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## INVESTIGATION OF THE INTEGRATED TRADE STRUCTURE ENVIRONMENT USING AGENT-ORIENTED APPROACH

Ukraine economic reforms make changes for improvement in all spheres of economic activity (including retail trade, that plays an important role in the socio-economic development and meeting the needs of each person). One of the factors of these changes is strengthening integration and the emergence of new organizational structures such as integrated commercial structure.

However, sustainable growth of trade and commerce and such new formations as integrated structures is impossible without effective management of trade enterprises. Taking into account that all enterprises are in constant interaction with their environment and take the initial resources for their livelihoods from it, therefore it becomes especially important to observe the structure of environment and existing relationships among all entities that are able to influence integrated trading company.

**Reviewing the literature.** The activities of integrated structures often become the object of attention by domestic and foreign scientists. There have been several investigations made by such scientists as: O. I. Amosha, V. M. Geiets, N. G. Mitsenko, G. O. Pasichnik, A. A. Pilipenko, L. I. Fedulova, O. Yu. Chorna. But considerable attention has been paid to industrial enterprises, rather less research has been devoted to integrated commercial structures and their features.

Many recent studies in the economic literature have focused on the external environment and its impact on the enterprise activity (N. O. Vlasova, B. V. Griniv, S. M. Iliashenko, O. S. Kravchenko, N. P. Liubushin, L. O. Ligonenko, A. A. Mazaraki, Yu. S. Tsal-Tsalko). But in their research, they do not account for the activity of all the participants in the external environment and dynamic development of integrated company, which is able to constantly change its structure by elements of business environments.

Therefore, the **purpose of the article** is to study the relationship between the integrated structure and its environment using multi-agent systems.

The important aspect of trade enterprises is the interaction with the external environment. This relationship determines the direction of influence on the efficiency of its operation. The business environment of the company (the direct impact factors) is the closest environment, which interacts with integrated structure. In

scientific literature its content determine through the set of phenomena, processes and institutions with which the organization directly interacts. It is able to have some influence on the nature and content of interaction [3]. The main structural elements of the business environment are suppliers of resources (materials, capital, labor), consumers, competitors, intermediaries. That is the main goals and objectives of business organization focus on this component of environment – customer satisfaction.

In his research devoted to strategic aspects of business management O.S. Vihanskii notes that the success of the enterprise management should not be only determined by the ability to adapt to change in a rapidly changing business environment by adapting their internal structure and market behavior. Enterprises should actively create the external conditions of the activity, constantly detect threats in the environment and and the formation of active external conditions of its activities, permanent detection of threats and potential in the environment [1].

Nowadays main features of the environment, Ukrainian trade companies are [9]: multi-vector orientation and a high rates of economic change, variability and dynamism, a significant degree of risk and uncertainty. That is, in practice, the integration of business entities are often forced reaction to changing external conditions, reduction of free market competition and increasing monopolization of markets. Therefore, under these conditions economic entities need time to detect changes in the environment, identify trends, develop and implement a system of measures to eliminate or reduce the negative effects

Environmental Influences on an integrated trading company, requires prior definition features of this interaction. We distinguish the following features:

1. Conditional distribution of the internal and external environment. A lot of factors that are external to the individual entity, in conditions of integration is simultaneously internal. Therefore it is difficult to draw a distinction between internal and external environment [8].

2. The interdependence of agents internal and external environment. According to O. A. Tretiak, integrated trading environment structures in contrast to con-

ventional commercial enterprises are not represented by a set of relatively autonomous entities that economically separated from each other. It is represented by a set of interdependent objects that structuring the product markets based on the optimization of supply chains flow of goods to the end user [11, c. 85].

3. Active behavior of the environment with respect to the commercial enterprises.

So, given the above, it is expedient to use multi-agent systems to study the mechanisms of this type of business and to create the models of their operation and development. This requires the research of relationships between sets of agents.

A multi-agent system (MAS) is a system composed of multiple interacting intelligent agents. Agents have specific roles and interact with each other to solve problems beyond the capabilities of individual agents or his knowledge [12, c. 12].

It is based on the transition from passive entities that are described as a class of objects to active entities. Active entities described as agents or patterns of a person with the following characteristics [6]:

1) autonomous: agent takes actions without interference of a human and has control over taken actions;

2) social ability: agents communicate (between themselves and/or with people);

3) reactivity: agents have some perception of environment that they are part of and may react to changes in the environment;

4) activity: agents may take actions to change their environment in order to achieve their goals.

The integrated structure of multi-agent simulation can be represented by a coalition (groups of cooperative agents, working together on a given task, short-lived and goal-directed, being a flat structure). Initially agents are independent and do not cooperate.

The advantages of the coalition formation is [Coalition formation in multi-agent systems—an evolutionary approach]

1. Any-time solution with worst case guarantee.

2. Distributed algorithm.

The basis of the coalition is a joint dominant orientation of purposes agents.

Coalition integrated structure can be determined by two types of agents – agent coordinator (coordination center of integrated trading companies) and agent-enterprise (participants of integration).

Agent enters the coalition, and thus takes part in the integration because of the need to achieve its goals of dominating (goals active object with the highest priority at this time [5]), and to find in this direction (agents with similar parameters of goals). Merging into one coalition resources and agents become common.

For each agent of multi-agent system of integrated commercial enterprise let us describe the overall structure as follows: the name, the set of properties, input-output (Fig. 1).

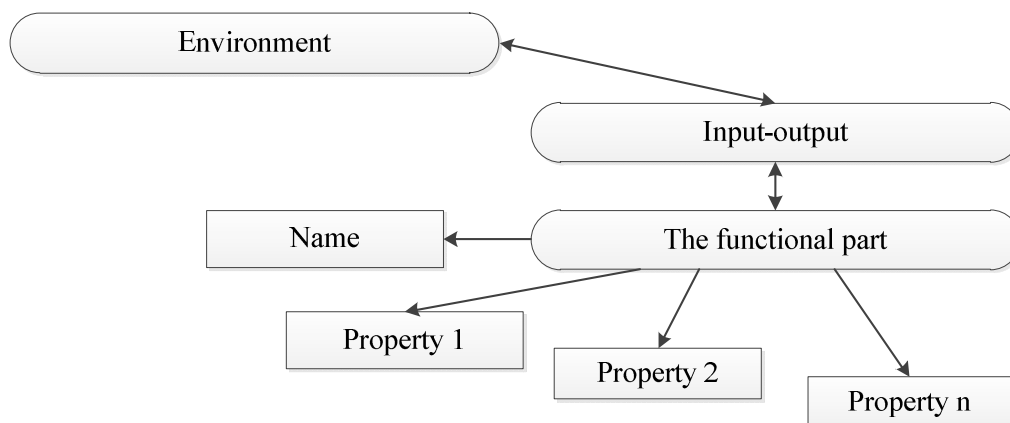


Fig. 1. The agent structure [10]

This allows on one side segregate them from each other and on the other to determine the types of relationships between objects of the environment. This set of environmental agents integrated structure represented by the set of agents-suppliers, agents-customers, agents-competitors, agents-government agencies and local governments, and agents-subjects of market infrastructure.

The structure of market infrastructure Mitsenko NG provides classified [7, p. 21],

The structure of market infrastructure Mitsenko NG offer to classified as follows [7, p. 21]: wholesale and food markets, agro-industrial, commodity and com-

modity exchanges, auctions, trading houses, agents, international trade broker, logistics and transport companies, financial institutions and insurance companies, educational institutions, research centers, advisory and consultative structures.

In terms of interaction in multi-agent systems, the relationship between actors of the external environment and integrated trading company can be represented by its architecture. The architecture is an abstract description of a system. It controls and coordinates the interaction between agents system structures their activities to achieve the desired behavior. The architecture of multi-

agent systems is seen as "a set of actors which are located in appropriate relations with each other and taking part in regular institutional forms of interaction with other actors" [13]. That's why the architecture of multi-agent system is given by a set of agents, behavior and functions defined by means of fuzzy rules.

Given the highlighted features of the environment of the integrated commercial enterprise it is appropriate to introduce a definition of potential coalition. The need for this definition caused by the fact that competitors, customers and suppliers can join the integrated structure resemblance when they have the same basic parameters of the dominant goals. That agents of the environment become agents in the internal environment. So agents of external environment become the agents of the

internal environment. So potential coalition will be called the set of external environment agents in which the parameters of the dominant goals most close to the parameters of the dominant coalition goals.

Thus, there is a model of multi-agent architecture structure (Fig. 2). For selected agents of external and internal environment it is characterized by the following types of relations R:

- $r_1$  – management processes;
- $r_2$  – process of information transmission;
- $r_3$  – the process of finding potential suppliers of goods and services;
- $r_4$  – processes of providing goods and/or services;
- $r_5$  – Integration Processes.

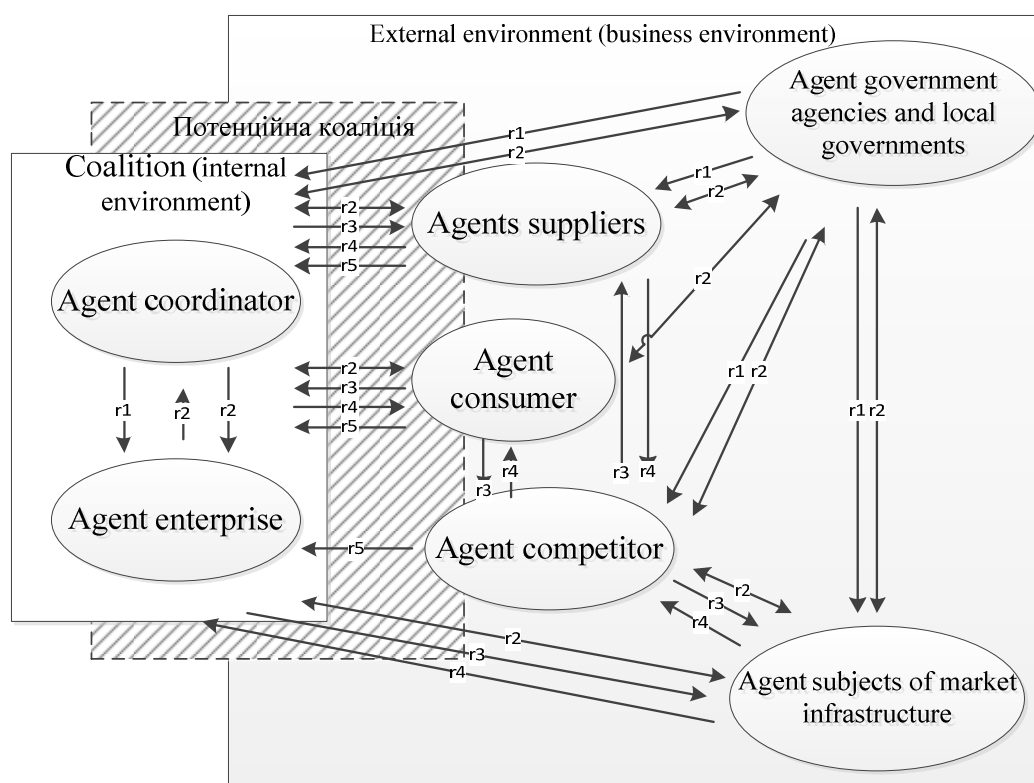


Fig. 2. Architecture of multi-agent systems of integrated commercial structure

The set of management processes occurs between such types of agents:

1) unilateral relation "Agent coordinator" – "Agent-enterprise", which describes the process of coordination and control over the activities of entities, sets rules of conduct for actors and functions of interaction with other actors in the environment;

2) unilateral relation "Agents-government agencies and local governments" – "Coalition", "Agents-government agencies and local governments" – "Agent competitor", "Agents-government agencies and local governments" – "Agents-suppliers", which defines the legal and regulatory framework of retail.

In the scientific literature, the main objectives for the regulation of commercial establishments are [2, c. 223]: development, adoption, control of normative legal acts, that providing the legal basis; protection of interests and trade enterprises development; realization of state policy on development of wholesale and retail trade enterprises as well as trade and production sector through the use of market mechanisms of management; determination of the appropriate price level and the amount of trade margins; regulation of terms and conditions of storage and sale; marking and exchange of goods; regulations of the sale of certain products; control over compliance with health standards trading.

The set of process of information transmission occur between these types of agents:

1) bilateral relation "Coalition" – "Agent consumer". The existence of this type of relation stems from the fact that the trading company supplying products to the consumer market, providing consumers with necessary information about the characteristics of the goods, their warranty terms, conditions of sale, reliability and so on. From the consumer receives feedback information about the competing products, needs and capabilities of customers, volumes and sales rates.

2) bilateral relation "Agent enterprise" – "Agent coordinator" associated with the need to exchange information about sales volumes and needs of stores that are part of an integrated structure. At the same time coordinating center sends to each enterprise analytical information.

3) bilateral relation "Coalition" – "Agents-government agencies and local governments". The information base that results from information integrated connection between trade structure and government are: official publication of government agencies and local government, statistical reporting.

5) bilateral relation "Coalition" – "Agent subjects of market infrastructure".

The result of information interaction of these objects is scientific research in the field of trade, reviews of market conditions, analytical reviews published in specialized economic journals and periodicals, presentations, symposiums, conferences, promotional materials, scientific publications, marketing reports, results of sample surveys and observations that contain information about the status and dynamics of the basic parameters of environmental factors of market infrastructure.

Process of searching for potential suppliers of goods and services relate to the request to provide the product or service and are determined by the presence of unilateral relations between following groups of agents as: "Coalition" – "Agents-suppliers", "Agent consumer" – "Coalition", "Agent consumer" – "Agent subjects of market infrastructure", "Agent competitor" – "Agents-suppliers", "Coalition" – "Agent subjects of market infrastructure", "Agent consumer" – "Agent competitor".

The result of a request for services or purchasing products is the resultant unilateral request  $r_4$ , inverse to the relation  $r_3$ .

Integration processes combine those actors which are identified in the potential coalition can be attached to the integrated structure.

Thus, the proposed model of multi-agent system architecture of integrated commercial structure allows you to identify interrelationships between all actors in the environment, and further define the structure of each type of agents will promote the construction of ontolog-

ical models of integration processes of commercial enterprise, identifying the mechanisms of their development and functioning.

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**Рогоза М. Є., Вергал К. Ю. Дослідження зовнішнього середовища інтегрованої торговельної структури за допомогою агентно-орієнтованого підходу**

У даній роботі запропоновано використання агентно-орієнтованого підходу до дослідження зовнішнього середовища інтегрованої торговельної структури як відкритої динамічної соціально-економічної системи, що взаємодіє із значною кількістю суб'єктів господарювання, здійснює обмін значними масивами інформації. У статті виділено групи агентів у складі зовнішнього середовища інтегрованого торговельного підприємства, встановлено види зав'язків між ними. Запропоновано використання поняття «потенційна коаліція» для характеристики тих агентів, які за зміни умов можуть приймати участь у інтеграційних процесах.

*Ключові слова:* інтеграція, інтегрована структура, торговельне підприємство, агенти, мульти-агентна система.

**Рогоза Н. Е., Вергал К. Ю. Исследование внешней среды интегрированной торговой структуры с помощью агентно-ориентированного подхода**

В данной работе предложено использование агентно-ориентированного подхода к исследованию

внешней среды интегрированной торговой структуры как открытой динамической социально-экономической системы, которая взаимодействует с большим количеством субъектов хозяйственной деятельности, осуществляет обмен значительными массивами информации. В статье выделены группы агентов в составе внешней среды интегрированного торгового предприятия, установлены виды связей между ними. Предложено использование понятия «потенциальная коалиция» для характеристики тех агентов, которые при изменении условий могут принимать участие в интеграционных процессах.

*Ключевые слова:* интеграция, интегрированная структура, торговое предприятие, агенты, мультиагентная система.

**Rogoza M., Vergal K. Investigation of the Integrated Trade Structure Environment Using Agent-oriented Approach**

In this paper, proposed the use of agent-based approach to the investigation of the integrated trade structure as an open dynamic socio-economic system that interacts with a large number of entities and business activities, exchanges substantial amounts of information. The article highlights the group of agents as a part of an environment of integrated commercial enterprise, established types of relationships between them. It is proposed to use the term "coalition potential" to describe the agents that may take part in integration processes.

*Keywords:* integration, integrated structure, traders, agents, multi-agent system.

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