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SOME ASPECTS OF ONTOLOGICAL MODELLING OF INVESTMENT ACTIVITY

The purpose of the article is to study and consider general trends, problems and prospects for the use of ontological modelling of investment activity.

Research methods are methods of semantic analysis of the basic concepts of the considered subject area (investment activity). The article discusses approaches to ontological modelling of investment activities and the development of modern intelligent expert systems that support investment processes.

The novelty of the research is the analysis of the use of ontological modelling in the optimization of investment activities

The conclusion of the research conducted in the article is as follows: the article considers various aspects related to intelligent technologies based on modeling, in particular on the ontological; the essence of ontological modelling of investment activity is considered. Use of cognitive-ontological model promotes the formation of optimum administrative decisions in the field of investment activity. The set of interrelated management actions for investment activities, their logical sequence constitute a holistic management strategy – a model of process management in the system of investment activities.

Keywords: intelligent systems; expert systems; investment activity; modelling; ontology; ontological model.

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Introduction. The investment company must work with large volumes of documents, which must be recorded, and contain all the data in full order and up to date. Besides, the content of these documents is important. Therefore, the technology of accounting and document processing is relevant to the investment company. One of the ways of such technification is the use of information or intelligent systems that provide the ability to store and process all necessary data. The development of these systems should be based on appropriate modelling, in particular ontological (The use of ontologies for effective knowledge modelling and information retrieval; Chan and Harrison, 2010).

Research in the field of intelligent systems' design based on appropriate modelling was conducted, in particular, in (Rassel and Norvig, 2017; Dzharratano and Rajli, 2017), where a modern concept of intelligent systems was developed, its main components, principles of development and requirements for such systems were determined. Research of intelligent systems and technologies based on complex models is devoted (Ruchkin and Fulin, 2014 (Generic Artificial Intelligence and Expert Systems) *Intellektualizirovannye komp'yuternye tehnologii podderzhki prinjatija reshenij*). The practical aspects of the intelligent systems and technologies development were paid attention (Chastikov, Gavrilova and Belov, 2015; Subbotin, 2011).

The issues of representation and processing of knowledge in intelligent systems built using appropriate models (often semantic, frame and ontological) were considered in (Symons, 1994; Gavrilova and Horoshevskij, 2001). Therefore, the urgency of the problem of developing intelligent expert systems (IES) is beyond doubt. The problem of development of IEC of practical direction, in particular, IES for the sphere of insurance activity on the basis of the corresponding ontological model is also actual. The proposed article is devoted to solving this problem.

Main material. Online insurance is a field of investment activity that has great potential for attracting customers, the adoption of a new standard for investment activity. Nowadays, there is a desire to develop and improve methods. The transition to a virtual environment facilitates the conclusion of investment contracts between the insured and the insured person without the involvement of banking or other intermediaries.

Cognitive analysis in the field of investment activity helps to understand existing problems, identify contradictions and analyze the processes occurring in this environment.

The essence of cognitive-ontological modelling (Maksimov, Kornoushenko and Kachaev, 1999) in the field of investment activity as an element of cognitive analysis is to simplify the reflection of complex problems and trends in the system of investment activity, the study of possible scenarios of crises and ways and conditions to overcome them. The use of cognitive-ontological modelling qualitatively increases the validity of management decisions.

The stages of cognitive-ontological modelling of process management in the system of investment activity are:

Determining the factors that characterize the environment, system, processes, situation (for example, the essence of the problem of content management can be

formulated using the factors “Investment service”, “Customer solvency”, “Income of the investment company”, “Number of customers”). “Costs for the organization of the investment system”, “Volume of investments”, etc.).

Identify the relationships between factors, direction and interaction between factors.

Determining the nature of the impact (positive, negative). At this stage, a top-level cognitive-ontological model is built (the corresponding cognitive map in the form of an oriented graph).

Determining the degree of influence of factors on each other (weak, strong). At this stage, the cognitive-ontological model of the field of investment is finally built (including cognitive maps and factors of investment, and processes of investment, and process management in system of investment).

Thus, the cognitive-ontological model of process management in the system of investment activity is a set of models (cognitive-ontological) for different processes and different levels of the system.

For optimal and effective modelling of process management process in the system of investment activity, the online insurance system should be structured, which involves identifying the basic elements of the system (subjects and objects of management; factors influencing the situations in which the system may be; processes, which occur in the system, factors that determine the impact on the system of the external environment, etc.) and identify types of relationships between elements of the system (hierarchical relationships, subordination, imitation, etc.).

In particular, it is necessary to divide the factors influencing situations in which there can be a system, and the factors defining influence on the system of external environment, on groups (Gavrilova and Horoshevskij, 2001):

- target, describing the essence of the problems for which the system is created;
- basic (general), describing the essence of the problem and which significantly affect the situation in which the system may be;
- insignificant, weakly related to the basic factors and those that do not significantly affect the situation in which the system may be.

When analyzing a specific situation, experts in the field of investment activity determine which changes in the basic factors are most preferable for him (Tkachenko and Tkachenko, 2017). But the target factors are the greatest interest for experts.

The purpose of management involves the generation of management decisions about the processes occurring in the system of investment activity, to ensure the desired changes in target factors.

In a set of basic factors the set is allocated:

- control factors = input factors of the cognitive – ontological model, necessary to start the formation based on the model of control effects on the system;
- internal factors that belong to both the object and the subject of management and are under some control of management in the institution of investment activity;
- external factors that reflect the influence of external forces on the situation or system, which are not under the control of management in the institution of invest-

ment activity or may be controlled from the outside (management entity, external entity). Among the external factors are usually distinguished:

- *predicted* (predicted), the occurrence and behaviour of which can be assumed on the basis of an analysis of available information;
- *unpredictable* (unforeseen), the behaviour of which the expert learns after their occurrence.

The use of a cognitive-ontological model helps to generate optimal management decisions. A set of interrelated management actions in concerning investment activity, their logical sequence constitute a holistic management strategy – an ontological model of process management in the system of investment activity.

Cognitive-ontological model of process management in the system of investment activity is a set of models (cognitive and ontological) for different processes and different levels of the system. In graphs depicting cognitive-ontological models, all arcs are weighted. These weights reflect the degree of influence of factors on each other. When specifying the weights of the arcs, the usual oriented graph becomes functional. The cognitive map consists of factors – elements in the system of investment activity, which can act as subjects of investment activity (for example, customers, investors (investment institutions)), and investment processes, and the links between these elements.

An example of a cognitive map of a situation in the field of investment activity at one of its levels, shown in figure 1 (Tkachenko and Tkachenko, 2017).

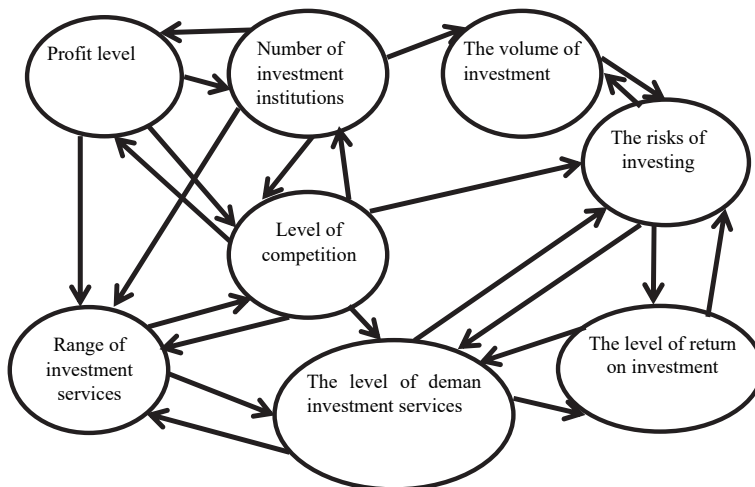


Fig. 1. Cognitive map for the upper level of investment activity

At the level shown in figure 1, each relationship between the elements of the cognitive map (factors) is revealed by the corresponding relations, each of which can be described by a set of variables (quantitative, qualitative). «Qualitative» variable

But the target factors are the greatest interest for experts. The purpose of management involves the generation of management decisions about the processes in the system of investment activity, to ensure the desired changes in target factors.

In the set of basic factors there are sets:

– *control factors* – input factors of the cognitive-ontological model, necessary to start the formation on the basis of the ontological model of control effects on the system;

– *internal factors* that belong to both the object and the subject of management and are under certain control of the management in the institutions of investment activity;

– *external factors* that reflect the influence of external forces on the situation or system, which are not under the control of the management in the institutions of investment activity, or maybe controlled from the outside.

The use of a cognitive-ontological model helps to generate optimal management decisions. A set of interrelated management actions in relation to investment activity and their logical sequence constitute a holistic management strategy – an ontological model of process management in the system of investment activity.

Conclusions. The use of cognitive-ontological model contributes to the generation of optimal management decisions in the field of investment activity. A set of interrelated management actions concerning investment activity and their logical sequence constitute a holistic management strategy – a model of process management in the system of investment activity.

During the development of IEC “Investment Ltd”, which uses a cognitive-ontological model, the following main steps were performed:

- analysis of the subject area;
- development of infographic model – model “essence-connection”;
- development of a data model of the IEC information base;
- development of the cognitive-ontological model of knowledge representation.

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ДЕЯКІ АСПЕКТИ ОНТОЛОГІЧНОГО МОДЕЛЮВАННЯ ІНВЕСТИЦІЙНОЇ ДІЯЛЬНОСТІ

Мета статті – дослідити та розглянути загальні тенденції, проблеми та перспективи використання онтологічного моделювання інвестиційної діяльності.

Методи дослідження – методи семантичного аналізу основних понять розглянутої предметної сфери (інвестиційна діяльність). У статті наведено підходи до онтологічного моделювання інвестиційної діяльності та розробки сучасних інтелектуальних експертних систем, що підтримують інвестиційні процеси.

Новизна дослідження – аналіз використання онтологічного моделювання при оптимізації інвестиційної діяльності.

Висновки. У статті розглянуто різні аспекти, пов'язані з інтелектуальними технологіями, що ґрунтуються на моделюванні, зокрема на онтологічному; сутність онтологічного моделювання інвестиційної діяльності. Використання когнітивно-онтологічної моделі сприяє формуванню оптимальних управлінських рішень у галузі інвестиційної діяльності. Сукупність взаємопов'язаних управлінських дій щодо інвестиційної діяльності, їх логічна послідовність становлять цілісну стратегію управління – модель управління процесами в системі інвестиційної діяльності.

Ключові слова: інтелектуальні системи; експертні системи; інвестиційна діяльність; моделювання; онтологія; онтологічна модель.

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НЕКОТОРЫЕ АСПЕКТЫ ОНТОЛОГИЧЕСКОГО МОДЕЛИРОВАНИЯ ИНВЕСТИЦИОННОЙ ДЕЯТЕЛЬНОСТИ

Цель статьи – исследовать и рассмотреть общие тенденции, проблемы и перспективы использования онтологического моделирования инвестиционной деятельности.

Методы исследования – методы семантического анализа основных понятий рассматриваемой предметной области (инвестиционная деятельность). В статье рассматриваются подходы к онтологическому моделированию инвестиционной деятельности и разработке современных интеллектуальных экспертных систем, поддерживающих инвестиционные процессы.

Новизна исследования – анализ использования онтологического моделирования при оптимизации инвестиционной деятельности.

Выводы. В статье рассмотрены различные аспекты, связанные с интеллектуальными технологиями, основанные на моделировании, в частности на онтологическом; сущность онтологического моделирования инвестиционной деятельности. Использование когнитивно-онтологической модели способствует формированию оптимальных управленческих решений в области инвестиционной деятельности. Совокупность взаимосвязанных управленческих действий по инвестиционной деятельности, их логическая последовательность составляют целостную стратегию управления – модель управления процессами в системе инвестиционной деятельности.

Ключевые слова: интеллектуальные системы; экспертные системы; инвестиционная деятельность; моделирование; онтология; онтологическая модель.

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