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STATE – REGION – BRANCH – ENTERPRISE: SYSTEM SUSTAINABILITY FRAMEWORK OF THE RUSSIAN ECONOMY¹

This paper investigates sustainability factors of the Russian economy as a multi-level, multi-entity and multi-aspect socio-economic system from the system perspective. The economic system sustainability concept is formulated as an ability to maintain preconditions for the development by supporting and effective using of economic system structure. The leading role of the community of economic entities at different levels (including the state as the entity of international relations, regions as the entities of Federation, enterprises as the business entities) in the economic sustainability is demonstrated. The necessity of the economic entity network “extension” by strengthening the sustainability of economic sectors is emphasized. The research into the internal basic system structure of an economic entity and external structure of its immediate surroundings in socio-economic, administrative-and-managerial and market environments using the results of the new economic systems theory contributes the evidence of the similarity of these structures to the conclusion. It is shown that each of the systems includes (together with an entity itself) four systems of different types (object, environment, process and project). The entity’s system environment has the same structure in administrative-and-managerial interlevel interactions. This makes it possible to combine the problem of the entity’s sustainability and the issue of the balanced system structures forming the economic entities’ internal and external environments. The method of calculating the index of such balanced systems is given. Recommendations on the selection of economic policy measures aimed at ensuring system sustainability of the Russian economy in the period of crisis are provided. It is shown that such a policy should be carried out in accordance with the principles of economic entity protection; balanced system of the economic entities’ internal and external environment; economic entities’ corporate solidarity regardless of their level in the management hierarchy.

Keywords: economic system sustainability, economic entity, entity’s system structure, system structure of entity’s environment, balanced system complex, new economic systems theory

Introduction

The country’s economy is known to be a complex multi-entity, multidimensional, multi-level and multi-aspect system. Sustainable functioning and development of this system are provided by a number of structural balances between the system components (elements, subsystems, etc.). Such balances traditionally comprise intercountry balances (export – import); interbranch balances; inter-regional balances; company’s balances; demand/supply balances, etc. All listed types of balances reflect those that aspect of proportion of economic systems/subsystems, related to a common hierarchical economic level: mega-, macro-, meso- or micro-level. However, interlevel balance is only one of the necessary conditions for sustainable functioning of the economy. Neither the current status, nor strategic prospects for such a complex system like the economy, could be clearly identified through the analysis of the conditions related to one level of the economy. As the world crisis of 2008-2010 demonstrated, the economic objects at any levels may not be sustainable without the support for the related systems and most importantly, the underlying and upper-level systems. The policy of “quantitative easing” actively carried out in the USA in recent years has become an important part of the measures to overcome the recession in the country. In Russia, the government’s crisis bailout plans include a wide range of activities on state support for regional budgets and easing enterprises’ debt burden. However, in the economic theory there is no commonly accepted and sufficiently universal model of functioning of the economy as a multi-level and multi-entity system (there are some visible advances in this direction, for example, the application of agent-based computer simulation and stochastic production frontier model) [1, 2].

In macroeconomic approaches the attention is focused on the relationship between “state and enterprises”; the spatial meso-economics focus moves to “state – region” bundle; microeconomics

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investigates, mainly, relationships between enterprises, as well as between enterprises and markets. The problem of building an integrated theory for the description of the functioning of a multi-level and multi-entity economy is becoming ever more relevant.

However, it is necessary to increase the level of abstract descriptions, to identify common features of economic objects at different levels and types of their interactions as compared with orthodox macro-, meso- and micro-economic theory. The most relevant basis for such a theory seems to be the concept of a system economy [3], based on J. Kornai's system paradigm [4, 5]. Consideration of different-level economic entities as systems makes it possible to apply categories of the general systems theory [6-8] along with the principles of spatial economy [9] and economic dynamics [10]. The experience in application of a systemic approach to the analysis of quality management of the region's development is described in [11].

The term of system sustainability of the economy is far from clear and can be understood in different ways. The paper examines the system structure of the economy as a sustainability factor of the latter. In (12) there has been introduced the concept of system resource economy as the core of current economic systems in the economy, i.e., the systems which integrate production factors and implement production, distribution, exchange and consumption. The present paper considers the system resource as the main economic sustainability factor. A particular attention is paid to the issue of the balanced basic system complexes built inside and around the economic objects, as well as the necessary conditions for the economic sustainability as a whole.

The application of a system approach in the economic research has a relatively long and diverse history accompanied by ups and downs [13]. The immanent contradiction arising in the development of a system approach is associated with the high level of abstraction concluded in the concept "system" and a high level of specificity that arises when trying to apply the system theory to solve real economic issues. It goes without saying that the system is the only abstract concept in the economic theory. The concepts such as region, enterprise, product, promotion, price, etc., are very abstract and combine completely different objects. However, they are easily "attached" to the particular level of economic analysis and management, which justifies the existence of such disciplines as regional economics, the theory of branch markets, the corporate theory, etc. This paper attempts to apply the general concept of the system to specific economic objects at different levels. It should be emphasized that the search for optimal relations between abstraction and special actions in the economic theory and methodology is a very complicated and difficult task [14].

Creating a system theory of inter-level interactions is particularly relevant in the current situation while searching for economic policy options and is able to suspend the development of the crisis in the country. The application of a system methodology appears to make it possible to solve this problem. The article supported by Russian Research Foundation grant, project No. 14-18-02294, develops a system economic theory in terms of the specific hierarchical level structure of the economic entities, while reflecting the general system characteristics of the economic entities' internal structure and external environment. We show that vertical axis "state-region-enterprise" (or "bunch" of such axes, permeating the entire economic environment) should be considered as a framework to ensure system sustainability of the economy. Accordingly, economic recovery is associated with rebuilding cooperation between the economic entities at the same or different levels of the hierarchy. Building up such relations requires the balanced internal structures and external environment of the economic entity both in the functional and administrative spaces. It is shown that breaking up the monopoly is necessary not only in functional but also administrative and inter-level relations between economic entities.

The main ideas of the economic system sustainability concept offered in the paper can be summarized as follows:

1. The community of the economic entities at all levels forms "a core entity" of the economy whose sustainability determines on the one hand, controllability of the economy and on the other hand, its ability to resist to external fluctuations.

2. Each economic entity represents the economic system endowed with the universal basic structure from four different types of subsystems. The balanced structure is a necessary condition of entity's sustainability (an internal factor). The external factors of entity's sustainability are linked to the issues of balancing the entity's external system environment in functional and administrative spaces.

3. As the system structure of the entity's external environment is similar to their internal system structure, the issue of sustainable economic entity framework combines with the research into the balanced standard complex of four different types of systems.

4. An anti-recessionary policy has to be aimed at providing the system-balanced economy both in horizontal and in vertical sections. The analysis of the balanced economic entities internal structure and external environment and option classification of imbalanced ones can be carried out with use of the balance index calculated depending on closeness of relations between the components of these systems.

1. Economic structure as a multi-level and multi-entity system. Entity structure of the economy

Nowadays the structure and composition of natural hierarchical levels of the economy as systems is a debating point [15-17]. The more or less common thing is "a ladder" consisting of five main levels whose names are usually formed by adding Greek roots to the word "economy" reflecting the size of the objects that are situated at this level:

- megaeconomics (global, or world, economy)
- macroeconomics (national economy)
- mesoeconomics (economy of regions and branches)
- microeconomics (economy of businesses, organizations and households)
- nanoeconomics (economy of individuals)

It should be noted that three of the above listed levels are net economic: the macro-, meso- and microeconomic levels. This is related to the fact that the megaeconomic level is under powerful influence of political forces and factors, and nanoeconomic level is under the influence of social factors.

In many cases mega-, macro-, meso-, micro- and nanoeconomy are considered as rather isolated parts (subsystems) of the economy, the economy being an association of these levels. When studying these components of the economy, the applied methodological approaches differ [18, 19].

Each of the five levels is characterized by the presence of typical socio-economic object of the research: for megaeconomic level such an object is the world economy; for macroeconomic level – the state (country); for mesoeconomic level – a region or branch; for microeconomic level – an enterprise or household; for nanoeconomic level – an individual. It should be noted that in a modern system of socio-economic institutions each of these objects is not only a relatively isolated economic object, but also an economic entity that is able to make their own decisions, has a set of rights and is responsible to others.

Thus, there is a four-step "ladder" of entities: (the world economy is not under consideration in this work):

- state – the entity of international relations
- region – the entity of the Russian Federation
- branch – the entity of the economy
- enterprise – the business entity
- individual – the entity of the society.

These objects are represented in a hierarchical structure in Figure 1.

It should be noted, however, that nowadays in the Russian Federation branch entity, as opposed to regional one, has not been fully implemented. In our opinion, this situation is a serious obstacle to the economic development, has provoked uneven technological development of branches and enterprises, creates the conditions for imbalance of interbranch exchange and undermines the system balanced economy and its integrity. This is particularly noticeable when trying to arrange import substitution. From our point of view, it is necessary to reorganize the structure of production management towards equal representation of the interests of branches in management of the national economy. Business associations, whose number in recent years has reached four hundred, fail to solve the problem of coordination of activities and modernization of branches. Nowadays the legislative branch at a higher country's level is represented by two chambers of the Federal Assembly of the Russian Federation: the State Duma and the Council of the Federation. The State Duma represents the interests of the individuals, i.e., nano-level entities. The Council of the Federation represents the interests of the regions, i.e., meso-level entities. As to economic micro-level entities (enterprises) and meso-level entities (branches), their interests are not represented in the bodies of legislative branch. Such a slant,

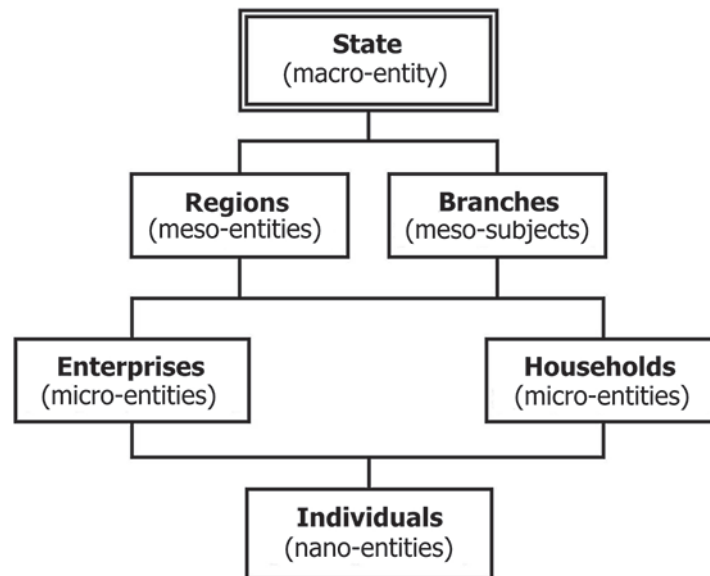


Fig. 1. Major economic entities

perhaps, has become one of the reasons for apparent dominance political directives over interests of the economic development.

In the light of the above, we reckon that it is necessary to revise the structure of the bodies of legislative branch. In other words, the membership of the Federal Assembly representing the interests of the country's population, and the Council of the Federation representing regional entities should include two parallel Chambers of Commerce, representing the interests of the branches as mesoeconomic entities and interests of enterprises as business entities in the legislative branch. It goes without saying that this structure should not be symmetrical, and the rights of the "economic chambers" (the chamber of industries and the chamber of enterprises) should not be similar to those of "social" and "regional" chambers. This structure appears to contribute the synthesis of social and economic welfare in the country's life whose achievement is vital for the society.

By and large the structure of economic entities represented in Figure 1, should be reflected in the structure of the national economic management, which implies that functioning of the bodies of economic macroregulation and monitoring, regional and branch regulation, as well as regulation and monitoring of economic entities and households activities (financial and economic performance, individuals' incomes and spendings) is carried out within the framework of social surveys and regulation).

2. Entity protection principle

The general structure of economic (more precisely, socio-economic) entities types is "a firm part" of the economy and should be supported and protected under any conditions. The specific structure of the entities at each level (list of entities of Federation, business entities, individuals, etc.) can vary. However, during the downturn of the national economy, the sustainability of entity structure should be imposed tougher requirements than in periods of economic growth. It is a question of protecting the majority of operating entities and their vertical and horizontal relationships. For example, the need for protection of such entities as the state as a whole, entities of Federation and individuals is out of the question. Since an individual's life-sustaining activity depends on the employers (for working-age people and health status) and household welfare, one should strive to protect the number of economic entities and households and strengthen family relations. The structure sustainability and encouragement for nano-level entities living are viable only when sustaining meso-level entity structure and strengthening (on the recession) inter-level relationships. Therefore, inter-regional and interbranch migration of economic and family entities in this period is regarded as undesirable thing. In particular, in our view, to invest in the increasing mobility of the population does not make sense. All in all, the principle of entity protection should be applied to such entities as the state, regions, enterprises, households and individuals.

Optimization principles (in this case – relating to the entity structure and location) in the period of crisis should give place to principles of sustainability.

The entity protection is closely linked to their sustainable interaction. The closer and bigger relationships integrating this entity with others, the greater the likelihood of its protection in the period of crisis. In these circumstances cooperation as a stabilization factor plays a more important role than competition as a modernization factor.

This is really not the case for the sustainability of the economic branch structure. The regional structure of the Russian economy needs not just in stabilization, but also in the “extension” providing the transformation of the economy into self-developing integral system. In the last two decades, the branch structure of the economy has had some gaps traditionally filled with imports. This situation undermines the economic sovereignty of the country. Therefore, in the light of the necessity of import substitution, the principle of sustainable inter-level relations in the branch area should be supplemented and adjusted with import substitution principles.

The relations shown in Figure 1 constitute the administrative structure of the economic system sustainability framework. There are functional interactions between the entity and its immediate environments around the framework. Thus, the sustainability of entities’ structure and the range of entities relations with their immediate functional and administrative environments determine the sustainability of the entire framework as a whole.

3. The basic entity system structure and pyramidal structure of the economy

The system sustainability of an economy, as it was shown above, is ensured through sustainability of the economic entity core. In their turn, prerequisites for such a sustainability are as follows: a) the balanced internal basic structure of each of the entities (the state as a macro-entity, the region as a meso-entity, the enterprises as micro-entity and an individual as a nano-entity), b) the entity’s system-balanced and most meaningful relations with the participants of its immediate environments.

In this chapter, we will look at an entity’s universal basic internal structure, and in chapter 4 – an entity’s external environment structure. We will start with the entity at the top hierarchical level, i.e., the country (the state) as a whole.

According to [20], the country’s basic (fundamental) system structure is represented by four subsystems: the state as a political organisation governing all aspects of the country’s socio-economic development; society as the country’s structured population by using various public organisations; the economy as the sphere of production, consumption, distribution and exchange; business as a system of capital accumulation and investment in various projects aimed at profit making. The most important interaction between the country’s four subsystems is on the periphery of quadrangle “state – society – economy – business”.

Next, the region as a meso-level entity can also be represented in the form of a similar structure configuration consisting of four subsystems. It is within a framework of the region that we highlight: regional authorities; regional community; regional economy; regional business. The main interaction between the subsystems is also carried out on the periphery of quadrangle “authorities – community – economy – business” [21].

Turning to the level of enterprises, as a micro-entity, we can also fix as a basic system structure the four-element configuration consisting of subsystems: enterprise management (management plus owners); social sphere – enterprise’s employees; economic sphere of the enterprise – the sphere of production and economic processes in the enterprise; business as the sphere of the investment projects aimed at profit making.

Attributes of such an internal system structure can be seen in relation to this indivisible system as an individual (nano-entity). In fact, for structuring such a system, there is no need to “saw” an individual into components. These components can be fixed, while observing various sides and aspects of the functioning of an individual. On the one hand, he/she is identified as an entity, on the other hand, as a citizen, then as a participant of production processes, consumption, distribution and exchange, finally, as an investor and a pioneer of business projects.

We can see that the internal system structure of the objects at different levels has common features. Chapter 5 will discuss their particular features in more detail and provide the general structure of entities’ internal environment.

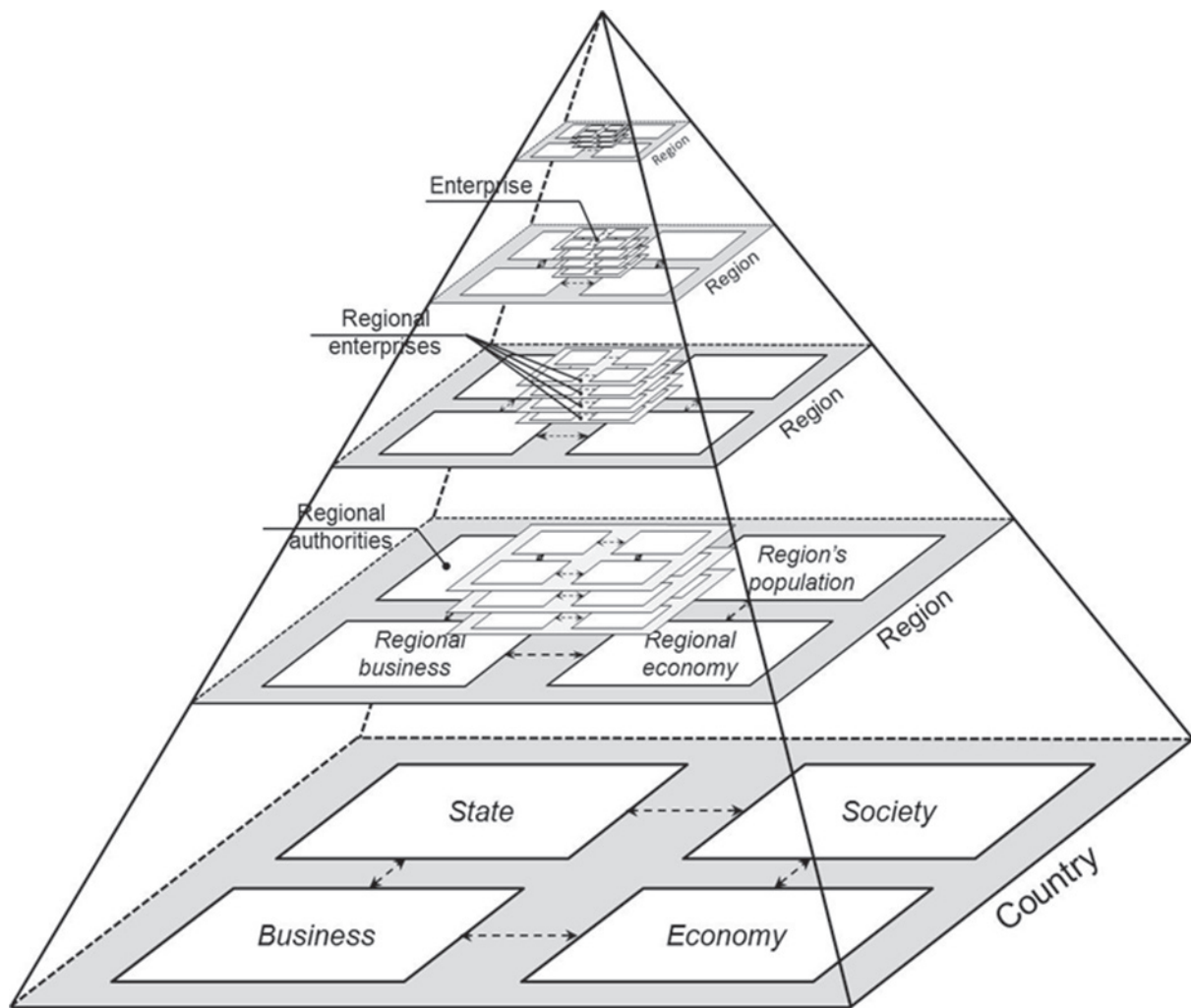


Fig. 2. Pyramid of economic entities (structure sector, 3-D surface)

Homogeneity of the internal system structure at different level and accordingly, different-scale entities and existence of the natural hierarchy “country – region – enterprise – individual” suggest that it should be possible to introduce an economy as a multi-level and multi-system in the form of a distinctive set of shelves which correspond to different-level entities. The most suitable external form for an image of such a framework is a rectangular pyramid whose base corresponds to the country as a whole, and horizontal sections are regions in descending order of the territory.

Figure 2 shows macro-level, meso-level (regional section) and micro-level (in the form of a range of enterprises located in the region) (see Fig. 2).

Figure 2 shows only three levels out of five: macro-level, meso-level (in regional section) and micro-level (in business entities section). Mega-level and nano-level are not represented in Figure 2.

Homotheticity of the entity internal basic structure make it possible to assume the existence of four separate vertical systems whose projection on the entity level shapes the entity basic structure. These vertical systems might be called as “authority”; “general public”; “economy”, “entrepreneurship”. In our country the “vertical power structure” is widely enough represented by bodies carrying out legislative, executive and administrative activities; such organizations as Russian Union of Industrialists and Entrepreneurs (RUIE), “Delovaya Rossiya” (Business Russia), etc. represent entrepreneurship; Public Chamber, Federation of Independent Trade Unions to some extent can be considered institutions representing general public; economic structures have not had any appropriate institutional forms yet, except for Chamber of Commerce and Industry RF (CCI RF). In the meantime, there are significant sustainability reserves of both the entity core and the entire economy behind it. With the appropriate directives of the country’s leadership, these systems could provide meaningful support for economic entities and inter-entity relations of all types. In fact, these directives are given on the basis of the required balance of macro-entity internal structure in the form of a configuration “state – society – economy – business”.

The pyramidal graphic model of the economy represented in Figure 2 as well as the hierarchical graphic model in Figure 1 should not suggest the idea of strengthening the hierarchical relations between the entities. Alternatively, in the modern world it is essential to restructure the relations between different-level entities aimed at strengthening partnership. The reconstruction should be based on the principles of solidarity, equality, balance of rights and responsibilities of all economic entities regardless of their size, organizational forms, functions and location, duration of life cycle. The problem of building such relations is complicated by the fact that interaction between the entities is not direct, but through communication, institutional, infrastructure, and other environments and processes.

4. Universal characteristics and properties of socio-economic systems

The community of entities represented in Figure 1 can be considered as a peculiar entity framework of national economy with regard to their vertical relations. The economy is far from being satisfied by its entity structure (functional, process, design and other types of economic structures fall outside of it). However, it is of paramount importance in the analysis of economic sustainability, especially in the period of crisis.

However, each of the entities that in aggregate constitutes the entity sector of the economy (Fig. 1) is a self-sufficient socio-economic system. i.e, the subsystem of the economy in the space of the economy of a similar level and, at the same time serves as a core element in the configuration of inter-level interactions. The concept of system sustainability of an economy implies a sustainable functioning of each of these systems. Whereas, it makes sense, provided that there is a balanced basic internal structure of each of these systems and external environment structure.

All in all, the system sustainability of the national economy is understood to be that sort of its condition when the sustainability of its entities is provided by relative stability of basic internal structures and entity external environment. Given this interpretation, the system sustainability means protection of entity structure in combination with harmonizing the entity “system environments”.

Let's clarify the concept of a system, which we use in this paper and look at universal characteristics of socio-economic systems.

The system is defined as an isolated and relatively sustainable (in terms of “public observer”) part of the economic space-time continuum characterized by external integrity and internal diversity.

This definition should not be viewed as formal, however, in a content-related context, it states such important features of the economic systems as their relationship with the reality and, at the same time, with its perception (unity of ontology and epistemics); the possibility of separating this system from a wide variety of others (identifiability); a minimum sustainability which makes it possible to observe the system within a vast period of time (observability); the ability to self-reproduction (integrity); the ability to change the internal condition (diversity). The proposed definition complements the classic understanding of the system as a set of interrelated elements [6]. The classic definition focuses on structural, internal aspects of the system, while the proposed one focuses on external, functional and dislocation aspects. Thus, the combination of the two definitions of the system makes it possible to use an integrated approach to system studies combining internal and external descriptions of the systems. This, in particular, allows to consider each of the economic entities as single research positions, and as a system interacting with external and internal subsystems by certain rules, including other similar entities.

Traditionally the system is considered economic if it is involved in the processes of production, consumption, distribution and exchange of goods and this view is backed by society (the “public observer” particularly). The number of economic systems include not only economic entities — enterprises, organisations, households, branches, regions, etc.), but also institutions (including enforcement tool), infrastructure, investment projects, transactions, logistical processes, business processes, etc.

According to the new economic systems theory [22], the basic functional properties of socio-economic systems are defined by their morphological characteristics that include: the presence of certain boundaries in space (spatial localization) and/or in time (temporal localization). Depending on these attributes the systems are divided into four groups:

1) the systems for which spatial and temporal boundaries are not clearly defined (environment-type system, for example, socio-economic institutions; business climate; infrastructure; type code of such a type of systems — A);

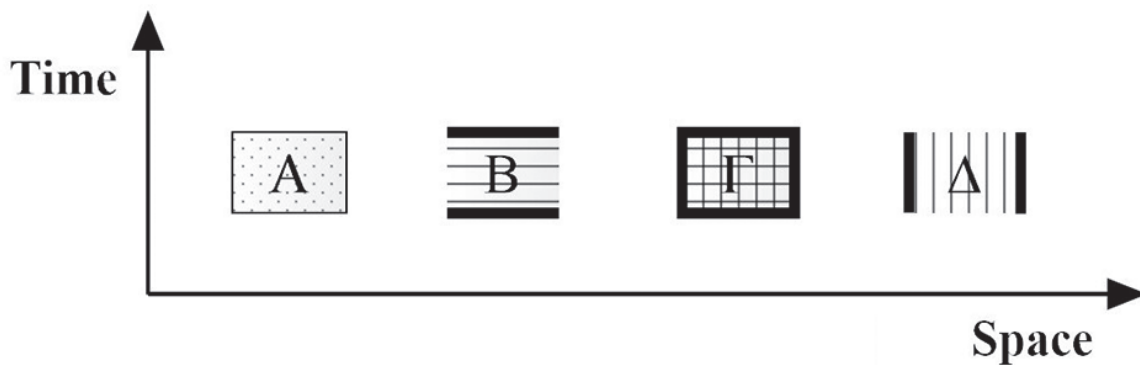


Fig. 3. Symbolic image environment-, process-, project- and object-type systems with regard for the availability of spatial and/or temporal boundaries

2) the systems for which temporal boundaries are defined, but spatial boundaries are not defined (process-type system, for example, logistical processes; diffusion of innovations; knowledge transfer; type code – B);

3) the systems for which both temporal and spatial boundaries are defined (project-type system, for example: construction of the building, development of a new type of the product; type code – Γ);

4) the systems for which spatial boundaries are defined, but temporal boundaries are not defined (object-type system; for example, country; region – the entity of Federation; enterprise; type code – Δ) (see Fig. 3).

Note that the image of systems in the form of rectangles of the same size in Figure 3 is given in conditional manner and does not reflect the proportions of their scope in a spatio-temporal continuum). In reality, each socio-economic system combines the features of all four types of systems, but a dominant can normally be selected.

5. Basic structural groups of socio-economic systems

As we have seen in Chapter 3, four interrelated subsystems make up an entity's basic system structure as the system regardless of the level. Nevertheless, for entities at different levels these structures have similar contents ("authority", "people", "production", "reproduction"). Internal factors of the entity sustainability depend on coordination of actions and the balance of the "power" of these forces.

External factors of each entity sustainability are, first of all, linked to the sustainability of their immediate environments. The question of the existence of the universal structures, forming such an environment, is not a priori clear. The question raised as to whether the diversity of systems, interacting with the entity, provides relatively sustainable structural system complexes which determine "strategic economic zone", is far from clear. However, the results of the new economic systems theory are known to imply that there is a relatively sustainable complex (cluster) around each any long acting in the economy object-type system. Apart from the object itself the cluster includes an environment-type system, representing a market and the environment, a process-type system implementing processes of sharing results and resources of the system with the external environment, and a project-type system, which provides support and development of reproduction activities of the object system.

As a result, we can see that both internal and external factors related to the sustainability of the entity functioning is determined by certain features of specific complex systems of four systems. This sort of complex, as shown in [23], emerges in multi-component systems, and is of fundamental importance for the successful functioning of the systems. These system complexes consist of four different types of systems: object, environment, process and project. The most important interactions for the functioning of such system complexes are implemented in the form of a ring-shaped structure "object – environment – process – project – object". Such a complex is referred to as a tetrad and is shown in Figure 4.

A tetrad is a minimum complex system, which is capable of implementing a complete cycle reproduction.

It should be noted that all types of economic systems, shown in Figure 1, apply to object-type systems.

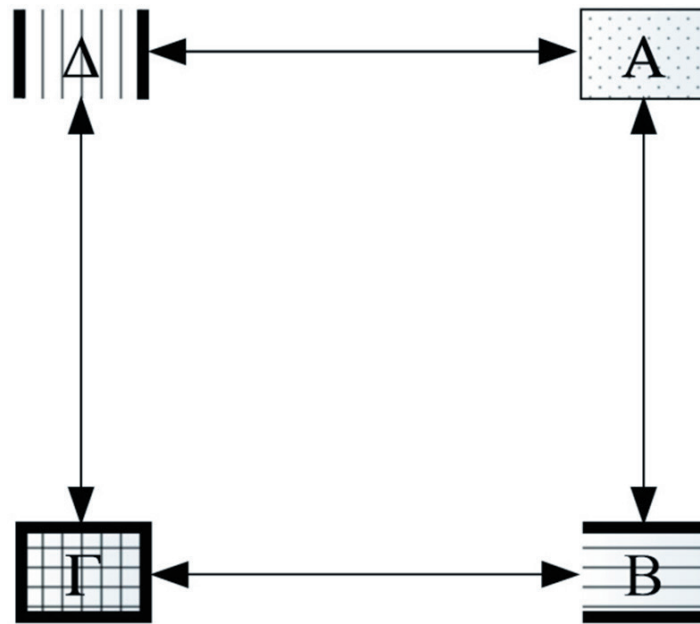


Fig. 4. Typical structure of tetrad

Furthermore, the functioning of each economic entity is deployed in the two main spaces: administrative (vertical) and functional or market (horizontal). The issue of the market space structure and, accordingly, the sustainable relationships of various types of systems in the market space has been studied within the framework of the system economic theory [22]. It has been shown that, in the process of functioning, the economic systems are grouped into functional complexes of four different types of systems.

Based on the data on the presence of recurring structural fragments, i.e., the tetrads, in the functional space of the economy and given the common properties of systems, it can be assumed that, and an administrative space is also structured in such a manner. In other words, the tetrad interaction of systems should be inherent to the administrative space of the functioning of economic entities.

This means that each entity is a member of at least two tetrads – administrative and functional. Let's briefly examine their structure.

Apart from the entity, an administrative tetrad includes three systems: the environment-type system, performing the role of the administrative environment; the process-type system implementing administrative and management processes; project-type system, within which institutional projects are carried out. Interaction between these systems relates to administrative and managerial decisions and accounts. The functional tetrad apart from the entity includes: environment-type system performing the role of infrastructure for traffic of goods created by entities; the process-type system implementing logistic processes within this infrastructure; the project-type system responsible for the development and implementation of production and reproduction projects. Interaction between the subsystems reflects the movement of produced, exchanged and consumed goods within this complex.

Thus, the basis of entity's external environment structure comprises two tetrads, whose point of intersection is this entity (see Fig. 5).

In Figure 5 the right-hand tetrad is an inter-level entity environment, the left hand tetrad being its inter-level relations. The tetrad balance shows the existence of the harmonious system development: proportion of diversity processes and unification, variability and sustainability, homogeneity and heterogeneity in spatial and temporal system parameters.

With respect to the region and its relationship with the federal center, this is as follows. The region is immersed in the environment "center – region", in the framework of which there are inter-balance processes, administrative and other influences and impacts. The regional political and socio-economic projects initiated by the center or requiring, to a greater or lesser extent, support or approval by the center, are implemented within the framework of subsystem external environment of the region. Disproportionality (hyperfunctions or dysfunctions) in the development of some of these three subsystems will inevitably leads to the distortion of the "center – region" relationships and violate sustainability of vertical structure pyramid.

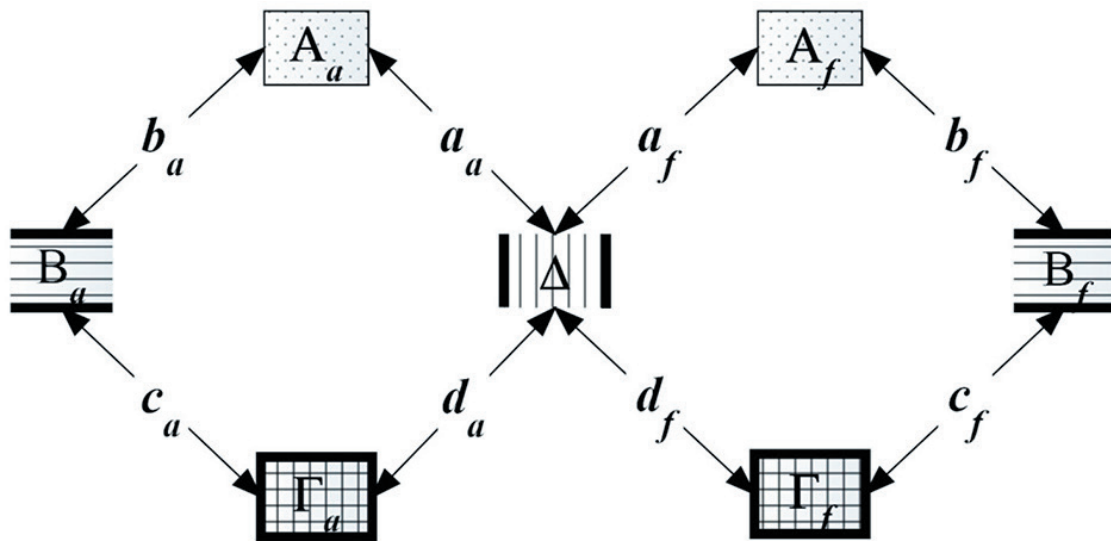


Fig. 5. Entity's external system environment (Δ)

With respect to the enterprise as a business entity, an administrative environment is defined as a system of relationships between the enterprise and the region or the federal center (depending on the size, importance of the enterprise and other factors) (environment-type system A_a); a set of interaction processes between enterprises with regional and/or federal authorities (process-type system B_a); lots of organizational and management projects initiated or supported by regional or federal authorities (project-type system Γ_a). Accordingly, exponent a_a is defined as a “document flow” between the entity and the external environment; (i.e., all forms of the managerial and administrative documents, both electronic or paper, and verbal). Exponent b_a describes an administrative environment (density, penetration, transparency, etc.) generated as a result of the process system requirements, as well as restrictions on administrative processes dictated by the environment. Exponent c_a describes intensity of “information traffic”, which provides development and implementation of the administrative–and–managerial stimulus. Finally, exponent d_a shows the frequency of appearance and size of administrative projects (initiatives, innovations, etc.) addressed to an entity within the framework of the administrative environment.

Similarly, the immediate environment of the state (i.e., the political environment of the state functioning, political inter-country and international processes and projects rather than the administrative environment) can be structured.

In general, the meanings of exponents a_a, b_a, c_a, d_a of the entity administrative environment structure and those of exponents a_f, b_f, c_f, d_f of the entity functional environment structure are similar. The first one indicates the closeness and intensity of goods turnover between the entity and environment; the second one shows a mutual turnover of services between environment and process subsystems by ensuring administrative or functional processes and the maintenance of the environment functioning; the third exponent describes the effect of these processes on the development of projects; and the fourth one is the number of changes in entity's structure and activities under the influence of administrative or functional innovations.

The relationships between entities at different levels, such as the state, the region, the enterprise, the branch (while ensuring its entity), are not built directly but through environment, process and project systems set the appropriate administrative or functional tetrad. The harmonious relations are defined by the balance of components of the relevant tetrad complexes.

Thus, system support for the entities' sustainable functioning is based on structural features of three types of a tetrad: the inter-entity basic system structure; the entity's immediate functional and immediate administrative environment. The key condition for such support is the system balance of each of the tetrad.

The issue of the system sustainability of the economy in the context of interaction between the state, the region and the enterprise, then, comes down to the problem of the balanced system structure of each of these entities and the balanced system structure of inter-entity interaction “state – region”, “region – enterprise”.

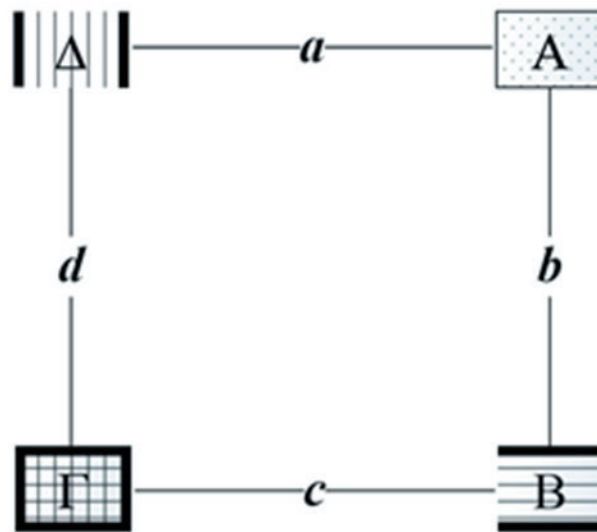


Fig. 6. *Balanced tetrad* ($a \approx b \approx c \approx d$)

6. Analysis method of balanced system tetrad

In this chapter, we briefly set forth the main principles and the estimation method of the balanced system tetrad. This is the first time the issue of the balanced tetrad have been empirically investigated (evidence from educational institutions) in (24).

The generic structure of the tetrad is represented in Figure 6, and includes the systems of different types interrelated by “ring” interaction scheme. Exponents a, b, c, d show the intensity of interaction between the systems, i.e., integrated relations between members of the tetrad: a is the intensity of relations between object and environment systems, b — between environment and process; c — between process and the project; d — between project and object systems.

The balance of such a configuration, in the general case, depends on the relation between exponents a, b, c, d . The tetrad is considered a balanced one if these exponents are approximately equal: $a \approx b \approx c \approx d$. Symbolizing of such a situation is a square (Fig. 6).

It should be stressed that the closeness of relationships between the systems rather than the

Table

Options for imbalanced structure of economic system branches

Configuration	The number of close relations	The number of weak relations	The relationship between exponents of relations closeness	Symbolically-rendered geometric representation of configuration
1	1	3	$a, b, d \gg c$	«Wedge» («triangle»)
2	2	2	$a, b \gg c, d$	«Wedge» («triangle»)
3	3	1	$a, c \gg b, d$	«Column» («rectangle»)
4	4	0	$d \gg a, b, c$	«Rank» («one-dimensional simplex»)
5	0	4	$a \approx b \approx c \approx d$	«Square neck» («square»)

size of subsystems A, B, Γ, Δ is of much importance for the balanced tetrad. In general, the options for the functional system configuration can be heuristically classified as follows. If one conditionally divides inter-system relationships into two classes: “close” and “weak”, there will be 5 options of the configuration (see Table).

Thus, there are four symbolically-rendered geometric subsystem configurations of a tetrad: “wedge”, “column”, “rank” and “square neck”. The last structure may only be recognized as a balanced one, because the other options for those or other subsystems are partially or completely disconnected from inter-system traffic of goods and eventually must lose the possibility of reproduction and, respectively, their potential capacity. Figures 7–9 show the options for the system configuration referred to in the table.

A balanced configuration option, “square neck” is shown in Figure 6.

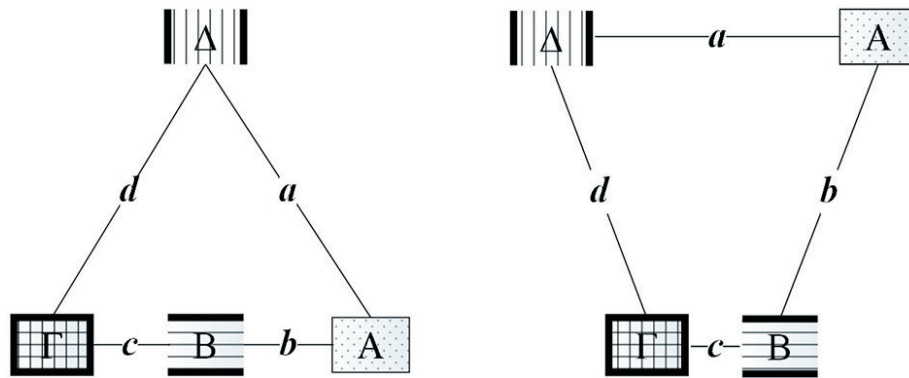


Fig. 7. Imbalanced tetrad configuration: option «wedge»

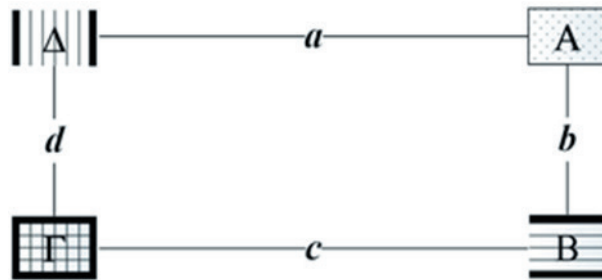


Fig. 8. Imbalanced tetrad configuration: option «column»

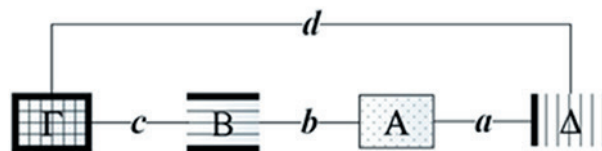


Fig. 9. Imbalanced tetrad configuration: option «rank»

In this situation there is the task of building the index of balanced/imbalanced economy quantitatively reflecting disparities in the development of four tetrad subsystems. The task is to construct a function $I = f(a, b, c, d)$ meeting the following conditions.

1. $I = f(a, b, c, d)$ is a function of minimal exponential type of homogeneity.
2. $0 < f(a, b, c, d) \leq 1$.
3. $I = f(a, a, a, a) = 1$ for any $a > 0$.
4. Function $f(a, b, c, d)$ is symmetrical, i.e., the value do not change whatever a shift of argument.
5. $f(a, b, c, d) \rightarrow 0$ at which $a \rightarrow \infty$ (b, c, d are fixed), and the same way for each argument.

An answer to the question is a function

$$I = \frac{1}{\left(\frac{a}{b} + \frac{b}{a} + \frac{a}{c} + \frac{c}{a} + \frac{a}{d} + \frac{d}{a} + \frac{b}{c} + \frac{c}{b} + \frac{b}{d} + \frac{d}{b} + \frac{c}{d} + \frac{d}{c} - 11 \right)}$$

Conclusion

This paper’s research into conceptualization, modeling and analysis of the system sustainability concept give grounds for a number of conclusions with regard to sustainability factors and feasible directions and measures of the economic policy ensuring the sustainability of an economy as a multi-level system.

1. The key to the sustainable functioning of the economy is a hierarchical structure of socio-economic entities that are relatively isolated, independent and responsible to the society economic different-level institutions ranging from macro- to nano-economic ones. The economic policy should be aimed at encouraging the operation of all economic entities. In particular, it is essential that the legislative branch at all levels of governance should represent the economic entities’ interests. The principle of the highest possible protection of entity framework of an economy should serve as a basis for the country’s socio-economic policy in the period of crisis. Creation of a complete framework for

sustainable development of the economy needs measures aimed to strengthening entity's branch structure of the economy. This requires restructuring the management and regulation systems of the economy, first of all, at the federal level. The principle of entity protection dictates the need for abandoning the widely practiced entity's "optimization", restricting or suspending the processes of staff redundancies at enterprises and impeding bankruptcy procedures and liquidation of economic entities.

2. Amid the crisis one should seek to establish a system equal partnership relations between entities, both located at the same level (for example, economic entities) and belonging to different-level entity hierarchy (for example, region — enterprise, state — individual, etc.). The idea of the inter-entity competition as the sole driving force of economic development should give place to a system vision of factors of economic sustainable development, among which competition and cooperation and their various combinations play an important role. Survival of individual entity amid the crisis is possible only in terms of close collaboration with other entities of different levels. In this sphere a monopoly abuse using administrative leverage leads to extremely negative results, corruption and decline in efficiency of the economy as a whole.

3. Consideration of the duality of economic entities i.e., each entity belonging to the functional and administrative structure, leads to advisability of extending the Federal anti-monopoly service prerogatives. Now its activities are mainly associated with overcoming an individual entity monopoly in the functional (market) area. It would be reasonable if Federal Antimonopoly Service (FAS) and administrative environment tackled a similar problem. In this area abuse of monopoly power and the use of administrative resource leads to extremely negative results, corruption and reduce efficiency of the economy as a whole.

4. A prerequisite for the sustainable functioning of each entity is a balance of its internal system structure. The function of such a structure for entities of all levels is performed by the four-subsystem complex of object, environment, process and project types, reflecting, respectively, the importance of organizational and managerial, social, techno-economic and business factors. An imbalance of this complex, a disparity of its constituents in the mid-term leads to the discontinuation of entity's activities. It is also necessary to ensure the alignment of group interests representing the listed factors in the entities' system structure and, accordingly, action consolidation of the relevant subsystems. This is of particular importance for processes involved in consolidating interests of major parties' production for domestic enterprises, where inequalities of the parties' power result in system deformations.

5. An analysis of the balanced system complex forming an entity's immediate environment may be carried out by using a methodology for assessing the intensity of interaction between the subsystems of this complex. Calculation of the balance index and classification of imbalanced types make it possible to develop the economic policy measures aimed at overcoming the imbalanced economic system structure and improving sustainability. The analysis of the balance of internal basic system structure and external environment for regional entities is of particular importance. The regional entities situated between macro- and micro-levels can carry out a stabilizing function by dampening negative downward and upward impulses. An analysis of the balanced internal and external systems at the regional level should be included in the number of standard procedures of both regional and branch socio-economic monitoring.

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