

## Electronic Commodity Market System for Food Networks

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### 1 Introduction

On the agricultural market, like any other market, there are transaction costs such as “discovering what the relevant prices are, the costs of negotiating and concluding a separate contract for each exchange transaction<sup>1</sup>”, and others.

According to our research the average level of transaction costs in Russia for small and medium-sized enterprises is about 28% of the total cost.

If the transaction costs of agricultural market are high, in order to reduce them entrepreneurs can arrange the additional production of goods within the firm, replacing market relationships on the relations within the firm.

For example, in Russia, the large grain producers often have their own storage of grain (elevators) and mills, bakeries and even shops, because it is more profitable. This option is to reduce transaction costs leads to integration of firms and the monopolization of the economy.

The second option - is to establish the market long-term relationships with suppliers and customers, and long-term contracts.

It is so important in Russia to have informal personal ties to reduce transaction costs (especially the risk of non-performance of contractual obligations). This saving of transaction costs turns out that the company ignores the new, more effective relations.

Both options to reduce transaction costs are leading to the exclusion of market relations, monopolization of the economy, abandonment of the principles of free-market capitalism. Hence, adaptation and development opportunities of the agricultural sector in a changing environment are reduced.

There is a third option - a more effective organization of the commodity market. Effectiveness of establishing new market relations has to be comparable to the costs of supporting long-term relationships, or the cost of similar transactions within the large companies.

Consequently, the challenge is to **reduce costs of market transactions**, without displacing of the market relations. This is the main objective of the project Electronic system of the commodity market "System of electronic sales".

Electronic commodity market system is developed primarily for agricultural markets, in particular, for the markets of grain and grain products.

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.

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<sup>1</sup> Coase, R. The Nature of the Firm // *Economica*. Volume 4, Issue 16, pages 386–405, November 1937. – p. 390

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 involving 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.

## 2 Automated control system of commodity market

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

### *Elements*

Elements of the market transaction are subjects of the commodity market: buyer, seller, bank, warehouse, freight forwarder, carrier, insurer, etc. That is, in the Electronic commodity market system the participants are not only the buyer and the seller, but also the market agents operating functions that provide execution of transaction at all stages of its implementation. It is so-called functional elements.

### *Relations*

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.

Systematic classification of goods includes the following levels: sector (Industry), group of goods (subsector), goods (type of goods), the nomenclature of goods, quality (grade – sort), detailed product description (qualitative or other characteristics). For example,

1. Sectors: Agriculture, Petrochemicals, Energy, Raw materials, Machinery etc.  
Choose the agricultural sector
2. Subsectors of Agriculture: Aviculture, Plant production, Animal agriculture etc.  
Choose Plant production.
3. Types of goods (types of plant production): Grain, Oil crops, Beans etc.  
Choose Grain.
4. The nomenclature of goods (grain): Barley, Millet, Wheat, Buckwheat, Rye, Oat etc.  
Choose wheat.
5. Quality (grade): high, 1, 2, 3, 4, 5.
6. Detailed description: photos, videos, product specifications, technical instructions etc.

Trade forms classification is built on the criterion - the presence of opportunity at the buyer and / or seller to change the price of goods (Table 1).

**Table 1.** Classification of trade forms

Who change the price in the process of economic tie implementation	Who compete	Example
Price is changed by buyers	Buyers are competing	Auction
Price is changed by sellers	Sellers are competing	Tender
Price is changed both by buyers and sellers	Both buyers and sellers are competing	Trading
Price is fixed by buyers	Buyers are competing	Buying up
Price is fixed by sellers	Sellers are competing	Shop

Trade levels classification describes the boundaries of goods movement. The following levels can be distinguished: Municipal (local) - covers the movement of goods within a single municipality, Regional - within a single region (the subject of the federation) and Interregional (federal) - within the federation, International.

Input and output of the market transaction it is specific addresses, from which and where goods or money move (Location).

Thus, the segment of the commodity market is defined as a set of similar economic relations, corresponding to the group of goods, trade form and trade level (Table 2).

**Table 2.** Commodity market segment

<b>Segment</b>	Goods (group of goods)	Grain
	Trade form	Trading (Forward)
	Trade level	Interregional

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

### *Processes*

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.

The participants (active elements) and the proposed model of the market relation in the Electronic system of the commodity market allow to economic agents make electronically the sequence of all the necessary procedures for implementation of economic transactions:

**1<sup>st</sup> procedure** – organization of interaction.

During this procedure, the user connects to the rules of those segments, that he is interested. Thus, user enters the market segments and becomes visible to all participants of these market segments. Now he can establish so-called functional links with the market participants (contracts on banking, warehousing, forwarding, insurance, transportation, etc.).

## 2<sup>nd</sup> procedure – conclusion of transaction.

During this procedure, buyers and sellers explore the counter and competitive business offers, create their own business offers for buying and selling goods and services, arrange negotiations with the owners of counter offers, organize convergence according to the terms of offers and conclude transactions on the fact of convergence of counteroffers.

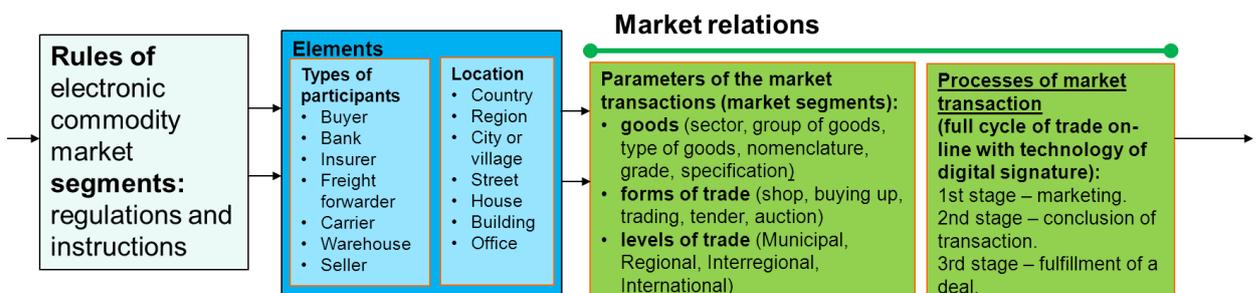
Work with functional stakeholders - the user connects to the concluded transaction functional participants (forwarders, carriers, insurers) for real fulfillment of concluded deal conditions.

## 3<sup>rd</sup> procedure – implementation of transaction

During this procedure, the buyer sends money to his bank account, the seller - goods to its bin card in the warehouse.

This procedure allows buyers and sellers to instruct other users to perform real actions with goods and money in accordance with the conditions of the deal. Terms of the transaction in the Electronic commodity market system are confirmed by transaction passport, where Digital signatures of buyer and seller, functional participants (bank, forwarder, carrier, and insurer) as well as Support center are indicated.

In accordance with the transaction passport when the moment of the deal performance comes, users implement the transfer of goods / money, banking, warehousing, insurance, forwarding and transportation.



**Figure 1.** Systematic description of market transactions based on the theory of systems engineering

The developed technology of the Electronic commodity market system allows to organize a full cycle of trade in electronic form for any product, through any form of trade and at any level of commerce, that is, at any segment of the electronic commodity market.

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

To ensure relevance in law of the Electronic commodity market system it is necessary to develop basic technology - the Electronic external legally significant document circulation system using digital signature.

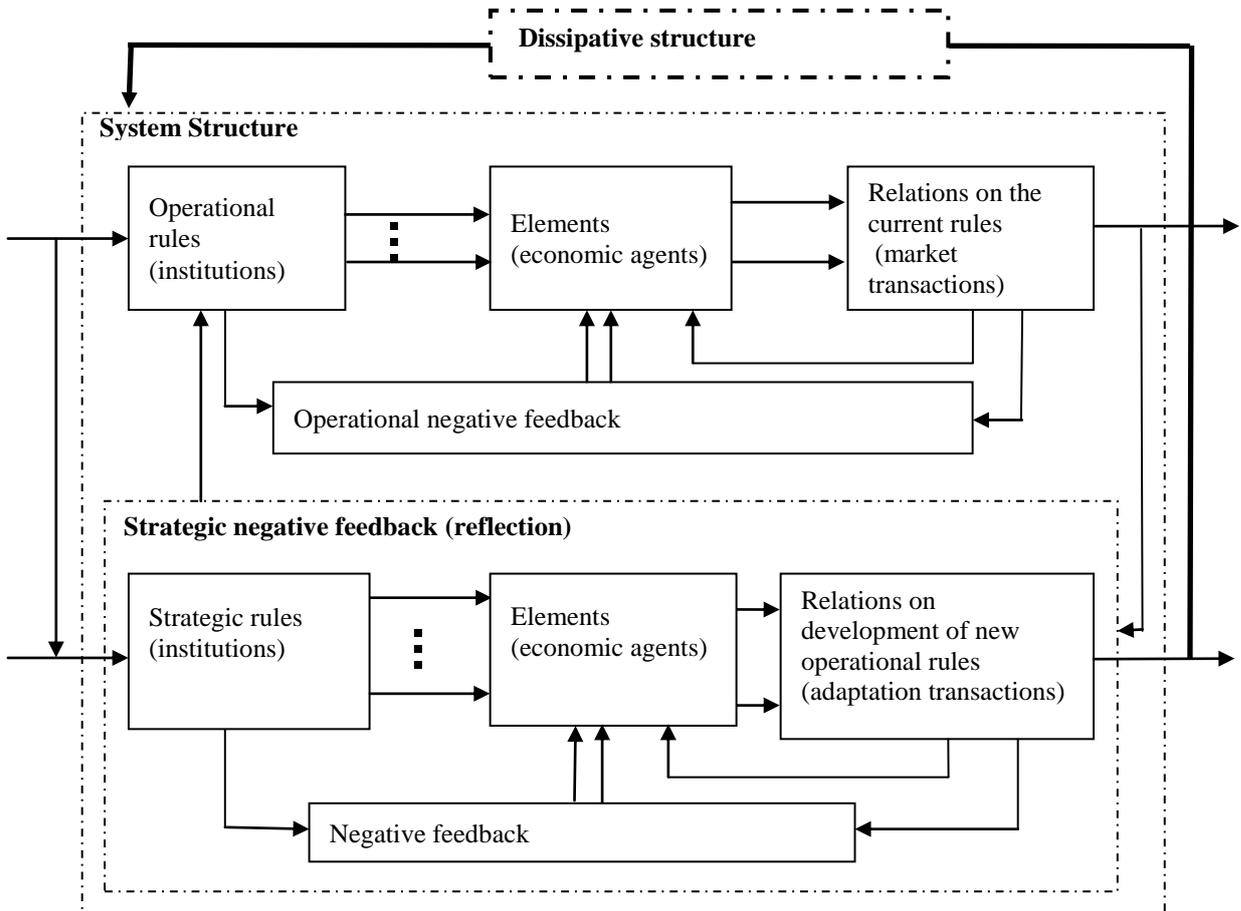
Currently Electronic system of the external document circulation is developing for Russia. In the year 2011, it is planned to complete the system and begin preparing for trial and working operation of the Electronic external document circulation system.

### 3 A structural-functional theoretical model of the commodity market as a self-organizing system

In order to ensure the operation, adaptation and development of the Electronic commodity market system it is necessary to develop an organizational - legal structure. To develop the organizational and legal structure of the system is required to have a structural-functional theoretical model of the commodity market.

The task to develop the structural-functional model of the commodity market was solved on the basis of the system approach methodology, in particular the Synergetics and Cybernetics, as well as Neo-Institutionalism. And Cybernetics is used in the part where it does not contradict Synergetics.

Combining cybernetic and synergistic approaches has made it possible to develop a model of self-organizing system that is adequate to the commodity market. In this model the system structure, functions of components and subsystems, all the types of rules and relationships are described.



**Figure 2.** shows a structural-functional model of the commodity market as a self-organizing system. (The positive feedback is shown by bold arrows).

The first structural element of the self-organizing commodity market, it is **rules** (institutions) that govern the economic agents' interaction.

The second structural element of the commodity market, it is **elements**, i.e. the economic agents (companies and individuals) engaged in transactions according to the institutions.

The third structural element of the commodity market, it is **direct connections**, i.e. market transactions.

The fourth structural element of self-organizing system, it is negative feedbacks.

**Negative feedback** corrects (compensates) deviations in work of the system on the basis of incoming information.

In the system, where the elements are intellectuals, (society, economy, market) negative feedback is a result of individual or collective intellectual activity, a process that is carried out by reflection.

The negative feedback consists of operational and strategic negative feedbacks.

**Operational negative feedback** corrects (compensates) deviations in work of the system on the basis of incoming information, without altering the structure of the system.

The function of the operational feedback on the commodity market is support (but not change) of the processes and the structure of economic exchange on the commodity market.

Operational negative feedback is effective at minor internal and external vibrations. With the growth of fluctuations the strategic feedback is needed.

**Function of strategic feedback subsystem** is in adaptation of rules and structure of the system to the changed conditions of external and internal environment.

Function of strategic feedback subsystem of the commodity market it is change, modernization of commodity market institutions and structure.

**Positive feedback** is a process of influence of previously unrecorded external and internal fluctuations, which lead to an increase in the number of new fluctuations in the system, which create a threat of the system destruction.

Complex systems can reorganize in the systems of other character. In this regard the elements that can receive the information from the positive feedback start to play the primary role.

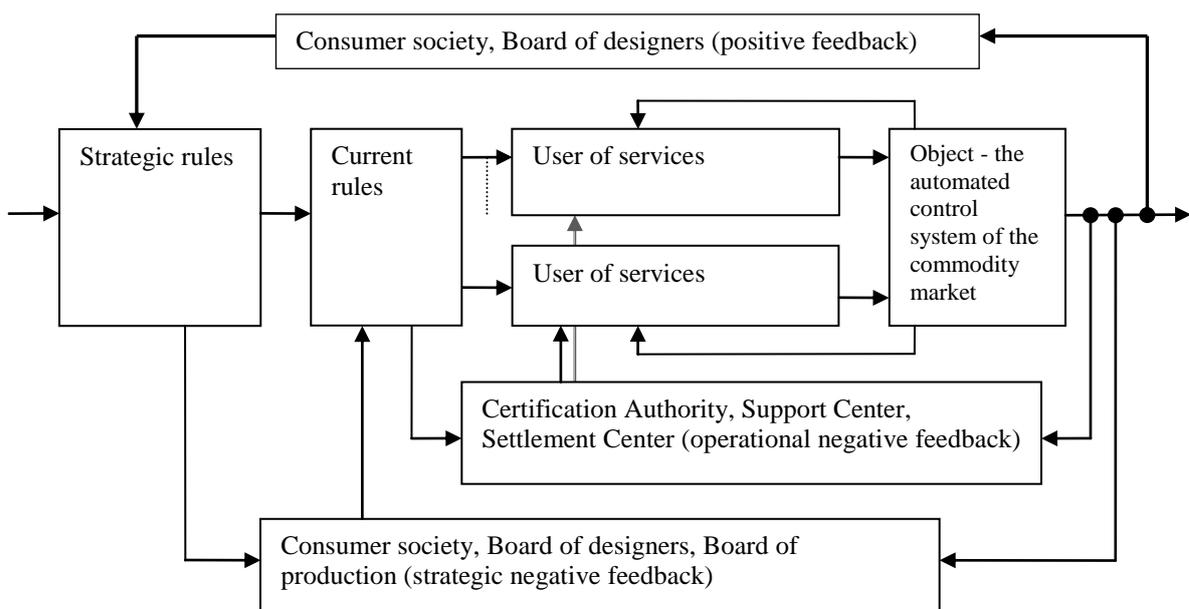
On the basis of new information, these elements create new rules and organize the dissipative structure. This is a mechanism of self-organization.

The function of the dissipative structure is rethinking, review and change of strategic and operational rules of the system. That is organization of a new structure on the site of the old one or building a system "from scratch".

After the transformation the dissipative structure disappears, as it dissolves in the system.

#### 4 Organizational-Legal Structure of the Electronic commodity market system

Organizational and legal structure of the Electronic commodity market system was developed on the basis of the model of self-organizing system. Fig. 3 shows the organizational and legal structure of Electronic commodity market system.



**Figure 3.** Organizational and legal structure 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<sup>2</sup>. 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).

At the consumer society the board of designers and board of production are created. In the board of designers there are shareholders and developers. The function of designers' board is update and development of the whole system. The board of production includes shareholders, developers and active system users. The function of production board is update and development of the system services.

Consumer Society and boards that act on the basis of strategic rules form a variable structure.

Thus, the requirements of self-organizing system to a variable structure are fulfilled.

The economic agents (system elements) take part in the control, adaptation and development of the whole system. Automated Control System (ACS) of the commodity market is owned by shareholders; the rules are governed and developed on a parity basis.

Consumer society develops rules and automated control system of the commodity market. On the fact of design the consumer society organizes operational feedback - establishes or connects organizations that act as support structures (Support centers, Certification Authorities and Settlement centers).

The support center provides commercial operation of the system - sells services for organization of external document circulation and trafficking of goods and services. Certification Authorities support the technology of digital signatures. Settlement Centre provides payment for services rendered.

Thus, the direct relations (market transactions, i.e. current **functioning** of the system) in the Electronic commodity market system are carried out on the basis of the **principles of competition** of market agents (Table 3).

Operational negative feedback (**control** of implementation of current trade rules) is based on **the principles of governance** 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 agents.

Positive feedback (**development** and self-organization, designing of the activity that nobody has ever built, that is, there is no example of this activity and hence a mechanism to promote innovation) are based on the **principles of Synthesis** and then the competition.

**Table 3.** Functions and principles of the Electronic commodity market system.

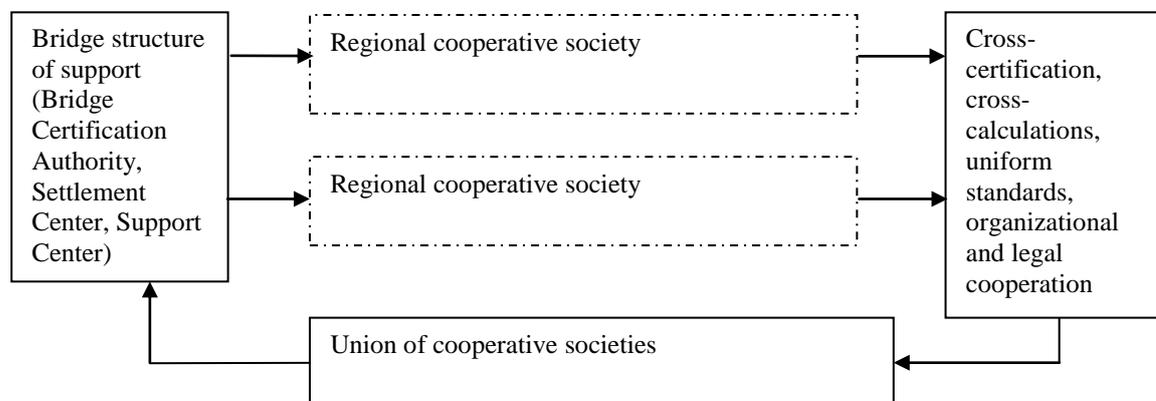
	<b>Subsystem</b>	<b>Function</b>	<b>Principle of interaction</b>
1.	Direct relations	Functioning	Competition
2.	Operational negative feedback	Control	Governance
3.	Strategic negative feedback	Adaptation	Cooperative
4.	Positive feedback	Development	Synthesis and then the Competition

Above the organizational and legal structure of the Electronic commodity market system is described that is sufficient for the region. But commodity market is the interregional and international system.

<sup>2</sup> Federal Law "On consumer cooperation (consumer societies, their unions) in the Russian Federation", 1992.

How to build interregional organizational and legal structure for the Electronic commodity market system?

The Consumer Cooperation Act in the Russian Federation allows creating the network organizational and legal structure for the Electronic commodity market system (Fig. 4).



**Figure 4.** Network organizational and legal structure of the Electronic commodity market system.

Network organizational and legal structure of the Electronic commodity market system can be organized by independent regional consumer societies and their regional structures of support. Regional consumer societies can organize interregional cooperation through the Union of Consumer Societies (as a non-profit association), and the bridge structure of support.

Union of Consumer Societies decides the questions on the organizational and legal interaction and represents the interests of regional Electronic systems of the commodity market in the federal government and at the international level.

Bridge structure of support provides adjustment of digital signatures, interregional transactions and optimizes settlement payments.

In the network organizational and legal structure of the Electronic commodity market system the working out, commercial operation, management and development of one or more segments may be executed by certain regional structure. In the bridge structure of support, except adjustment of electronic signatures, interregional transactions and optimization of settlement payments will be additionally implemented cataloging and standardization of the uniform for all members of the Electronic commodity market system goods classifiers, forms and levels of trade and the harmonization of the fundamental steps of the algorithm (the order) of transactions implementation in electronic form.

In the presence of International organizational and legal structure the technology of the Electronic commodity market system will be international. Because it will not be important what country the user is from. All transactions concluded in the system will have legal significance and contain clear for everybody mechanism of implementation.

In Kazakhstan, Belorussia, Ukraine, France, Austria, Germany, England, and 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 (Genossenschaft mit beschränkter Haftung ihrer Mitglieder)<sup>3</sup>.

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

<sup>3</sup> Gesetz vom 9. April 1873, über Erwerbs- und Wirtschaftsgenossenschaften. Nr. 70/1873. Österreich.

So the developed system is universal in the sense of the institutional model and technology. System can be implemented for using within a particular country, and for informational and economic exchange between countries.

## 5 Conclusion

Agricultural market has always been and remains one of the freest markets, meeting the requirements of free-market capitalism. This is due to the fact that the food market is heavily influenced by the external environment. That is, to better cope with external fluctuations, agricultural market has to adhere to free market principles, and, consequently, the principles of self-organization.

Therefore, the agricultural market can be a favorable environment for the Electronic commodity market system. Using of the Electronic commodity market system, on the other hand, can make agricultural market more adaptive and self-organizing.

What will receive the market agents from the introduction of self-organizing Electronic commodity market system?

- Freedom to quickly, cheaply and automatically carry out an objective assessment of the effectiveness of possible economic relations in which they are interested. In contrast to the existing subjective assessment of the effectiveness of their own economic relations in the absence of timely and accurate information about possible new economic relations and high costs to search for them and setting.
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- Freedom to regulate and develop the commodity market segments in which they operate. In contrast to the existing lack of opportunities for small and medium-sized enterprises directly modify the rules of the game of their market segments.
- Freedom to participate in the regulation and development of the commodity market institute. This will reduce the dependence on administrative decisions, which usually regulate market in the critical circumstances, and long overdue.

Agricultural market is not an isolated system and its agents are connected with other sectors of the economy. Therefore, the implementation of the Electronic commodity market system on the food market can lead to dissemination of the principles of competition and cooperation, freedom and self-organization on other markets.

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