering relic subjectivity.
Prospects of application: an instrumentalization of the sustainable (directed) development.

Keywords: wandering subjectivity; perceptual space; secondary naturalness; catching-up understanding; cultural unit; steady reproduction; explanatory model; the emergency; double bind

"Le mort saisit le vif"
(French proverb)

Introduction. Relevance, purposes, tasks

From the position of a subject of economic activity the new reality is described by such characteristics as unprecedented and constantly increasing instability of trends and aggression of the environment. Therefore development of adequate models allowing to identify mentioned phenomena and to build optimum or at least acceptable strategy seems to be relevant.

Culturologists announce approach of the era of a postmodern which does not accept "big narratives". But megaprojects of globalization, sustainable development, human rights, digital economy, etc. appear in the mainstream of public consciousness one by one. These megaprojects are attractive from the humanitarian point of view. However there are routine questions of the potential of feasibility of the relevant institutes, their possible stability, consistency, etc. There can be fears that they will appear to be simulacra or something, significantly surpassing expectations of the public.

Today the most important is the research of the phenomenon of digital economy as it is based on spontaneously and promptly developed processes of digitalization of daily occurrence.

In this work we will focus on one of the processes accompanying formation of digital economy – on the return influence of the cultural-civilization community being built on its collective architect (Designer). Some part of this influence can be realized and excluded by the mentioned subject of activity (Collective Architect), but there is a temporal blind zone inaccessible to understanding without application of special receptions which are discussed in the present article.

Methods

First of all it is offered to use the method of pair categories. We shall use pair category natural-artificial. We shall consider (after O.S. Anisimov) that "Natural is a type of being (existence) of something out of an organizing framework of sociocultural and activity type" [1, p. 39]. "Artificial is the content of the ordering thought or the organization the use of which consists in being a source of the ordering statements (means of rationing)" [1, p. 56]. It is important that this pare gives a wide range of possibilities for the description and formation of natural-artificial and artificial-natural entities of the world around, both in a statics, and in dynamics of transformations of these entities on the conditional axis set by the mentioned categories. "Hayek, developing the evolutionary theory of morals, expands the use of category Natural on process of cultural evolution, emphasizing with that its spontaneity and independence of conscious intentions of certain individuals" [2, p. 239]. "Making artificial – process of transformation of "natural" (morphology or organization as morphology) by bringing attributes of "artificial" into it” [1, p. 99].

Global collective "Designer" of digital economy constantly raises degree of artificiality of the environment of his operating and dwelling. We use the term "Designer", but not "Constructor" because the field of "his" activity includes not only technical instruments, but also the sphere of human activity generated by application of these technical instruments. Individual and collective subjects of various levels of sociocultural community constitute this collective "Designer" not systemically. The radical feature of market relations is shown in in these circumstances. They make competitive, collaborative, network interactions in the course of prosecution of their private and group interests. Economists and representatives of other scientific disciplines study the proceeding processes carefully. The space of operational and strategic thinking of human being is limited owing to the physiological reasons, and the front of scientific research and technical development extends constantly. Businessmen convert the extending front of scientific results into the incalculable and escalating number of commercial projects and programs complicating global community – both in technical and social relation. In particular, we develop not only real economy, but also office economics, and in its continuation – digital economics and their various expansions, impact investing for example.

The totality of innovations is so numerous that it became emergent and uncontrollable. Daily exchange reports confirm it. Thus, the above described dynamically increased conglomerate of interactions "becomes natural". Due to the mass updating of situations of the described type we offer, in addition to the dictionary [1], the term **secondary naturalness**.

The world becomes "natural" again. Human should master phenomena unfamiliar for him in many respects as something quite new in spite of the fact that these phenomena were created by him. They are artificial in fact. Human tries to introduce orderliness in it. The result of the process can be characterized as **secondary artificiality**.

One more method that we suggest to use is the concept of a virtual subject. It is widely applied in cybernetics of high orders and in quantum physics. This is conditional figure of the "Observer".

Besides that we suggest to use methodologies of sustainable reproduction of a cultural unit. The term "cultural unit" came from anthropology. The concept "cultural unit" designates any social integrity which has properties of a separate culture. "Steady sets of lines, categories, patterns and subjects which are reproduced from generation to generation in certain ratios, or in cultural configurations are characteristics of a cultural unit" [3, p. 83]. In due course of concretizing the term "social integrity", we will not distinguish it from "cultural-civilization community" [4]. We shall also note relationship of this concept with "a local civilization" in the interpretation of A.J. Toynbee. It means "the closed society which is characterized by means of two main criteria: religion and form of its organization; territorial sign, remoteness degree from that place where this society originally arose" [5].

The reader, of course, noticed that system approach is also widely used in this paper.

Results

So, the collective subject – "Designer" – forms the Present, in particular, digital economy and is at the same time forced to accustom to continuously becoming complicated "digital jungle" in the mode of **catching-up understanding**. We are not focused on the autopoiesis content which is in relevant access of the collective subject as “hi” has no cognitive difficulties with it. We shall focus on the mode of work with the content of the mentioned temporal blind spot.

Deviations from stationarity of the environment bear the impress of historically developing activity of the "Designer". These deviations from stationarity can be presented as a result of reconstruction of the activity of his virtual opponent – collective "Subject of History". "He" exists in "his" own "lagging behind" time and continuously participates in designing of the "Designer of the Present” by means of the ideological resource converted according to requirements and opportunities into other available resources. "The delay shift" is defined by an average period of time during which transformation of results of "Designer" activity into again natural is realized.

During history the power as the basis for distribution of resources repeatedly passes from one social group to another. According to this process the relic, "shadow" essence of "the subject of history" wanders on levels of sociocultural community structure. Therefore we can define this essence as the **wandering subjectivity**.

Lack of stationarity of the emergent environment essentially differs from the processes proceeding in it from so called white noise. These processes contain a print of historically developing activity of the person as a configurator of these processes. The picture of non-stationary processes in the environment can be understood as the result of reconstruction of activity of a virtual collective subject – "the Designer of History". This subject "exists" in "his" own "shifted" time. The shift is defined by the temporary step during which the results of collective activity of human community formed by social and psychological factors becomes secondary natural. This virtual "Designer" "makes efforts on designing of the "Designer of the Present". As the activity of "the virtual Designer" during the different historical periods is defined by different levels of structure of sociocultural community, his subjectivity is wandering. The purpose of this work is creation of explanatory model of the listed processes. In the future this model will help us to develop the measures parrying actions of "the virtual Designer", in particular the double bind messages (term by Beytson [6]) menacing to sustainable development of sociocultural community.

Discussion

So, in the process of forecasts creation we suggest to use the development of the Present along with the concept of the active environment the concept of the wandering relic subjectivity influencing "Designer of the Present", in particular, of "Designer" of digital economy. In the case of searching for analogy in the field of exchange trade, our thesis is similar to the offer to use the fundamental analysis along with technical analysis. Attempts to guess the future changes of the active environment remind methods of the technical analysis of the exchange markets. Adoption of the concept of "Subject of History" allows us to forecast influences to which "Designer of the Present" will be exposed for more extended time periods.

The prospects of use of the received results lie in the area of instrumentalization of the concept of the sustainable development.

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JEL:O16

SMART CONTRACT, AS A LOGICAL STEP IN THE DEVELOPMENT OF THE DIGITAL ECONOMY

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Abstract. The article analyzes the evolution of the traditional centralized contract system into a decentralized system in the transition to a digital economy. As a result of the comparative analysis of these systems, the author outlines the advantages of implementing smart contracts using blocking technology in modern business processes.

Keywords: development of the digital economy, blockchain technology, smart contract.

Smart-contract, supported by crypto currency, is an actual information technology on the service market during the transformation to the digital economy. Smart-contract is a computer code which is integrated into crypto-currency's net powered by blockchain technology. Blockchain allows the participants of transaction to work with decentralized distributed database. It enables to make transactions without intermediary and consequently makes the process cheaper. The difference between smart-contract and blockchain is that every transaction in the system not only fixes the flow of funds, but also has a code, which sets the conditions of the transaction. The code can be edited for the client's purposes, what makes smart-contract applicable almost in all spheres. In other words, smart-contract contains not only information about the date, time and conditions of the transaction, but also executes on its own, that means it provides the execution of deal's obligations independently.

The mandatory features of smart-contract are:

1) digital signature based upon the private keys, which are available to all sides of transaction;

2) The existence of the subject of the agreement and instruments for its execution (e.g. bank or crypto-currency accounts for transfer of funds);

3) Clear execution's conditions of the agreement, which is signed by transaction's participants using digital signature;

4) The existence of decentralized private database, which will help to carry out the transaction.

Consequently, smart-contracts work in the following way: participants make an agreement about the transaction and draw up a contract, then the currency and assets are allocated in the database, participants sign the contract with digital signatures and the program starts monitoring the execution of agreement's conditions. As soon as the conditions were met, the client gets the products and the seller gets the money. At present the implementation of smart-contracts is being tested in different fields of activity.

The division based on automation can be conditionally made into three groups:

On automation, contracts can be conditionally divided into three groups:

1) Partially automated contracts: part of the transaction is fixed on paper carriers, another part of the transaction is automated, for example, only payments are automated;

2) Automated contracts: operations are conducted using a computer, but copies of transactions are additionally recorded on paper;

3) Fully automated: the entire transaction is carried out on the computer.

At the moment partial-automated contracts are the most common, for example, taxi services, where automated electronic payments are supported. A promising option is fully automated smart contracts, but this kind of contracts is only tested. The difficulty lies in the fact that a very large number of participants in transactions must be involved in the program: banks, government bodies, companies, etc. An example of automated smart contracts are popular services for car-sharing: in order to use the services of car-sharing, the user must first enter into an electronic contract with the company that provides the corresponding services, after that the user is provided with a car on the terms agreed in the contract. The entire procedure is carried out electronically, using a mobile application.

Consequently, smart contracts differ from traditional contracts in the speed of the transaction, the absence of intermediaries, cheapness and no need of physical presence of the parties making the transaction. At the present time there is an evolution of the traditional contract system, which is centralized and requires the participation of intermediaries, into a decentralized unmediated system. In our opinion, the most promising sectors for the implementation of smart contracts are international logistics and supply chain management, accounting, financial management and insurance. For example, the scheme for implementing smart contracts in logistics can be presented as follows: the company plans to conclude a transaction for the transportation of goods. For this purpose, the specialized code on one side is tied to the customs base, on the other side to the bank account for which the money for transportation will be received, the system will consider the transaction completed when the cargo is in the possession of the consignee, and the logistics company gets the money for the services provided.

The simultaneous introduction of several information technologies capable of increasing the efficiency of managing international cargo transportation is proposed. The information environment, built on the technologies of blockchain and smart-contracts, which will be available to all participants of the transportation: the sender, the payee, the carrier, the bank, the terminal, the insurance company, controlling bodies, etc. The implementation of the smart-contract technology based on blockchain will create an open database that will allow the logistics company - the client to work without intermediaries. Electronic registration of the trailer, insurance companies, as well as companies involved in the certification of goods will be included. The development of special GPS-sensors that are attached to a transport container provides the company-client with the ability to track the movement of goods in real time, so there is no need for agent compensation. It is provided to logistic intermediaries, informing the company about the stage of the transportation.

As an example, consider the process of international shipping, which can be represented in the traditional contract system in the form of a sequence of 10 steps:

1) The exporter sends a notification to the importer, the notice states that the goods are ready for shipment;

2) The exporter signs an agreement with the owner of the vessel, submitting an application for freight;

3) Upon arrival at the port, the ship's captain notifies the exporter;

4) Next, the exporter starts processing the accompanying documents necessary for transportation;

5) If the order for transportation of cargo is accepted, and the vessel is already in the port, then before the arrival of the cargo in the port it is considered as an idle period;

6) After loading, a copy of the bill of lading is given to the captain of the vessel, he signs it and seals;

7) The exporter is provided with all necessary accompanying documentation;

8) The captain of the vessel gives to the exporter the Manifesto confirming the transfer of the documentation;

9) Upon arrival at the destination, the captain of the ship sends a notification to the importer;

10) Representatives of the importing company arrive at the port to obtain the necessary documentation and the goods to be transported.

Integration of all participants in the chain of custody will help reduce the number of stages of the transportation process, thereby reducing the total time for transportation. Then, the process of international shipping, after the introduction of the smart-contract technology can be described in 5 steps:

1) Using the mobile application, the exporter sends the importer a notification of the readiness of the goods for shipment;

2) Smart-contract automatically enters into an agreement with the owner of the selected vessel and sends an application for freight;

3) The application helps to issue electronic documents for transportation;

4) After registration, the bill of lading is automatically sent to the captain of the ship for the electronic signature;

5) Upon the arrival of the goods at the port, the importer receives a notification, and the transportation fee is automatically transferred to the logistics company.

Thus, the number of steps performed was reduced by 2 times. GPS sensors solved the problem of the ship's idle time, because the application automatically reads out the time for documenting and, in accordance with it, chooses a vessel that will arrive at the port exactly at the time when all the data necessary for transportation will be collected. That is, the client company has information about where the ship is and how long it take it to arrive at the port. Upon arrival at the port, the application automatically sends a notification to the client company. Since the database is distributed, and all participants in the transportation have the same information and the ability to track all procedures in real time, there is no need to notify participants about the stage of the transportation. The application automatically notifies the participants and sends them all the documents necessary for transportation and signing. Integration into the chain of custody of all participants of transportation will help to reduce the number of stages of the transportation process, thereby reducing the total time for transportation.

Therefore, there are several advantages of implementing smart-contracts:

1) Conclusion of deals without intermediaries;

2) Saving money;

3) Saving time;

4) Optimization of business processes of a particular enterprise, due to reduction of paper work;

5) Openness and transparency of transactions;

6) Decentralization of the system and equitable ownership of information;

7) High level of security of transactions;

8) Accuracy - due to automation, the probability of errors related to the human factor is reduced.

Thus, with a massive introduction of smart-contract technology, in conditions of competition, tariffs for freight traffic should significantly decrease, which in turn will have a positive impact on the pricing of many products.

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JEL A13

TRENDS OF SOCIAL AND ECONOMIC DEVELOPMENT IN THE CURRENT PENSION LEGISLATION

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Abstract. In the article the problems related to changes in the pension system in Russia are discussed. The actuality of this topic is determined by the social significance of the problem. The aim of the study is the analysis of the international experience in matters of changes of the pension age and impact of earlier reforms of the Russian pension system. The task is to investigate the necessity to change the pension legislation for which the Pension Fund of Russia must fulfill its obligations against the preferential categories of the population in the long term, as well as to determine the consequences of the changes for the socio-economic development of the country.

In the course of solving this task, was studied the legislation of pension provision in Russia for its conformity with international standards in the field of compulsory pension insurance. Identified the main groups of indicators that have the maximum impact on the quality and standard of living of the population of Russia – macroeconomic, labor market and employment, demographic, income level and wages, the performance indicators of the Pension Fund (especially which show the quality of life of pensioners).

Established that the approaches used in the Russian practice to solve the problems aggravated in the work of the pension system are not always similar to the used tools in similar situations in other countries. This points to the necessity for further research in this area, the development of a monitoring system of budget and other financial indicators that provide a system of pension payments.

Keywords: demography, population, migration, mortality rate, wages, retirement age, replacement rate, living wage of pensioner.

According to many experts the situation emerging in Russia in recent years in the field of pension benefits of citizens cannot help but cause concern and constitute for the revision of the current legislation in this area. This is due to the analysis of indicators characterizing the obligations of the Pension Fund of Russia (PFR) to pensioners, which are considered taking into account the requirements of the Federal law No. 400 of 28.12.2013 "About insurable pensions", the legislation in force at the time of pension assignment, including law of the Russian Federation of 15.05.1991 №1244-1 "About social protection of citizens exposed to radiation as a result of the Chernobyl disaster" and law of the Russian Federation of 19.04.1991 № 1032-1 "About employment in the Russian Federation". Construction of forecasts on indicators of the considered group must be performed on the basis of carrying out the social and economic analysis on the main indicators (and their interrelations) characterizing:

- macroeconomic situation;
- demographic situation on the basis of data from the last population census, taking into account statistical calculations;
- differentiation by income (including wages) by type of economic activity and standard of living of different categories of the population;
- number and sex-age structure of insured persons and pension recipients;
- the situation on the labor market (level of economic activity, employment, duration of periods of work and unemployment for different groups of the population);
- the state of the stock market and the return on investment of pension savings;
- characteristics of policyholders (type of economic activity, legal form and form of ownership, number of employees);

- distribution of the insured persons and pensioners depending on insurance and special (professional) experience, not insurance periods of experience;

- differentiation of the insured persons by the amount of payments and other remunerations on which insurance premiums are accrued;

- revenues and expenditures of the FIU budget for each component;

- accrued and paid for each insured person contributions to insurance and funded pensions;

- accounting of pension rights of insured persons (made by summing the calculated pension capital accumulated before 01.01.2015, converted into individual pension coefficients, and individual pension coefficients accumulated by the insured person after 01.01.2015);

- pension savings of insured persons;

- number and structure of recipients of social benefits;

- the amount of pensions and other payments for each recipient;

- the impact of the movement of funds on the cumulative component on the stock market;

- life expectancy of pensioners.

Demographic characteristics of the Russian population are used both to analyze the current state of the pension system and to assess the forecasts of its development in the short, medium and long term. Demographic indicators are closely related to internal and external migration. Internal migration peaked in the 90s and continued to decline in absolute terms, according to Rosstat. In the international long-term migration to Russia in recent years, the main share is occupied by the CIS member States (Kazakhstan, Tajikistan, Uzbekistan, Moldova, etc.). However, the problem of legalization in the labor market of migrants is very acute, because the number of documents issued for employment (both legal entities and individuals) continues to decline. This means a decrease in the number of legal/illegal migrants and a shortfall in revenues to local budgets.

Information on the number and distribution of migrants by age in one – year age groups is used in the analysis of the dynamics of the working-age population, taking into account gender (there is a feminization of migration flow) - can affect the long-term population forecast, as migration almost completely provides population growth [1].

The decision to raise the age limit in the course of pension reform cannot but affect the main indicator of labor activity of Russians – wages. In a well-functioning economy, the labor market does not allow for a very large pay gap for those employed in mass occupations. However, when the interaction of the labor market and its service systems is unbalanced, there is a sharp differentiation in the levels of wages in various sectors of the economy.

From the analysis of the wage spread in the Russian economy over the past 15 years, it is established that in 2003, wages in the banking sector and insurance were 6.9 times higher than the level of payments in agriculture; in 2010 fuel and energy and the industry for the production of coke and petroleum products, mining-an excess of 4.9 times the wage in relation to textile and clothing production, agriculture and forestry, the production of shoes, leather and leather products.; in 2017, the gap between wages in the oil and gas industry and the leather and leather goods industry grew again to 5.2 times.

The observed wage gap in various sectors of the economy can be explained by the difference in the professional requirements of the employee, his level of training, natural, physical and personal data. In addition, payments may differ by including compensation for working conditions that are associated with risk to life, poor environment or territorial characteristics. The last factor is one of the most important in the analysis of wages at the regional level.

The gap of more than 4 times between the extreme levels of wages in the regions may indicate an economic imbalance associated with a low level of labor productivity, a decrease in the level of labor mobility, the mismatch of the structure of the economy to the needs of society. The sharp differentiation of wages that arises for these reasons is based on age, sex and demographic factors.

According to the sample survey of organizations for October 2015 (Table 1), the ratio of wages of men and women in ten age categories is considered.

Table 1

Average salary of women and men by age groups in 2015 (rubles)

	Group	1	2	3	4	5	6	7	8	9	10
All employees	**Total**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**60-64**	**65 and older**
Women	28021	25044	29108	29672	29969	29399	28468	27196	26273	24864	26256
Men	38605	31595	38909	43591	44962	41680	39346	36906	33773	32269	33891

Source: Women and men of Russia: Stat.sb.// Rosstat. M. – 2016.

The graphical representation of these data (see figure 1) shows that men's wages are higher throughout the period of employment than women's. In addition, the male sex is characterized by the achievement of maximum financial performance in work at the age of 30 to 44 years. In the period from 45 to 64 years, men have seen a serious decline in wages. The abrupt change in the level of men's wages and the almost even corresponding figures for women can be explained by the great problem associated with the high mortality rate of men of working age. According to the calculations of the mortality rate [2] in 2015, this figure in Russian men 35-39 years of age is 7 times higher than in German men, and at the age of 60-64 years-2.5 times higher. The corresponding difference in the mortality rate for women in the groups under consideration is 4.5 and 1.7 times.

The population pyramid constructed for Russia has a reduced form with a large share of the adult and elderly population on the background of a relatively low birth rate and increasing life expectancy. This points to the need for regulatory measures in the labor market that would ensure a decent level of wages to the working population and the preservation of social guarantees for privileged categories.

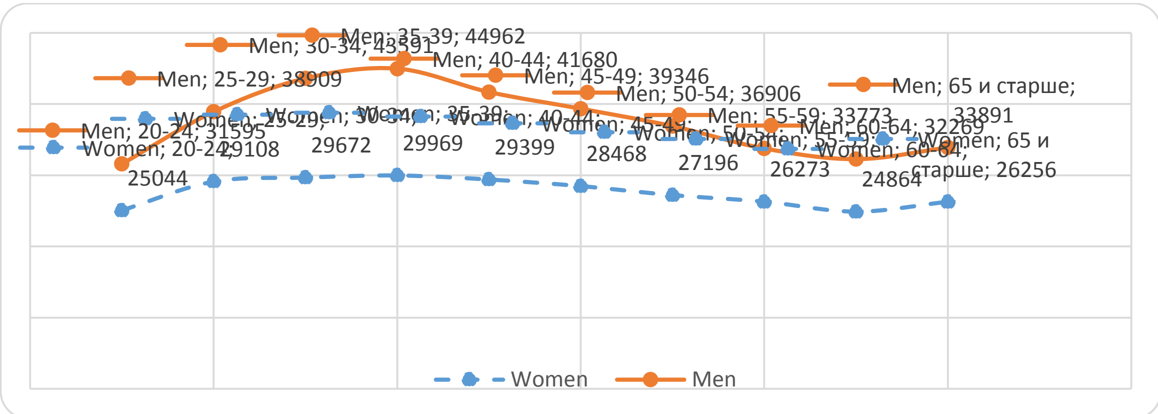

Fig. 1 Average salary by age group

Source: compiled by the author

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JEL P45

PENSION EXPENSES AND BENEFIT PENSION PLANS IN RUSSIA

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Abstract. This paper aims to add to an important discussion on the main objectives of the IAS 19 in order to understand how the companies organize accounting and disclosure for employee benefits in Russia. We also aim to contribute to the discussion on the question of pension plans along with the accounting specifics of pension expenses in Russia. At the same time, Russian pension system has undergone dramatic changes recent years. The situation is complicated by the lack of pension allocation by working people and, moreover, by the decrease in demographic. We analyze the tendencies in Russian pension system through literature review and find that most of the Russian recent research literature is dedicated to the issues of state-level administration of pension expenses rather than to the companies' interests. This appears to affect more menacing on the background of the required International Financial Reporting Standards (IFRS) implementation. The findings should be of interest to the accounting academics, companies and policymakers.

Keywords: Accounting of the Pension Payments, Employee Benefits, History of Pensions, Pension Expenses

Since the paper covers the transition experience of the Russian accounting towards IFRS-based one, we look at the history and approaches to the IFRS implementation in Russia. We find that the specific interest towards the issues of planning and management of pension expenses increased last years from the side of the companies. The actuality of the raised issues in this study is caused partly by the increasing demand for effective pension plans administration, and partly – by the necessity of planning the expenses from the company's side through the logics of the mechanism of decision making support realization.

The issues that are discussed in relation to the management of the pension system are still not examined enough. For example, the issues of planning and managing of the company's pension expenses, etc. By raising these issues we hope that this study will add to a discussion whether the questions of state administrating of the pension payments are playing a predominant role in the research within the scientific, organizational, administrative and regulatory activities.

From the other hand we consider that the preliminary aim of the company is to determine the effectiveness of its business activities and decisions. We find thus that the existing challenges are connected with the peculiarities of balancing state and private interests.

The paper therefore shows the necessity of developing such mechanisms of planning and management of pension expenses that will provide an optimal balance between the interested parties. Some steps for creating such mechanisms are reflected in this paper.

We trace the evolution of the pension expenses system from the time of the insurance deductions theory development authored by W. Petty in his "Treatise on Taxes and Fees" (1662), as well as in the papers by A.Smith and J. Sysmondi (Schumpeter, J. A., 1954).

The literature review shows that European research of the pension payments issues mostly relate to such facts as the widespread concern that the population of working age people are not currently allocate sufficient funds for their pension provision in the future (Paraskevi, Peasnell, 2009). This can be partly explained not only by the imperfection of the formation mechanism for management and planning of such payments, but by the demographic situation as well (Mikhalkina, Pisanka, 2013). This is due to a decrease in the population of working age people, economic activity reduction, and an increase in the number of pensioners as a consequence of the increasing availability and quality of health services (health care reform). The other issue here to be examined - is the migration (the growth of the number of refugees and migrants).

In order to assess the extent of the pension system, we set a system of indicators of an aging population retirement (Table 1).

Among these indicators we excrete:

- the retirement aging index,
- the demographic burden and
- the proportion of the elder people in the total number of people of retirement age.

The methodology suggested can be realized within several iterations:

1 Step - calculating the retirement aging index:

$$\left(P_p \big/ \mathrm{Pch} \right) * 100 \qquad (1)$$

where - is the total population of both sexes, older than the employment age; - is the total population of both sexes under the age of working age (children).

2 Step – understanding the demographic burden on the working population due to the retirement-age population:

$$\left(P_p \big/ \mathrm{P_w} \right) * 100 \qquad (2)$$

where - is the total population of both sexes of working age.

3 Step - the proportion of older people (80+) in the total number of persons of retirement age:

$$\left(P_{80+} \big/ P_p \right) * 100 \qquad (3)$$

where - is the population aged 80+.

We use the suggested methodology to find out the dynamics of structural indicators that quantify the retirement aging population in Russia, as follows.

Table 1

The dynamics of structural indicators that quantify the retirement aging population in Russia

Indicators	2001	2002	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Retirement aging index	107,2	111,6	121,0	124,8	129,2	132,3	133,5	134,3	137,0	137,6	137,2	136,6	136,8	136,5
Demographic burden due to the retirement-age population	34,3	34,2	32,3	32,2	32,6	33,2	33,7	34,7	36,2	37,2	38,4	39,6	41,1	42,7

Source: Authorial computation based on Federal State Statistics Service data [http://www.gks.ru/ (10.02.2017)]

Among others, one of the main functions of the state is the production of public goods. In Russia national issurance, health and educational services, pensions and benefits are afordable due to the state's resources (natural, power, financial) allocated for the implementation of such projects. Thus state provides financial support for such activities in various ways. Therefore, a reasonable budget policy allows the state to perform its functions most fully and efficiently.

There is an assumtion that Russian budget is going through hard times. This is caused partly by existing fall in oil revenues in 2013-

2014. And partly because of the changes in internal and external political situation: while share of defense and security expenses is growing, the share of "closed" expenditure items is growing. Meanwhile, the share of expenses for the social projects is decreasing. Now the state is searching ways to extract additional income and reduce costs (e.g. through possible increase of the income tax by attaching it to the pension contribution rate).

After all, we see the additional purpose of this paper in describing the existing problems of Russian budgetary policy, their nature and the ways to overcome them.

Based on the data from the Table 1 we conclude that there is a tendency of pension aging index increasing in Russia (Table 2). We explain such dynamics through the life expectancy overall increase, from the one hand. And from the other - through the low level of fertility. Socio-economic effects of aging can be also evaluated by the increasing dynamics of the demographic burden on the working population due to the retirement-age population. (see Figure №1).

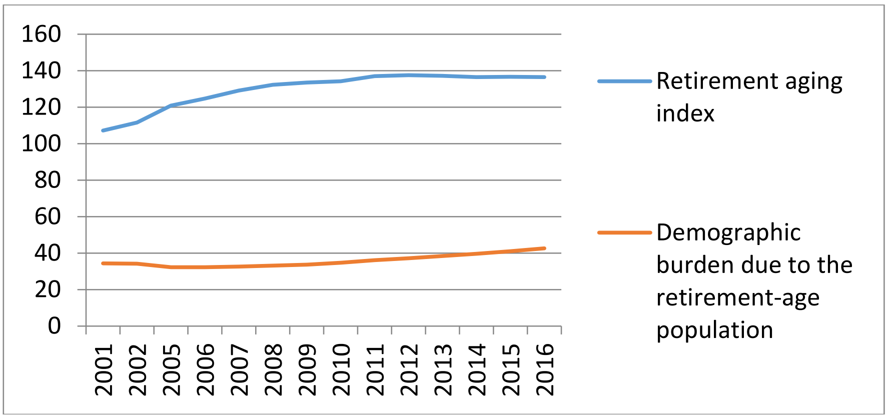

Fig. 1 **Pension aging index through 2001-2016 in Russia**
Source: Authorial computation based on Federal State Statistics Service data [http://www.gks.ru/ (10.02.2017)]

This trend in the field of demography and migration is quite typical for Europe as well. In addition, the transition to a fixed payment form (including UK), calculated on the amount of wages paid, was complicated by the new regulatory requirements and demographic changes that significantly increased the cost of such schemes (Paraskevi, Peasnell, 2009).

We consider the main IAS 19 requirement that the entity should recognize “a liability when an employee has provided service in exchange for employee benefits to be paid in the future; and an expense when the entity consumes the economic benefit arising from service provided by an employee in exchange for employee benefits” (IAS 19).

A separate group of problems include questions of the pension expenses which are indicated in the financial statements. International Financial Reporting Standards (IFRS) in the early editions (SFAS 87, 1985; IAS 19, 1983) oriented mostly on the disclosure of costs and financial assets information reflection (Napier, 2009). However, these accounting standards that allow companies to ignore wash out or segregate insurance contributions figures are constantly criticized and gradually disappear (ib.).

Besides, accounting and pension expenses administration issues are caused also by the “influence of accounting reporting on management decisions by the enterprises, government, trade unions, investors and creditors” (Zeff, 1978).

In Sandu M. paper (2012) the issue of the employees in the performance of their pension expectations, and companies' interests balance is investigated. There is a concern about the influence of the produced charges on net income, cash flows, as well as the overall stability of the companies. Normally accounting standards (IFRS 19, SFAS 158) assume two types of pension payments: deductions plans with a fixed payment of pension (DB) plans, and deductions from wages, including extra-budgetary funds, without a guaranteed payout (DC). Selected contributions scheme will be in their own way affect the ways of their accounting and reflecting in the reports.

Russian legislation provides a unified system of insurance funds formation: by deductions of payments from the payroll and payout amount at retirement is calculated based on accumulated points, formed on the basis of deductions made for each employee.

Thus the main role of insurance contributions is to promote the implementation of social support and protection for citizens by the state. The main problems existing in pension contributions of today's Russian system are considered to be: increasing burden on budget because of medical and social expenses rising for elder people (Samaruha, 2013); aging of the people; and besides, deterioration of the numerical ratio of workers and pensioners.

In order to provide readers with the full possible understanding of the areas of research in the field of insurance contributions in Russia, we analyzed the principle publications issued through the period 2012-2017. We define the area of the research objectives and measure their relevance to each.

We find that 34 research publications were dedicated to the pension and social payments issues (Appendix 1, Table 1). The overall analysis gives us a notion on the most widespread area of existing research in the field of social and pension insurance. It was found that most popular fields of research were state and funds interests (19 points from 30) and population (18 points from 30). However the issues of the companies' interests and their role in the system of insurance coverage remain unrevealed (10 points from 30).

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CONTENTS

SYSTEM ANALYSIS IN ECONOMICS – 2018:
PROCEEDINGS OF THE V INTERNATIONAL RESEARCH CONFERENCE–BIENNALE
(21–23 NOVEMBER 2018)

Published by
Prometheus publishing house
51-1, Arbat str.
119002 Moscow, Russia
Phone: + 7 495 730 70 69
E-mail: info@prometey.su

ISBN 978-5-907100-59-6
9 785907 100596