INSTITUTIONAL MODEL OF SELF-ORGANIZING ECONOMIC SYSTEM

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It is known that self-organizing systems are highly adaptive and can survive even in conditions of extreme instability. The national economies, markets and enterprises are trying to achieve sustainability and adaptability. Therefore, the task was to develop a structural-functional model of self-organizing economic system. The task is solved on the basis of the system approach, in particular the Synergetics and Cybernetics, General System Theory and Theory of Homeostasis, as well as Institutionalism, theories of Schumpeter and Tugan-Baranovsky. The developed model is being tested and used in practice in Russia for the project Electronic commodity market system.

Keywords: institutions; interaction of economic subjects; self-organizing system; electronic commodity market system.

Коды классификатора JEL: B52, L81.

1. Introduction

All economic systems, including national economies, markets and enterprises, are trying to achieve sustainability and adaptability. How can it be achieved in a context of increasing complexity and instability of the economic environment? It is possible due to the structure and functions of the economic system.

In economic cybernetics the model of adaptive control system is used. The adaptation process is carried out by the inclusion of two levels of negative feedback in
But the adaptive control system is not self-organizing. Why? - In the adaptive control system the regulatory body controls all operations of the executive mechanisms. The actions of each executive mechanism are pre-planned and strictly governed. In case of increasing fluctuations and in the extremely unstable state the elements (executive mechanisms) can’t organize themselves and transform the system, they don’t have such a “right”.

In Synergetics the general patterns of the self-organization, development of the system are considered (Haken 1988; 1993; Prigogine 1984; 1997). But in Synergetics, unlike Cybernetics, the mechanism of the system functioning is not considered.

Therefore the task was to develop the model of economic self-organizing system based on Cybernetics and Synergetics, moreover to use the Cybernetics in the part where it does not contradict the Synergetics to provide a mechanism for self-organization. Also General System Theory (Bertalanffy 1976) and Theory of Homeostasis (Cannon 1932; Gorsky 1990) are used.

Since it is economic model, then to create it the economic theory is used, in particular Institutionalism (Coase 1937; North 1990), Schumpeter’s theory (Schumpeter 1946; 1963), theory of Tugan-Baranovsky (1922).

2. Model of self-organizing economic system

Figure 1 shows the structural-functional model of self-organizing economic system (Fomina and Fomin 2008).

![Figure 1. The structural-functional model of self-organizing economic system](image-url)

The elements are economic subjects (individuals, entrepreneurs, and companies) engaged in economic interaction according to the rules.

Current rules are the institutions that govern the current interaction of economic
The direct connections (or object) are the current interaction of economic subjects, the exchange. To provide self-organization the direct connections are carried out on the basis of the principle of competition. Direct connections also can have cooperative or conflict character.

Operational negative feedback obeys current rules and compensates deviations of the system on the basis of incoming information. Its function is support of the processes and structure of economic interaction, using the principle of control of the rules execution by economic subjects.

Positive feedback it is a process of influence of previously unrecorded external and internal fluctuations, which lead to an increase in the number of new fluctuations (deviations) in the system such as an autocatalytic reaction, which create a threat of the system destruction.

The first level of positive feedback it is a flow of deviations, which can’t be recorded or corrected by operational negative feedback. Feature of these deviations is that they lead to destabilization of the economic system. Such deviations lead to the need of adaptation. The action principle it is conflict.

If operational negative feedback can’t cope with the growth of fluctuations, the system proceeds to a higher level of negative feedback; the strategic negative feedback is used.

Strategic rules are the institutions of the economic system in general, the institutions of the adaptation, i.e. the rules of changing the current rules.

The function of strategic negative feedback it is the adaptation of institutions and structure of the economic system to the changing conditions of the external and internal environment, by changing the current rules, current institutions. In self-organizing system the strategic negative feedback is based on the principle of cooperation. It means the inclusion of the economic subjects in the process of making new rules, in the process of adaptation.

The second level of positive feedback it is a flow of deviations, which can’t be recorded or corrected by strategic negative feedback. The action principle is conflict. The aim of the 2nd level of positive feedback is the destruction of strategic and current rules of the system.

The second level of positive feedback leads to the activation of self-organization processes of economic subjects by means of emergence and implementation of dissipative structures.

Dissipative structure it is the prototype of the new system within the acting system, arising from the positive and negative feedback. Dissipative structures are created by economic subjects that generate the new rules of interaction and adaptation. The formation of dissipative structures it is a process of self-organization; it is the synthesis of innovations in the economy.

Between dissipative structures (innovations) and the old system the fight for the elements (for market) may arise. If as a result of competition the choice in favor of a
certain dissipative structure is carried out, then the bifurcation point occurs – the point of no return the system to the previous structure and principles of the organization.

The mechanisms of emergence and implementation of the dissipative structure correspond to the mechanisms of negative and positive feedbacks (see Figure 1). On the one hand, the dissipative structure acts as a negative feedback by changing the strategic and current rules of the system and fulfilling the function of the system development. On the other hand, the dissipative structure acts as a positive feedback that completely reorganizes or destroys the system.

The dissipative structure is a temporary structure. After the transformation the dissipative structure disappears and new methodology as if dissolves in the system.

Table 1 shows the classification of subsystems of direct connections, negative and positive feedbacks of self-organizing system.

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Function (why?)</th>
<th>Principle of interaction (how?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Direct relations</td>
<td>Exchange</td>
<td>Competition</td>
</tr>
<tr>
<td>2. Operational negative feedback</td>
<td>Support</td>
<td>Control</td>
</tr>
<tr>
<td>3. First level of positive feedback</td>
<td>Destabilization</td>
<td>Conflict</td>
</tr>
<tr>
<td>4. Strategic negative feedback</td>
<td>Adaptation</td>
<td>Cooperation</td>
</tr>
<tr>
<td>5. Second level of positive feedback</td>
<td>Destruction</td>
<td>Conflict</td>
</tr>
<tr>
<td>6. Dissipative structure</td>
<td>Destruction and development through self-organization.</td>
<td>Competition, Control, Cooperation and Conflict</td>
</tr>
</tbody>
</table>

This model describes the processes of functioning, adaptation and development of self-organizing economic system as evolution of its institutions in changing internal and external environment.

3. Electronic commodity market system

The model of self-organizing economic system is being tested and used in practice in Russia for the following projects: Electronic commodity market system “System of electronic sales”, Electronic external legally significant document circulation system, System of efficient accommodation management (for homeowner associations).

In this paper we are considering the project Electronic commodity market system “System of electronic sales”.

The main objective of the project is to reduce costs of market transactions, without displacing of the market relations.

Electronic commodity market system is developed primarily for agricultural markets, in particular, for the markets of cereals and cereal products. This is due to the specialization of the Omsk region. For example, in the Omsk region annually is produced about 4 million tons of grain, is consumed less than 2 million tons.

But during development it became clear that it is necessary to create not only a
regional trading system for food market, but the Electronic commodity market system for the Russian Federation, than then for the international market.

The reasons are following:
- Food is often exported outside the region, where it is produced.
- Farmer or grain producer wants to sell the grain as well as to buy some industrial and agricultural goods (petrol, diesel, spare parts, agricultural machinery, seeds, fertilizers, etc.)
- In addition to the buyer and seller in transactions are involved banks, warehouses, freight forwarders, carriers, insurance companies, etc.

Project “System of Electronic Sales” is a development of the automated control system (ACS) as well as organizational and legal structure of the Electronic commodity market system.

Automated control system of commodity market

Automated control system is developed on the basis of the formalized description of relations, elements and processes of the automation object (commodity market).

Elements of the automated control system of the commodity market are buyer, seller, and so-called functional elements: bank, warehouse, freight forwarder, carrier, insurer, etc.

Commodity market relations are the market transactions. The market transaction is described by its parameters: goods, form of trade, level of trade, input and output. Specific description of goods, form of trade, level of trade and territory should be incorporated into the relevant classifications.

Thus, in the Electronic commodity market system the following principle for constructing segments of the commodity market is defined (see Table 2).

<table>
<thead>
<tr>
<th>Commodity market segment</th>
<th>Goods (group of goods)</th>
<th>Soft Red Winter, grade 3, bio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade form</td>
<td>Trading (Forward)</td>
<td></td>
</tr>
<tr>
<td>Trade level</td>
<td>Interregional (Omsk region, Altai region)</td>
<td></td>
</tr>
</tbody>
</table>

Each segment corresponds to certain current formalized rules of economic exchange. Within the segment the homogeneous market transactions are being implemented. Formalized rules of the segment describe not only the structure of the market relation, but also its implementation.

The process of implementation (execution algorithm) of market relations in the ACS of the commodity market it is a sequence of economic procedures, providing a full cycle of trade in electronic form. In the Electronic commodity market system the algorithm of market transactions implementation is fully automated – from organization of interaction to conclusion of transaction and control of its implementation.

The preliminary results showed that the technology the Electronic commodity
The market system is universal for Russia and for any other country, and for international relations.

**Organizational-Legal Infrastructure of the Electronic commodity market system**

For Electronic commodity market system have been developed organizational-legal infrastructure based on the model of self-organizing economic system.

Figure 2 shows the organizational and legal infrastructure of Electronic commodity market system.

![Organizational and legal infrastructure of Electronic commodity market system](image)

**Figure 2. Organizational and legal infrastructure of Electronic commodity market system**

In accordance with Russian legislation, members of the commodity market can establish a consumer society for creation, management and development of the Electronic commodity market system on conditions that one shareholder has one vote. In the consumer society can be involved simultaneously government, business and people. Shareholders are engaged in investing of the development and later in management of the Electronic commodity market system and receive dividends (cooperative payment).

Automated Control System (ACS) of the commodity market is owned by shareholders; strategic rules are governed by and developed on a parity basis.

Consumer society develops rules and automated control system of the commodity market. The consumer society organizes operational negative feedback – establishes or connects organizations that act as support structure (Support centers, Certification Authorities and Settlement centers).

At the consumer society the board of designers is created. In the board of designers there are shareholders, developers and active system users. Function of the board of
designers is the registration of deviations in the work of the system, both internal and external fluctuations, which can’t be compensated by support structure in the operational negative feedback.

The results of the board of designers are the basis for the strategic negative feedback (for the consumer society). Consumer Society organizes the work of the strategic negative feedback and adapts the system.

R&D Department investigates the deviations in the work of the whole system, internal and external fluctuations, and develops projects of radical transformation of the system, its subsystems or external environments.

R&D Department creates conditions for formation of dissipative structures and their distribution based on the principles of competition, control, conflict and cooperation that provide the development and self-organization of the system.

Thus, the direct relations (market transactions - current functioning of the system) in the Electronic commodity market system are carried out on the basis of the principles of competition of market subjects. Operational negative feedback (support of the current structure) is based on the principles of control of the Support structure. Strategic negative feedback (adaptation to changing external and internal conditions by changing the rules) is carried out on the basis of cooperative principles of market subjects.

Network organizational and legal structure of Electronic commodity market system is created as a network of consumer societies and their unions.

In the presence of transnational organizational and legal structure above described technology of the Electronic system of the commodity market will be transnational. Because it will not be important what country the user is from. The transactions concluded in the system will have legal significance.

In Kazakhstan, Belarus, Ukraine, France, Austria, Germany, England, Spain, there are the similar laws on cooperatives, as in Russia.

For example Russian Consumer society can exercise the same functions as the Austrian cooperative with limited liability of its members (GenossenschaftmitbeschränkterHaftungshärführerMitglieder).

That allows to make preliminary conclusions about the possibility of the System implementation in the CIS (Commonwealth of Independent States) and the EU.

**The trust to Electronic commodity market system**

Using of information technology is associated with the issue of electronic trust (e-trust). E-trust consists of opportunities Electronic commodity market system to provide a range of indicators, in particular:

- Independence of the organizational legal structure, software, products of certification and data encryption from the narrow circle of private owners or the State, since Electronic commodity market system is built on the principles of consumer cooperation.
- Presence of technology, eliminating opportunistic behavior of the users of the
system and providing risk minimization to lose the funds in electronic transactions. In Electronic commodity market system not only the buyer and seller are involved in the transactions, but also banks, warehouses, freight forwarders and insurers. Also the system contains statistics of previous transactions; mechanism of funds reservation for the transaction is used.

- Prevent of unauthorized viewing and distribution of content information that is sent, stored and processed.

Network of Consumer Societies should provide the minimum cost of access to the Electronic commodity market system.

Electronic commodity market system primarily focused on small and medium business, which is increasingly supplanted by monopolies off the market. Electronic commodity market system should support the competitiveness of small and medium enterprises, allowing consumers to choose quality goods based on its actual composition and origin.

Influence of Electronic commodity market system on the transaction costs

First of all the Electronic commodity market system will have an impact on the costs of external legally significant document circulation (contracts, invoices, waybills, etc.). Table 3 shows the comparative analysis of the costs of paper-based document circulation (the average for Russia) and electronic documents circulation.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Paper-based document circulation</th>
<th>Electronic document circulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs of printing</td>
<td>35 rubles (average).</td>
<td>10 rubles.</td>
</tr>
<tr>
<td></td>
<td>The cost of paint, paper,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>depreciation of the office</td>
<td></td>
</tr>
<tr>
<td></td>
<td>equipment.</td>
<td></td>
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<tr>
<td>The cost of the envelope and delivery expenses</td>
<td>30 rubles (average).</td>
<td>5 rubles (maximum).</td>
</tr>
<tr>
<td></td>
<td>This is the price of e-document</td>
<td></td>
</tr>
<tr>
<td></td>
<td>delivery in Electronic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>commodity market system.</td>
<td></td>
</tr>
<tr>
<td>Time of delivery</td>
<td>1 - 10 days for Russia.</td>
<td>3 - 5 minutes.</td>
</tr>
</tbody>
</table>

The table does not include the cost of salaries of employees, including lawyers, secretaries, etc. Since these costs are almost not reduced.

Thus, the using of e-document circulation in the Electronic commodity market system will reduce the costs of document circulation of economic agents in average of 3.5 times, accelerate the process of document circulation. That also has an impact on the reduction of transaction costs. This is confirmed by the practice of using electronic document circulation between firms and banks (the Internet bank).

Implementation of the Electronic commodity market system and the execution
of the complete cycle of trade in electronic format will reduce transaction costs, such as the costs of market positioning, market research and advertising; partner search, negotiation and representation expenses; travel expenses, control of trade execution.

On the other hand, expenditure on staff salaries (marketing managers, lawyers, economists, etc.), expenditure on public relations are not reduced. Also the speed of the transaction will increase in the Electronic commodity market system.

According to our calculations, the use of the Electronic commodity market system will reduce the transaction costs of small and medium-sized enterprises of the Omsk region on 3 - 12%, an average of 6% (before income tax expenditures).

The price of services of Electronic commodity market system will not exceed 2% of the transaction. The system acts as a trusted third party in transactions, providing security control and insurance of transactions.

The average transaction costs in the Omsk region is about 28% (in costs before income tax). So the savings from the use of the Electronic commodity market system will be from 1 to 10% for economic agents.

4. Conclusion

The development of theoretical structural-functional model of self-organizing economic system is presented in this paper. The description of the processes of functioning, adaptation and development of self-organizing economic system is given.

As an example of the practical implementation the project of Electronic commodity market system is described.

To date, in Russia has been established organizational and legal prototype and has been developed the technology of the Electronic commodity market system.

In 2012 it is planned to implement operational test of the Electronic system of the external legally significant document circulation – the basic technology of Electronic commodity market system.

It gives ground to make preliminary conclusion about feasibility of the structural-functional model of self-organizing economic system.

REFERENCES


