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A Conceptual Approach to The Synthesis of The Architecture of Information and Trading Systems

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ABSTRACT

The subject of the work is the development of methods for designing the architecture of information and trading systems; the object of the work is the architecture of information and trading systems, the purpose of the work is to improve the efficiency of designing the architecture of information and trading systems; to achieve this goal, the following tasks are solved: the concept of information and trading system is discussed; classification of information and trading systems is given; the design paradigm is formed information and trading systems; innovative methods of designing information and trading systems are described; the directions of the development of scientific support for the design of information and trading systems are discussed; the scientific methods in the article are: historical and logical analysis, methodology of science, theory of complex systems, system engineering; the scientific novelty of the article is the development of methods for designing the architecture of information and trading systems.

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1. INTRODUCTION

The relevance of the work is associated with the increasing role of information and trading systems (ITS) in the conditions of a new technological order. The practical development of information and trading systems has been observed since the 1990s (Calvo *et al*., 1996). However, to date, the design of such systems is carried out mainly by heuristic methods based on common sense considerations. A scientifically based theory of designing information and trading systems has not yet been created.

The hypothesis of the article is the assumption that the formation of a methodology, a paradigm for designing information and trading systems will increase the efficiency of the processes of designing the architecture and functioning of information and trading systems.

The purpose of the work is to improve the efficiency of the design and operation of information and trading systems.

To achieve this goal, the following tasks are being solved:

(i) the concept of an information and trading system is discussed;
(ii) the classification of information and trading systems is given;
(iii) the paradigm of designing information and trading systems is being formed and its elements are defined;
(iv) innovative methods of designing information and trading systems are described;
(v) the directions of the development of scientific support for the design processes of information and trading systems are discussed.

The object of the article is the architecture of information and trading systems.

The subject of the work is the development of methodology and the formation of a paradigm for designing the architecture of information and trading systems.

We perform an analysis of scientific publications on the topic of this article.

2. LITERATURE REVIEW

Since the end of the 20th century, the theory of complex hierarchical systems has been actively developing (Allen & Giampietro, 2014). At the beginning of the 21st century, the fourth industrial revolution is observed, one of the directions of development of which is information technology (Bikse *et al*., 2022). In 2023, there is a crisis associated with the formation of a new technological order. The role of complex hierarchical systems is increasing the development of innovative trading systems is observed (Murmann & Frenken, 2006).

They research the roles of users of information and trading systems (Hu *et al*., 2020). A. Cooper has been developing the method of "interaction design" for interfaces proposed by him for more than 20 years (Ahamed, 2017). This method allows you to create powerful solutions that customers enjoy working with. It is expected that in the conditions of the new technological order, there will be an intensification of innovations in the field of various types of complex systems (Glushchenko, 2022). Experts note that the development of complex systems can lead to an increase in the systemic influence of interfaces and data exchange protocols (hereinafter simply protocols) as part of all types of complex systems (including information and trading systems). Analysts note that the architectural approach is becoming increasingly widespread and growing in importance when designing various types of complex systems (information and trading, etc.) and software for such systems (Hernandez-Fajardo & Duenas-Osorio, 2013).

Interfaces and data exchange protocols act as important system-forming elements of architecture, structure, and algorithms for the functioning of complex systems (Cheng *et al*., 2013).

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At the same time, at the beginning of the 21st century, the method is developing and the "institutionalization" of structural analysis of systems and, in particular, field analysis, as a tool for solving inventive tasks. Tim Brown's method of design thinking is becoming increasingly widespread (Micheli *et al*., 2019). Further development of ergo design as a method of designing and optimizing processes in complex systems is observed (Kharchenko *et al*., 2021; Glushchenko, 2022a). To increase the level of scientific validity of interaction design when creating complex information and trading systems, interfaces, and data exchange protocols, it may be useful: to further develop the theory of organizational behavior; more active use of the results of the theory of organizational behavior in interaction design (Glushchenko, 2022b). Scientists are studying possible directions for the development of scientific support for the design of information and trading systems. When analyzing and designing information and trading systems, a functional decomposition representation of such systems can be useful (Glushchenko & Inei, 2024).

Summing up a summary of the study of scientific publications on the topic of this article, there is every reason to say the following. There is an increase in the importance of the tasks of designing information and trading systems. The importance of these design tasks is growing due to the increasing level of diversity and practical significance of information and trading systems. Therefore, the relevance of this article can be considered proven.

3. METHOD

By the conceptual approach to the synthesis of the architecture of information and trading systems, we agree to understand: firstly, a systematic view of the architecture of such systems, taking into account their purpose; secondly, ensuring the systemic unity of essential properties, connections and interconnections of elements within an information and trading system to ensure the implementation of the functions of such a system.

4. RESULTS AND DISCUSSION

We agree to call the information and trading system systems created for automated transactions of purchase and sale of products (goods and/or services). Information and trading systems have many properties of complex systems (a large number of heterogeneous elements, emergence, versatility, etc.), which allows them to be classified as complex systems. For this reason, system engineering can be considered the most adequate methodology for their research.

The general theory of information and trading systems can be considered as one of the directions of the development of system engineering.

The scientific support (platform) of an information and trading system is understood as a certain set of knowledge that ensures the safety and effectiveness of the design and operation of these systems. As already noted, the scientific and educational platform of information and trading systems (ITS) belongs to the field of system engineering. We agree to call the paradigm of scientific support for ITS design a system association: the philosophy of scientific support; the ideology of designing such ITS; the organizational culture of ITS; policies (strategies and tactics) of ITS creation. We will agree to call the general theory of ITS the scientific discipline of ITS.

The scientific method in the general theory of information and trading systems (GT ITS), we agree to call a system of principles and techniques by which objective knowledge of scientific processes and socio-economic results of ITS creation is achieved. Types of ITS: marketplace; ecosystem; intelligent system; ITS using neuromarketing. Neuromarketing can

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be used in ITS to: evaluate the optimal parameters of products; evaluate the effectiveness of advertising; staff training in game approaches; prevent crises and panic in the market and others. It is proposed to recognize the following functions as basic functions from ITS:

(i) methodological, which consists in the formation of the conceptual apparatus, the theoretical foundations of scientific research;
(ii) cognitive, which includes the processes of accumulation, description, study of facts of reality in the field of ITS;
(iii) instrumental (regulatory), which is of a practical nature;
(iv) legislative, which is embodied in the process of substantiating the need and developing legal norms in this area;
(v) optimization, which includes the synthesis or selection of the best methods and techniques for the design, production, and operation of ITS;
(vi) predictive, which includes an assessment of the state of ITS, economy, and society in the future in terms of the possibility of ITS development;
(vii) preventive, which consists of carrying out proactive and preventive measures based on the results of the forecast of ITS development;
(viii) psychological, which includes explaining to stakeholders the benefits of ITS;
(ix) socialization of knowledge, which ensures the dissemination of knowledge about the role and significance of modern ITS;
(x) system-forming, which covers the accumulation of knowledge and scientific unification of elements in the field of ITS.

The roles of GT ITS will be the following: optimization of scientific support in the field of ITS; reduction of risks during research and implementation of projects in the field of ITS; increase in financial results of ITS.

It is possible to describe such laws GT ITS:

(i) the importance of ITS in the conditions of the new technological order will increase;
(ii) it is necessary to overcome the backlog of ITS scientific support from the practice of developing such systems;
(iii) GT ITS refers to generalizing scientific theories of an object's nature;
(iv) GT ITS will develop as a scientific and educational platform and will combine all the knowledge necessary for the sustainable development of the ITS sphere;
(v) GT ITS is a structural and specialized element of system engineering;
(vi) development from ITS includes trends of differentiation and specialization of this science;
(vii) Increasing the complexity of ITS and ITS sciences stimulate the development of ITS;
(viii) functions from ITS can be considered as directions of development of this theory and ITS scientific platform;
(ix) in the field of ITS, there is a five-level technological pyramid. Such a five-level technological pyramid can be a factor in structuring the ITS scientific platform.

The main tasks of ITS and ITS scientific platform (as a set of knowledge about ITS) can be considered:

(i) formation of the paradigm, mission, and vision of ITS development;
(ii) development of the classification of ITS types;
(iii) improvement of methods of system engineering in the field of ITS;
(iv) development of ITS design methodology;
(v) synthesis of methods for substantiating ITS architecture;
(vi) development of the theoretical foundations of ergonomic design in the field of ITS;
(vii) formation of methods of scientific support of ITS life cycle;

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(viii) development of methods for assessing the risks of ITS sustainable development;
(ix) formation of methods for assessing the impact of ITS on the socio-economic development of the state and society, and more.

Express analysis shows that at the beginning of the 21st century, four directions of development of such systems can be distinguished: marketplaces; trading ecosystems; intelligent trading systems; information and trading systems using neurotechnologies (neuromarketing, etc.).

By marketplace, we understand a virtual trading platform where goods, and services (products) of other companies are sold using information technology. The marketplace is similar to a hypermarket: there are different sellers (suppliers) on the same site and buyers can shop in different stores while in the same environment.

Under the trading ecosystem, we agree to understand a complex of information and other types of services aimed at creating an integral product that provides the purchase and sale of everything necessary to meet a set of key needs of certain social groups.

Intelligent information and trading systems are distinguished by the fact that their activities include the formation of new knowledge about the structure and specifics of customer needs based on the analysis of previous requests and purchases of goods and/or services.

Information and trading systems using artificial intelligence look like a promising option for such systems. They will use neurotechnologies to determine: hidden needs; subconscious needs; valid assessments of the quality of goods and services, etc.

A comparative analysis of these types of information and trading systems is performed in **Table 1**.

The opportunity to study these types of information and trading systems, abstracting from their specifics, is associated with such features:

(i) all these types of systems have common types of structural elements (subject and control object);
(ii) in all these types of systems, there are mechanical (for example, automated warehouses) and software parts;
(iii) all these types of systems are aimed at satisfying (directly or through goods) certain individual and social needs;
(iv) for all these types of systems, a mission, vision, and goal of creation can be formulated;
(v) all of them can be presented to stakeholders in the form of a certain set of performance indicators (target efficiency, costs; risks of functioning;
(vi) there are temporary characteristics of functioning and other things.

At the same time, when creating information and trading systems, not only OT technologies are integrated, but also other types of technologies, for example, neurotechnologies (for example, neuromarketing, etc.).

When designing and analyzing information and trading systems, it is possible to use a functional decomposition representation of such systems. In information and trading systems, it is possible to distinguish (decompose) such functions:

(i) information function, which consists of creating a behavioral readiness of the client to make a purchase (deciding by the client about the purchase);
(ii) settlement and payment function, which consists of making payments for the purchased product (product or service) (confirmation of receipt of payment);
(iii) logistics service of the client in the interests of transferring the purchased goods to him or rendering the service (transfer of the goods to the buyer /rendering of the service);

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control and fiscal function, which consists of the control of commodity and cash flows and their taxation (confirmation of the completion of the transaction and ensuring its taxation).

Table 1. Comparative analysis of types of information and trading systems.

No	Parameters of comparison of trading systems	Information and trading systems (marketplaces)	Information and trading systems Using neurotechnologies	Information and trading ecosystems	Intelligent information and trading systems
1.	Satisfied need	The customer's clear need for specific products (goods or services)	Subconscious, latent needs	a set of needs of a representative of a certain social group, determined by lifestyle	Latent or specific needs, combinations of customer needs
2.	Interaction object	Typical buyer	Individualized set of requirements for products	A certain social group of people	A buyer with specific properties or behavior
3.	Content of the activity	Promotion of goods and services from their producers to consumers	The study with the use of technical means of subconscious, latent needs	Formation of a certain image and lifestyle of a social group	Analysis of deep needs and behavioral characteristics
4.	The nature of competition in the market	Competition at the level of goods and services, ways to promote them	Competition at the level of technical means and methods of studying subconscious and latent needs	The desire to avoid competition by creating a unique set of products	The desire to win the competition based on a deeper knowledge of customer behavior
5.	Type of competition	The market of pure competition	Oligopolistic competition	Monopolistic and oligopolistic competition	Oligopolistic competition
6.	The risk of monopolization of the market	Low level	increased level	high level	high level
7.	The risk of manipulation of the buyer by the seller	Low level	increased level	high level	high level

Source: developed by the authors

In general, the algorithm of functioning of the information and trading system has the following form: informing a potential buyer about the products offered a decision by the customer about the purchase a payment for the product - confirmation by the seller of receipt of payment-transfer of goods (provision of services)-confirmation of the legality and the fact of completion of the act of purchase/sale (including taxation of the transaction).

Due to the complexity of the structure of the processes occurring in information and trading systems, they talk about their architecture.

As already noted, the study of the content and significance of the architectural approach in the design of complex information and trading systems is devoted, among other works. In

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these works, the architecture of a complex system and/or its software is understood as a set of such elements: the fundamental organization of the system embodied in its elements; algorithms for interaction, and the relationship of system elements (software) with each other and with the external environment; principles of designing such systems; methods of system evolution. Researchers believe that the concept of "architecture" concerning complex systems is largely subjective. At the same time, the very concept of "architecture" has a large number of contradictory interpretations to a certain extent.

Experts believe that often each development team has its point of view on the concept of architecture and its impact on the process and results of designing a complex system. At the beginning of the 21st century, a large number of definitions of the architecture of a complex system are known. A certain set of interpretations of architecture, mainly concerning the understanding of software architecture, is presented on the website of the Institute of Software Engineering (Carnegie Mellon University).

In 2023, there is an increasing tendency to differentiate architectural and non-architectural design as fundamentally different approaches to design and, as a result, different types of project activities. At the same time, attempts continue to define and describe various architectures as separate practices. At the same time, it should be borne in mind that architectural and non-architectural design of complex systems (and their software) are largely "intertwined". It is recommended to take into account that architectural solutions (in comparison with conventional, non-architectural design solutions) are considered as having the following properties: architectural solutions are more abstract; architectural solutions have a conceptual basis; architectural type solutions are more global; architectural approach is focused on the success of the mission of a complex system; architectural approach allows you to create the highest-level structures of systems.

At the same time, interfaces and data exchange protocols can be considered as elements that play an important role in the architecture of complex information and trading systems. This is because interfaces and data exchange protocols act as important elements of algorithms for the functioning of various types of complex systems. Based on this, all the requirements for interfaces and exchange protocols should be divided into two parts: objective requirements determined by the characteristics of its functioning processes, of which they are a part; and subjective requirements that are determined by the goals and behavior of consumers. As already noted, Alan Cooper insisted on the need to take into account consumer behavior. This separation of requirements for complex information and trading systems can be considered conditional. This is because the goals and behavior of customers are largely determined and related to such factors: industry characteristics of the market; the functions of the ITS complex; the type of ITS; customer behavior and other factors.

At the same time, the essence of any category, including interfaces and exchange protocols, objectively expresses their functions and roles as part of complex systems. The express analysis allows us to say that interfaces perform the following functions as part of complex systems: adequate representation of one element to other elements of the information and trading system; physical connection of elements of the structure (and architecture) of the information and trading system; standardization of standard representations of elements of such complex systems to each other and the complex system as a whole; technical support for the decomposition of an information and trading system in the processes of design, creation, maintenance, monitoring, and diagnostics of the states of elements and the entire complex system as a whole; ensuring the technical possibility of optimizing the architecture of complex systems and others.

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The performed analysis gives grounds to name such functions of information exchange protocols in the interfaces of complex systems: standardization of procedures (algorithms) for information exchange between elements of a complex system; ensuring the implementation of algorithms for the functioning of a complex system; documenting the results of information exchanges between subsystems of a complex system (or software elements) and more.

The roles of interfaces as part of information and trading systems can be called: ensuring the system unity of elements and their integration into a single whole - a complex system; creating a technical opportunity to optimize the architecture of an information and trading system; ensuring the manufacturability of the design of a complex system (design processes, pre-production, assembly, maintenance, control, diagnostics, etc.); technical ensuring the principle of modularity of the design of the information and trading system and more. The roles of information exchange protocols in interfaces can be called: ensuring the technical feasibility of the algorithms of functioning; documentary support of the processes of functioning of a complex system; control of the correctness of information exchanges; diagnostic role and more.

The analysis shows that the task of optimizing the appearance (structure and main characteristics) can be set and formulated when designing both the information and trading system itself and interfaces and data exchange protocols in such complex systems. The basis for the formulation of such an optimization problem may be contradictory statements that:

(i) an excessively multifunctional interface (or data exchange protocol) will have excessive functional (and, as a result, weight-dimensional and cost characteristics);
(ii) an insufficiently multifunctional interface will not allow adequate implementation of data exchange processes in complex systems.

Therefore, there may be an optimal appearance (structure and main characteristics) of both the interface and the data exchange protocol for a certain class of complex systems.

Innovative methods of designing optimal information and trading systems and their interfaces (and/or data exchange protocols) can be considered:

(i) formation of the information and trading system design paradigm;
(ii) interaction design based on the analysis of the needs and lifestyle of clients;
(iii) field analysis;
(iv) method of design thinking;
(v) the method of ergonomic design (Kharchenko *et al*., 2021; Glushchenko, 2022a).

Let's consider and briefly describe these methods of innovative design of information and trading systems (their interfaces and data exchange protocols).

The paradigm of designing information and trading systems will be called a system association: the philosophy of designing such systems; the ideology of designing such systems; the organizational culture of creating information and trading systems; and policies (strategies and tactics) of creating information and trading systems.

The philosophy of creating information and trading systems can be called the most general view of the project and the process of functioning such an information and trading system.

The ideology of the creation and functioning of information and trading systems can be called: firstly, the basic idea of creating the information and trading system in question; secondly, the way power is distributed among stakeholders in the process of creating and functioning of such information and trading systems.

The organizational culture of creating information and trading systems can be called a systematic combination of such elements: values, beliefs, and behavioral stereotypes of developers and staff of such an information and trading system. Ergo design of organizational

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culture of information and trading systems can solve the following tasks: optimization of elements of organizational culture; and harmonization of relations between elements of organizational culture of information and trading systems.

The mission of creating an information and trading system can be understood as a general description of the expected socio-economic effect of such information and trading systems, and the expected benefits from it for society.

The vision of creating an information and trading system will be called the motivating scenario for the creators of such a system for the development of such an information and trading system. At the same time, the scenario is understood as a logical sequence of events in the development of the projected information and trading system.

The design of an information and trading system can be based on the method of designing the interaction of sellers with buyers. It is known that Alan Cooper began his work on the first edition of his book "Interface. Fundamentals of Interaction Design" about 20 years ago. In his work, A. Cooper convinced programmers that it was necessary and that it was time to step forward to meet users. To do this, you need to write programs that these users will like. At the beginning of 2023, a completely different situation developed: the digitization of all types of information forces users to plunge headlong into new IT technologies. In this paper, methods of interaction design are being developed. Interaction design is understood as a method of designing interactive digital environments, systems, products, and services focused on a person. At the same time, much attention should be paid to behavior design: an aspect that traditional IT design disciplines often neglect. When designing interaction, a purposeful (goal-oriented) approach is put at the forefront, in which the main attention of designers is focused on the goals of users. Within the framework of this approach, it is recommended to study: the reasons why the user needs this product; the expectations of users from using the product; and the worldview and inclinations of users. It is for these reasons that the "interaction design" method allows you to create powerful solutions that customers enjoy working with.

"Vepol" (substances-field) analysis can also be useful in designing an information and trading system. At the same time, the "Vepol" (S-field) analysis was originally intended to: represent the original IT system (for example, an information and trading system, interface, or protocol) in the form of a specific (structural) model; transform this structural model to obtain a structural solution that eliminates existing shortcomings. Structural real-field (vepol) analysis is considered a branch of the theory of inventive problem solving (TIPS). "Vepol"(s-field) analysis studies the restructuring of a complex system. At the same time, the field analysis allows us to present the initial system in the form of a specific (structural) model. "Vepol" is considered a model of a minimally controlled system that includes two interacting objects and describes their interaction. Within the framework of this approach, interacting objects (systems) are conventionally called "substances", they are designated B1 and B2. The interaction of objects ("substances") itself is called a field and is denoted by P. Any object is called a "substance", and in information systems, it can be an element (interface) or a data exchange protocol. A "field" can describe any action or interaction. For example, in information systems, the "field" can be an algorithm, program, or procedure.

As part of the design of the information and trading system, the "substances" can be the seller (B1) and the buyer (B2), and the "field" is their interaction with the use of information and neurotechnologies in the process of forming the buyer's willingness to make a purchase. The problem is to create a high level of customer readiness to decide between buying a product (product or service).

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With this approach, the process of designing an information and trading system (interfaces and/or protocols) can be considered as an iterative process of solving "elementary" inventive tasks. Based on the analysis and classification of the work performed in the design of an information and trading system (interface or protocol), a list of such elementary inventive tasks can be formed.

To form such a list, it may be recommended to answer the following questions: which element (who); under what conditions (when); where (with what "content"), and in what area (what) should be done to ensure the effective functioning of the information and trading system (interface and protocol as elements of a certain class of complex systems)? Such a list of "elementary" inventive tasks may include the following elementary tasks: description of information service requirements; description of calculation requirements; description of logistics requirements for the transfer of goods; description of the interface requirements; definition of the appearance (structure and characteristics) of the interface; description of the protocol algorithm; prioritization of actions in the information and trading system and much more.

The application of the method of design thinking in the design of rational (allowing you to perform tasks) and optimal information and trading systems (interfaces, etc.) is as follows. At the stage of empathy, information is collected, and tactical and technical requirements for the information and trading system (interfaces and data exchange protocols) are analyzed. At the focus stage; in the interests of designing an optimal information and trading system (interfaces and data exchange protocols), an analysis of the tactical and technical requirements for the information and trading system (interfaces and protocols) is carried out; the information obtained at the previous stage (empathy) is studied; problems that need to be solved during the design are formulated. At the stage of Ideation (development), ideas and hypotheses are put forward that eliminate the "gap", ensuring compliance with the requirements for the optimal appearance of the information and trading system (interfaces and protocols). At the integration stage, these ideas are systematically combined (aggregated) into a graph tree of ideas for an information and trading system project. Such integration allows you to create a holistic image of the project (to determine the structure and key characteristics) of the information and trading system. At the prototyping stage, modeling and materialization of the results of the integration of ideas into a single whole is carried out. At the same time, a prototype of the information and trading system project is being created. At the testing stage, the created prototype of the information and trading system is subjected to tests (mental, full-scale, etc.).

Ergonomic design can also act as an innovative method of designing an information and trading system (interfaces and/or data exchange protocols). Ergonomic design when designing an information and trading system (interfaces and exchange protocols) can be used to solve such tasks: creating a harmonious information and trading system from a set of elements; forming the perception of a set of elements of an information and trading system as a whole; harmonizing relations between elements of an internal information and trading system; harmonization of relations between the information and trading system and its external environment; harmonization of interaction between the elements of the information and trading system in the process of their joint functioning (within the agreed protocols of behavior of subsystems) and other things.

Ergonomic design at the stage of synthesis of the appearance (structure and main indicators) of an information and trading system (interfaces and/or protocols) can solve the following tasks: identifying factors that shape the appearance of an information and trading system (interface and/or data exchange protocol); optimizing the appearance of an

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information and trading system (interface and/or exchange protocol data); harmonization of the architecture and/or indicators of the information and trading system (interfaces and/or data exchange protocols) and others.

The stages of creating an information and trading system can be called: pre-project research of an information and trading system; design (creation of a project) of an information and trading system; creation of an information and trading system; operation (functioning) of an information and trading system; monitoring of performance indicators of an information and trading system.

The risk in creating an information and trading system is the possibility of negative deviations in the design and/or functioning of such systems.

Risks when creating an information and trading system may consist of the following: incorrect choice of the paradigm, goals, mission, and vision of creating an information and trading system; incorrect selection of structural elements of such an information and trading system; incorrect choice of tools for the functioning of an information and trading system; insufficient effectiveness of the control system for the functioning of the information and trading system, and more.

By the effectiveness of the information and trading system, we agree to understand the ability of this system to achieve the goals set for them, provided that this system fulfills certain restrictions. These may be restrictions; on the number of resources consumed; for the duration of the implementation of certain socio-economic processes.

The application of the methodology of ergonomic design in the design of such information and trading systems should: increase the efficiency of such systems; and create a synergetic effect in the functioning of such systems due to the more effective interaction of elements of such ecosystems.

The level of efficiency of the information and trading system can be assessed using criteria for evaluating the effectiveness of the functioning of such systems. The criterion for evaluating the effectiveness of an information and trading system can be understood as the rule of choosing the best option from many possible options for such a system.

The criterion for evaluating the effectiveness of an information and trading system can be synthesized based on the performance indicators of such a system. An indicator of the effectiveness of an information and trading system can be called the most important indicator of such a system, reflecting its purpose and main characteristics.

The performance indicators of an information and trading system can include a list of the main functions of such a system; and performance indicators for each of the functions of this system.

The main indicators of the information and trading system are investments in the creation of an information and trading system; the current profit of the information and trading system (short-term effect); the value of the assets of the information and trading system (firm); the return on assets of this firm and more.

When designing information and trading systems (ITS), it is recommended to take into account that the life cycle of ITS includes the following stages: ITS design, its creation, its operation, ITS modernization, and ITS disposal. To increase efficiency and, at the same time, reduce the risks of designing information and trading systems (ITS), scientific support should be ahead of practical processes in this area.

In the interests of creating an effective and ahead of the practical needs and projects of scientific support for ITS design, a program of advanced scientific research can be proposed, which may contain such structural elements.

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The direction of research, which can be called analytical and prognostic in the field of development of information and trading systems (ITS), may include research related to the history of development, research on the state of scientific support, and forecasting the development of ITS in the process of becoming a new technological order.

In the process of detailing the research topics, the research area of information and trading systems can be divided into the following particular research areas: the history of ITS development; regional or industry specifics of ITS; the current state of information and trading systems (ITS); ITS security; scientific support for ITS development; methods of forecasting ITS development; clusters, technology platforms and ecosystem trend the development of ITS in the period of a new technological order.

The direction of research, which can be designated as "Macro-designing of information and trading systems", can be associated with the formation of methods for determining and optimizing the appearance (key characteristics and architecture); the development of methods of a system design of such objects; methods of designing ITS architecture in the period of a new technological order. This area of research may include the following particular areas of research: the general theory of ITS; the paradigm of ITS development; modeling methods in the design of ITS; ergo design in ITS architecture; industry and regional customer orientation and/or customization of ITS and more.

The direction of research, which can be called "instrumental", can be engaged in the synthesis of design methods and software development of structural elements (parts) ITS. This direction may include the following particular areas of research: methods for optimizing ITS architecture; development of methods for designing and creating software for ITS information subsystem; synthesis of methods for designing and developing software for the promotion channel, and logistics of goods within ITS; synthesis of methods for designing and creating software for the subsystem of monetary settlements; differentiation (customization, customer orientation) ITS, etc.

In addition to these areas, an integrative direction can be created in the scientific support of information and trading systems (ITS), which can cover: methods of optimizing the life cycle and stages of the ITS life cycle; the formation of ITS maintenance systems during operation; the development of a methodology for ITS reengineering; the study of management methods in ITS; brand creation and rebranding in ITS; formation of a personnel training system and much more.

This article develops the provisions of the works.

The integrated use of methods for optimizing the architecture of information and trading systems discussed in this article makes it possible to increase the economic efficiency of the functioning of such systems.

5. CONCLUSION

The article develops methods for designing the architecture of information and trading systems. The article deals with the problem of optimizing the architecture of information and trading systems (their interfaces and data exchange protocols). The article develops and discusses innovative methods of designing information and trading systems, as well as their interfaces and data exchange protocols between the constituent elements of complex systems (information and trading systems). The following can be considered as innovative methods of designing information and trading systems: formation of a paradigm for designing information and trading systems; interaction design method; field analysis (part of the theory of inventive problem solving); design thinking method; ergonomic analysis and others. The

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application of these innovative methods can improve the efficiency of the architecture of information and trading systems.

It can be recommended to develop a methodology and practice of forming a paradigm for designing information and trading systems. It may be useful to use the method of "interaction design" when creating and analyzing the functioning of information and trading systems.

In the interests of the development of this kind of work, it can be recommended to introduce such disciplines as philosophy and methodology of science; theory of organizational behavior; theory of hierarchical systems; theory of technological structures; and system analysis in the field of IT; neurotechnology in the field of information technology; theory of inventive problem solving (TRIZ) into the academic disciplines studied by students of IT specialties; and others.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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