Innovative credit management system for manufacturers/importers

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Abstract. This article delves into the theoretical underpinnings and significance of developing intelligent systems in the contemporary era, with a particular focus on the banking sector of Kazakhstan. It elucidates the description, purpose, functionality, tools, technologies, and mechanisms of an envisaged intelligent credit system tailored for the Kazakhstani banking landscape. This exploration underscores the pivotal role of digitization, cutting-edge technologies, and artificial intelligence in augmenting banking operations, especially in the context of addressing non-performing loans and enhancing lending efficacy.

Keywords: digitization, technologies, artificial intelligence, intelligent system, banks, credit.

1. Introduction

Modern society operates under the influence of ubiquitous digitization and computerization. Starting from the 1950s and up to the present day, artificial intelligence has been actively developing, penetrating various spheres of activity (from product manufacturing to the service sector, from space exploration to everyday processes).

In the broadest sense, artificial intelligence is «a branch of computer science that studies methods, techniques, and approaches to modeling and reproducing with the help of electronic computing machines the rational activity of a person associated with problem-solving» [1].

From a practical standpoint, artificial intelligence is a software complex that essentially replicates human skills. Evidence of this lies in the fact that human life and thought are built on neural connections, while the functioning of artificial intelligence relies on constructed neural networks. Essentially, artificial intelligence is the result of applying analogy as a scientific method of cognition.

The main feature of artificial intelligence is its ability to learn and self-improve. This enables the application of artificial intelligence in medicine, finance, commerce, industry, and ensuring order and security. In other words, it can be applied wherever there is a need to process large volumes of data, systematize, forecast, and optimize human labor.

One of the main directions of artificial intelligence is the creation of intelligent systems. In the broadest sense, the modern scientific community interprets intelligent systems as «automated systems based on knowledge».

Another approach reveals the essence of an intelligent system as «a complex of software, linguistic, and logical-mathematical tools for implementing the main task - providing support for human activity and information retrieval in the mode of advanced dialogue in natural language» [2].

The criteria for categorizing a system as «intelligent» is a subject of debate within scientific circles. Scholars have defined that an intelligent system must operate in an external environment with other agents, possess cognitive abilities (such as perception, action control, reasoned thinking, or language use), adhere to behavioral principles based on rationality and social norms, and have the ability to adapt through learning. The characteristics of intelligent systems are presented in Figure 1. Based on these characteristics, it can be concluded that modern intelligent systems are built on knowledge. They simulate human art of analyzing unstructured and weakly structured problems. Through analysis, models of knowledge representation, extraction, and structuring are developed, and issues related to creating knowledge bases are studied.

It is also noteworthy that one of the most important aspects in building an intelligent system is the selection of artificial intelligence methods that will provide the system with the cognitive abilities necessary for functioning as a cohesive entity.
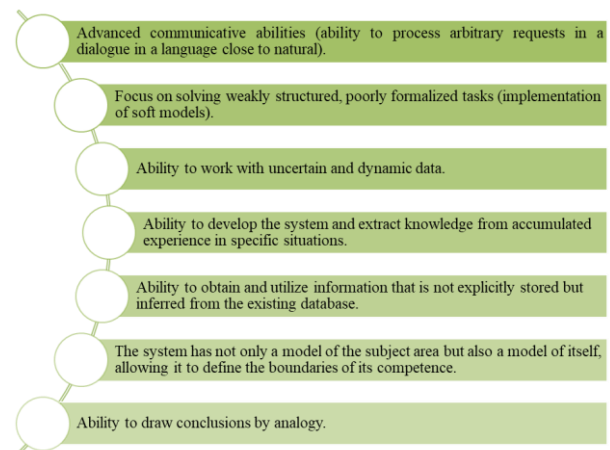

Figure 1. Features of Intelligent Systems [3]

2. Materials and methods

Based on the presented features, we conclude that modern intelligent systems are built on knowledge. They mimic human art of analyzing unstructured and weakly structured problems. Based on the conducted analysis, the development of models for representation, extraction, and structuring of

knowledge is carried out, and issues related to the creation of knowledge bases are studied.

Thus, during the theoretical research stage, it was established that the main goal of building intelligent systems is to identify, study, and apply the knowledge of highly qualified experts to solve complex practical problems using modern technologies. Therefore, intelligent systems are aimed at automatically solving current tasks through the collaborative efforts of human labor and technology.

As mentioned above, intelligent systems are applied in various societal domains. Successful examples include:

– Transportation (intelligent traffic management system based on the analysis of traffic flow and road congestion).

– Flight management (intelligent aerospace flight control system based on the analysis of atmospheric indicators, aircraft movement, and spacecraft).

– Biometric monitoring (facial recognition, fingerprint recognition, voice recognition).

– Manufacturing (application of robotic technology and automated systems for timely equipment diagnostics, reporting repair needs, inventory management, etc.).

– Climate monitoring (intelligent system for predicting natural phenomena based on atmospheric analysis and satellite imagery).

The object of the present research is the application of an intelligent system in the banking sector. The main goal is to enhance the bank's business processes.

As mentioned above, intelligent systems are applied in many areas of public life. The subject of research is the development of an intelligent credit system, specifically in the banking sector. This direction is quite relevant, as in the conditions of an unstable economic environment, the risks of banking activities increase, and it is precisely intelligent systems that are intended to mitigate these risks [5].

The main areas of application of intelligent systems in the banking sector include:

1. Customer scoring (based on the analysis of big data, automatically making decisions on loan applications).

2. Financial monitoring (based on the analysis of big data, detecting atypical customer behavior and preventing cases of fraud).

3. ATM and terminal servicing (based on the analysis of big data, forecasting demand for cash, scheduling ATM loading and terminal unloading, thereby reducing cash collection costs).

Let's briefly review the current state of the banking sector in the Republic of Kazakhstan. In 2022, international sanctions were imposed on several leading banks in Kazakhstan (Bereke Bank, Halyk Bank, Fortebank, RBK bank). As a result, "rating agencies lowered or withdrew long-term international ratings of banks, and banks were disconnected from international payment systems Visa and Mastercard" [6].

Negative trends have led to a mass exodus of clients, closure of correspondent accounts in foreign currencies, increased processing times for client and bank payments, and transfers by correspondent banks [6].

However, the main problem of the banking sector in Kazakhstan is the high volume of non-performing loans: by the end of 2023, it amounted to 9% of the total lending volume. Moreover, in early 2024, the banking sector of Kazakhstan shows signs of recovery after a prolonged correction phase with high credit losses, yet the problem persists [7].

Currently, the banking sector of Kazakhstan has as its key focus «the creation of digital banks with highly reliable and flexible IT infrastructure, digital transformation, which will be ensured by transitioning to a microservices architecture and implementing clustering and building its own data center (DC)» [8]. The country's banks actively apply Data-driven technologies and End-to-End processes, along with mass labor automation.

As a perspective, the banking sector considers the possibility of creating a special environment for model development, simplifying their implementation, automating model performance assessment, and developing a data warehouse.

2.1. Main provisions

To address the problem of reducing non-performing loans, the creation of an intelligent credit system may be recommended.

Description. The intelligent system is aimed at solving tasks in the banking sector regarding the organization of a configurable analytical component of the credit system. It is assumed to be embedded in the bank's existing software.

Goal. The intelligent credit system is intended to make effective decisions on loan applications in the lending sector for manufacturers/importers of goods [9]. Thus, during the assessment of the possibility of granting credit, the intelligent system evaluates the applicant by using new methods and algorithms for collecting, storing, and intelligently analyzing large volumes of data.

Functionality. To address the set tasks, the intelligent credit system implements the following main functions (presented in Figure 2).
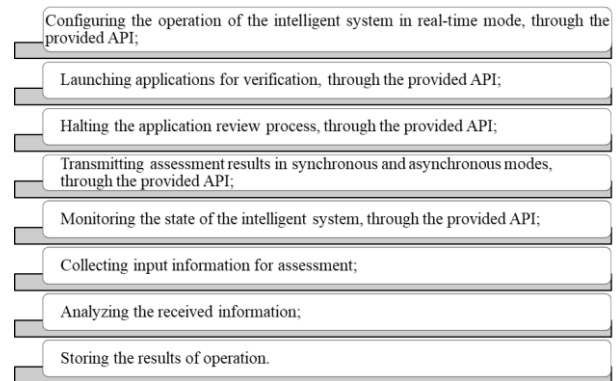

Figure 2. Functionality of the Intelligent Credit System

Tools. It is assumed that for the effective performance of its functionality, the intelligent credit system consists of a complex of services, configurations, and databases. The list of basic services of the proposed intelligent system is presented in Table 1.

Table 1. Basic Services of the Intelligent Credit System

Service Name	Description
dss-system	The service allows for prompt response to credit applications and their processing.
dss-reques	The service enables making effective decisions on credit applications.
docker-compose.yml	Docker Compose Configuration File
application.yml	Application configuration file (located in the service-named folder for each of the services)
dss	Archive Database on a Personal Computer in the PostgreSQL DBMS
definitions.json	Configuration for working with RabbitMQ

3. Results and discussion

Technologies. The proposed intelligent credit system can utilize such current software technologies as Docker Compose, RabbitMQ, and the programming language Java. Mechanism. Schematically represented in Figure 3. It is assumed that the intelligent credit system will provide the capability of: delivering information from the manufacturer or importer of goods to the decision-making center, processing credit applications, forming a strategy and making decisions, generating an archive of processed applications, and sending the result to the applicant.

Thus, the intelligent credit system will assist the banking sector of Kazakhstan in capturing key aspects of business processes within the framework of financing manufacturers/importers of goods (actions taken, methods of control, resources required for this) and will enable the visualization of the results obtained from these actions.
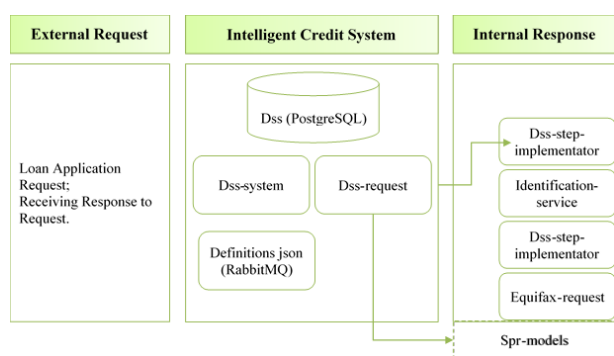

Figure 3. Mechanism of Operation of the Intelligent Credit System

4. Conclusions

In the dynamic landscape of modern banking, marked by increasing digitization and technological advancements, the implementation of intelligent systems emerges as a critical strategy for fostering efficiency, mitigating risks, and enhancing decision-making processes. The elucidated concept of an intelligent credit system tailored for the banking sector of Kazakhstan holds promise in addressing the persistent challenge of non-performing loans while streamlining lending operations. By leveraging contemporary technologies such as Docker Compose, RabbitMQ, and Java, alongside innovative algorithms and analytical tools, this proposed system stands poised to revolutionize credit assessment and decision-making processes. Through the seamless integration of configurable analytical components within existing banking infrastructure, it promises to deliver prompt, data-driven insights to facilitate informed lending decisions. Consequently, the envisioned intelligent credit system not only aligns with the strategic objectives of Kazakhstan's banking sector, emphasizing digital transformation and microservices architecture, but also embodies a transformative paradigm shift towards leveraging artificial intelligence for sustainable growth and risk mitigation. As the banking sector of Kazakhstan embarks on a trajectory of recovery and digital transformation, the adoption of intelligent systems represents a pivotal step towards fostering resilience, innovation, and competitiveness in the global financial landscape. We believe that this will increase the business efficiency of lending in the Republic, reduce risks, and improve the dynamics of the development of the banking sector.

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Өндірушілерге/импорттаушыларға арналған несиелерді басқарудың инновациялық жүйесі

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Аңдатпа. Бұл мақалада Қазақстанның банк секторына ерекше назар аудара отырып, қазіргі дәуірдегі интеллектуалды жүйелерді дамытудың теориялық негіздері мен маңыздылығы қарастырылады. Онда Қазақстандық банктік ландшафтқа бейімделген интеллектуалды несие жүйесінің сипаттамасы, мақсаты, функционалдығы, құралдары, технологиялары мен механизмдері түсіндіріледі. Бұл зерттеу цифрландырудың, озық технологиялардың және жасанды интеллекттің банктік операцияларды кеңейтудегі, әсіресе жұмыс істемейтін несиелерді өтеу және несиелеу тиімділігін арттыру контекстіндегі шешуші рөлін көрсетеді.

Инновационная система управления кредитами для производителей/импортеров

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Аннотация. В этой статье рассматриваются теоретические основы и значение разработки интеллектуальных систем в современную эпоху, с особым акцентом на банковский сектор Казахстана. В нем разъясняются описание, назначение, функциональность, инструменты, технологии и механизмы предполагаемой интеллектуальной кредитной системы, адаптированной к казахстанскому банковскому ландшафту. Это исследование подчеркивает ключевую роль цифровизации, передовых технологий и искусственного интеллекта в расширении банковских операций, особенно в контексте решения проблемы проблемных кредитов и повышения эффективности кредитования.

Ключевые слова: цифровизация, технологии, искусственный интеллект, интеллектуальная система, банки, кредит.