

# Cognitive Mechanism for Creating a Robot Assistant in Compliance Activities

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## ABSTRACT

The widespread dissemination of digital technologies in various areas of economic activity creates prospects for the formation of a single digital space. In such conditions, it becomes possible to use progressive modern technologies in financial control, aimed at finding errors and facts of non-compliance with legislation, identifying cases of fraud and misappropriation of assets. The article proposes a project to create a complex of digital technologies for activities in the field of compliance control, which is a single robotic system. The proposed project includes a cognitive mechanism with a list of cognitive compliance control processes and tasks, as well as digital technologies. The developed mechanism with the use of digital technologies is proposed to be introduced to digitalize the information processes of compliance services of large enterprises in the real and financial sectors of the economy.

**Keywords:** *Compliance control, cognitive processes, artificial intelligence, control and audit activities, digital technologies*

## 1. INTRODUCTION

At the beginning of the XXI century, the emergence of imbalances and crises of economic systems has led to the need to form effective mechanisms to ensure the economic security of society and the state. These mechanisms include compliance control, the purpose of which is to minimize threats of loss of business reputation of companies in the real and financial sectors of the economy as a result of non-compliance with the norms of antimonopoly, anti-corruption, financial legislation, business ethics rules and internal standards. The organization's reputational risks can lead to the loss of confidence of investors, creditors, banks, as a result of which bankruptcy may occur. The functions of the state include the formation of tools for reducing threats to safe development and ensuring control over the activities of socially significant organizations (socially significant, financially significant, strategically significant, etc.). Compliance is aimed at detecting and preventing corporate crimes and errors, improving business and internal control processes [1].

Currently, a complex of digital technologies based on artificial intelligence, big data analysis, robotization of business processes (RPA), sensorics, opens up prospects for compliance control to accelerate the collection and processing of information. Digital technologies contribute to the development of methods of remote inter-firm communication and continuous operational control. In September 2016, a working group of the International Auditing and Assurance Standards Board (IAASB) recommended that auditors use digital technologies (AI systems with Big Data Analytics technologies) in order to enhance the quality of services and minimize the risk of

non-detection. In control and audit activities, advanced technologies are being introduced by Big 4 audit companies, which, together with IBM Watson, develop programs for extracting and recognizing data, collecting information from Internet sites, conducting web analytics, and digitizing cognitive processes. In Russia, digital technologies for combating fraud, forecasting, and analyzing risks are used in Sberbank, MTS, Rostelecom. The practice of deploying the digital technologies to provide compliance functions is currently not perfect. In this regard, the formation of a cognitive mechanism is required that integrates digital technologies into a single complex and allows to create an assistant robot for performing applied tasks in compliance activities.

### 1.1. Related Work and Methodology

The term "cognitive" means "to know, to learn", and "cognitive economics" is a knowledge-based economy. Cognitive technologies are "methods and algorithms for achieving the goals of subjects based on data on the processes of cognition, learning, communication, information processing by humans and animals, the neuroscience, the theory of self-organization, computer information technologies, mathematical modeling of the elements of consciousness and a number of other scientific areas" [2]. Cognitive technologies include a wide range of technologies for rationalizing and formalizing intelligent systems for the generation and functioning of knowledge, expertise, communication, and decision-making [3]. The range of technology tasks includes the interpretation, diagnostics and monitoring of information, the formation

of new data based on knowledge for forecasting and planning, management of economic systems.

Integration of cognitive technologies for the implementation of a specific set of processes makes it possible to create an assistant robot for compliance control. J. Kokina et al. fairly notes that artificial intelligence technologies and neural networks are of great applied value in the controlling activity [4]. Intelligent Personal Assistants (IPA) is a software package that performs a set of control operations autonomously and at the user's request based on the principles of reasoning and other cognitive functions [5]. Cognitive Assistants are the "technologies with natural language processing and interactive decision support for extracting and searching for relevant information, planning and risk assessment, allowing to understand voice commands and answer questions in the most convenient form" [6]. Using the Cognitive Assistant, the semi-structured and unstructured tasks are solved, large amounts of information are examined and data from internal and external information sources are compared.

The use of cognitive technologies in control and audit activities is the subject of research of H. Issa [7], J. Kokina [4], Fanning et al [8], C. Brandas et al. [5], E. Koskivarra [9], R. Fay et al. [10].

S.E. Bonner et al. determined the composition of technologies that enhance the controlling activity: expert systems, genetic programming, neural networks, fuzzy and hybrid systems [11]. With the use of expert systems, practical problems are solved on the basis of systematization, accumulation of knowledge and experience, preparation of a response to a user's request. An example of the use of expert systems to perform compliance procedures is the development of M.M. Eining and D.R. Jones [12]. Scientists have found that expert systems create the ability to identify fraud risks. To make decisions and detect fraud, O.J. Welch [13] used genetic algorithms that allow one to search for information in an unbounded and semi-structured space and select the best solution from various alternative options. The most promising studies are works in the field of application of neural networks and hybrid models for risk assessment and detection of facts of economic crimes (Fanning et al. [8], C. Brandas et al. [5], E. Koskivarra [9]). The cognitive technology operation principle is based on the procedures for identifying elements non-compliant with a certain type, as well as for detecting anomalies. H. Issa et al. made a conclusion about the wide possibilities of using machine learning technologies for detecting fraud and deep neural networks in order to analyze information from social networks, videos, press releases, news, text processing and recognition, as well as images of documents on paper [7]. Neural systems are based on deep learning methods and the formation of a system of empirical data, i.e. large-scale "knowledge base" with a large dimension and many structures, endowed with conceptual and visual-figurative thinking. Knowledge discovery in databases is performed

using methods of selection, cleaning, transformation, modeling and interpretation of information.

For the implementation of compliance activities, the most important are Big Data analysis procedures. R. Fay et al. examined the procedures of the analysis of big data for detection of risks and identification of the facts of fraud [10]. The work of G.V. Soboleva [14] is devoted to the use of big data for assessing the risks of fraud. Big data analytics technologies integrate structured and unstructured data, sensor data, emails, phone calls, social networks, blogs, and other internal and external data. The importance of the Big Data technology for compliance consists in the application of linguistic analysis of test documents and web pages, as well as for understanding the context and content, including the perception of the emotional coloring of the text. The technologies for visual recognition of images and identification of objects, locations using drones, or video taken by surveillance cameras are used to detect fraud and assess the safety of assets. It shall be noted that certain control procedures and areas of application of cognitive technologies in the literature have been investigated in sufficient detail, and the integration of cognitive technologies is required to create an integrated robotic technology.

The methodology of this study is based on the modeling of cognitive processes, a systematic approach that allows the integration of processes into a single mechanism. The study used the methods of detailing and concretization, as well as analogy and generalization.

## 2. RESULTS

Compliance control as a form of controlling activity is based on the policy and procedures for assessing compliance risks, monitoring compliance with legislative norms, training employees and building a corporate compliance culture in the company. Compliance procedures are aimed at combating corruption and laundering of proceeds from crime, identifying violations of ethical standards, and regulating conflicts of interest. When developing a robot assistant, the peculiarities of compliance procedures shall be taken into account, combining methods of checking the normative behavior of employees with documentary methods and an actual assessment of the safety of assets. The cognitive system of compliance control shall be designed with the inclusion of the following subsystems: the basic complex of software and hardware; subsystems of cognitive technologies; knowledge management subsystems with an accumulated database.

The robotic system ensures the deployment of digital technologies aimed to provide for the compliance processes with a given list of cognitive tasks. A developed and structured system of processes for compliance control is proposed (Table 1).

**Table 1** Modeling the compliance system based on the allocation of cognitive processes and the use of digital technologies

<b>Cognitive processes</b>	<b>List of cognitive tasks</b>	<b>Digital technology</b>
<b>I. The process of entering information into a robotic system, communicating with the user and recognizing information</b>		
I.1 Communication Processes	Interaction with government agencies, external auditors (auditors), supervisory authorities (for banks), self-regulatory organizations	Hybrid Intelligent Systems: Expert systems, neural networks, machine vision, machine learning (including speech recognition technologies), cloud technologies
I.2 Processes for collecting and processing information	Search, collection of information from external and internal sources, procedures for documentary verification of data, electronic transactions. Analysis and processing of the "hot line" information. Verification of the use of insider and other confidential information. Control of the presence and authenticity of documents	
I.3 Observation processes	Observing the procedures performed by employees. Organization of physical security and safety of assets. Complete and regular inventories	
II. The process of training the assistant robot, representation and accumulation of knowledge	Collection and analysis of information for training the assistant robot	
<b>III. Analytical information processing and monitoring process for compliance procedures</b>		
III.1 Processes for verification of compliance with regulations and standards	Verification of compliance with cash settlement operations, purchase and sale operations and other types of operations for compliance with legislation and the terms of contracts. Analysis of the correction of violations identified during the previous compliance procedures; assessment of the possibility of circumvention of legislation. Checking the legal and tax status of counterparties; transactions with counterparties in the areas of compliance risk. Checking the correctness of the calculation of taxes and other obligatory payments, the formation of tax reports. Verification of the transaction prior to its implementation for compliance with legislation and organizational and administrative documentation. Verifying that the value of an asset upon acquisition or retirement is consistent with contractual and market conditions. Analysis of the legality of transactions (the absence of complex schemes of an intricate nature, transactions with intermediaries and having no economic content, a legitimate purpose). Comparison of the address of the buyer and the addresses of employees, search for information about the buyer in open sources. Verification of transactions in respect of which legal proceedings are pending. Checking unauthorized accounting records for credibility. Verification of procurement transactions if prices differ from market prices (including transactions with related parties).	Decision support systems: business intelligence, data mining, text analysis, web analysis, business intelligence systems, predictive analytics
III.2 Procedures for assessing, monitoring and managing compliance risks	Identification and assessment of compliance risks, identification of significant risks (establishment of circumstances/opportunities/attitudes towards fraud), accounting of risk events, selection and systematization of risk areas depending on the level of significance, monitoring of reputational, regulatory and operational risks of the organization, monitoring of legislative changes. Quantitative assessment of the likelihood of occurrence and possible consequences of regulatory risk, analysis of new products and methods of their implementation for regulatory risk	
III.3 Analytical procedures	Collection of information and analytical procedures when conducting due diligence checks on counterparties and employees (anti-corruption procedures); analysis of internal and external factors affecting the level of business reputation and image of the company. Assessment of accounting policies in terms of possible manipulation of financial results. Analysis of the feasibility of large and unusual expenses, the legality of compensation payments. Analysis of the movement of funds on bank accounts, verification of the absence of fictitious supplies. Customer identification procedures	
IV. The process of training, the formation of a compliance culture of company employees	Employee training, computer training based on a combination of various practical situations, ethical compliance checks. Prevention and identification of the threat of conflict of interest. Monitoring compliance by employees with internal policies, requirements for behavior	
<b>V. Management process</b>		
V.1 Planning process	Drawing up a compliance program based on optimization principles and significant risk areas (defining the list and sequence of compliance procedures)	
V.2 Process for organizing compliance review	Preparation of documents, generation of reports on requirements for any date, systematizing and summarizing detected errors, violations, significant events, suspicious transactions. Process for assessing the reliability, consistency and appropriateness of evidence collected through compliance procedures	
V.3 Coordination, monitoring and management decision making process	Making organizational decisions at all stages of compliance control. Verification of compliance with the program	
VI. The process of forming inferences at all stages of compliance control, forming judgments and conclusions	Application of inference methods based on the professional judgment at all stages of compliance	Cognitive control technology and methodology

The processes of entering, communicating with users, and recognizing information are implemented using an intelligent interface and access to the accounting and information base, technologies for reading information from documentation, as well as pattern recognition. Natural language interface, machine vision and voice control technology allow to collect and group information, to define a set of tasks. The process of teaching, presenting and accumulating knowledge is aimed at creating a knowledge base with a set of facts characterizing the subject-object area of compliance, regulatory support and the base of patterns for generating conclusions and inferences of the controller. The advantage of the knowledge base and repository is the release of the compliance officer from storing a lot of information in memory and the comparison of facts to identify violations and contradictions. Based on machine learning technology, a set of typical situations and patterns is formed for identifying, selecting, and classifying information. Analytical processing of information for risk assessment and other compliance procedures is performed using technologies for extracting and analyzing information of small and large dimensions. Procedures for identifying industry, regulatory, and other external factors, as well as events and conditions as incentives for fraudulent actions by employees of the organization, are important in assessing compliance risks. Analysis procedures allow to identify suspicious transactions, amounts, ratios, relationships between indicators and trends. With the help of big data analysis technology, publications on social networks and news articles, reports of rating agencies, analytical reports can be analyzed and information about the market and competition, legal, industry, and political environment is collected. Such information indicates the

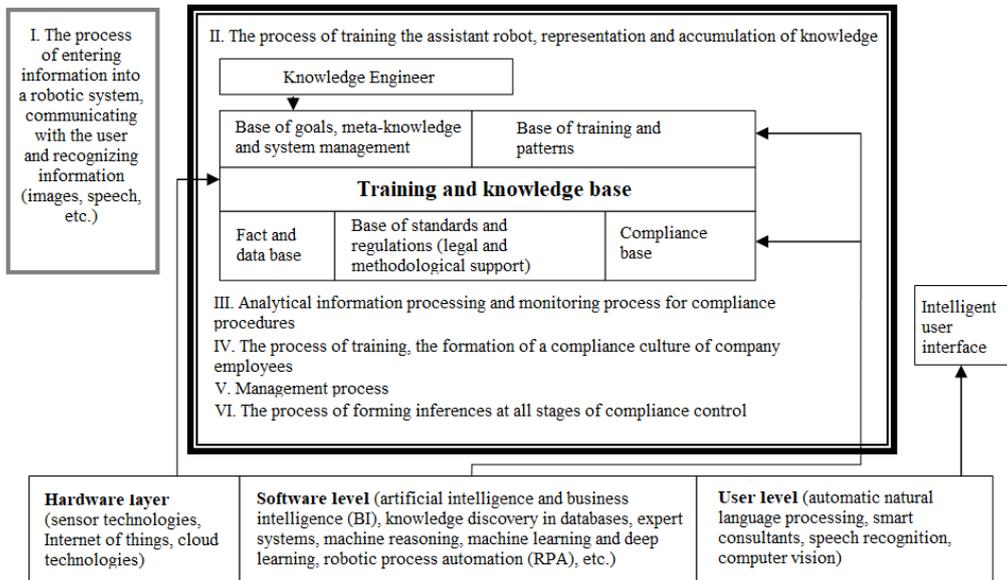
expected level of regulatory and reputational risks. The analysis results can be atypical trends, abnormal deviations, economically unjustified transactions with counterparties, questionable transactions with affiliated persons. For compliance, the important information is semi-structured data on enforcement proceedings (website of the Federal Bailiff Service), information on large government procurements, tax arrears, license registers, etc.

The search for abnormal deviations allows to reveal hidden patterns, build a model and analyze “exceptions” in the found patterns. On-demand visualization of analysis results and manipulation of graphs create the ability to quickly identify risk areas and errors.

Management processes are associated with the use of management decision support systems and are based on a multi-criteria choice of actions under conditions of uncertainty. The area of application is the planning and organization of control activities.

The process of forming inferences and conclusions is a logical conclusion based on cognitive methods of forming a professional judgment, comparing the facts revealed during the implementation of compliance procedures. Conclusions are formed by technical, semantic, and logical processing of the initial data. The base of rules and procedures allows to train the system and form a logic of thinking, like a human, which will establish the truth or falsity of the hypotheses put forward, analyze and compare data, evaluate the connections between them, generate and select the best solution from the set of existing ones [15].

The set of cognitive processes of compliance control and digital technologies for transforming information can be represented as a diagram of the cognitive mechanism in Figure 1.



**Figure 1** Cognitive Compliance Mechanism Using Digital Technologies

We believe that the cognitive mechanism shall consist of hardware, software, and user levels. In the cognitive

system, an interconnected movement of information is performed, from collecting, fixing, and registering data to

obtaining information of a new quality about the state of an object, process or phenomenon, its storage, and transmission to the user.

### 3. CONCLUSION

Therefore, a system based on the use of digital technologies with an accelerated mechanism for collecting and processing data, which creates the prerequisites for the transition to better and more complex compliance control procedures. The functions of the controller in the conditions of use of the assistant robot are to assess the importance and relevance of information, interpret the results obtained and identified violations of the law. In order to trust the conclusions of the assistant robot, it is necessary to ensure the validity of the model created using machine learning. To build a knowledge base and rules of correspondence, accuracy of classification and structuring, it is required to form a representative training sample, correct selection of classification features and methods of conducting an experiment. In the context of the introduction of digital technologies into compliance activities, it becomes necessary to ensure the confidentiality of personal information and the experience of the person who carries out machine learning, personal data from social networks. The system shall guarantee the information security and protection against the threat of information leakage.

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