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DIGITAL TRANSFORMATION OF BUSINESS: USE OF BLOCKCHAIN IN THE OIL & GAS INDUSTRY

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Abstract. The relevance of this paper is due to the rapid development and spread of modern digital technology in many areas of human activity, including the oil & gas sector. Effective communication between oil traders and banking organizations urges both parties to reimagine the approach of data and financial exchange. This brings new challenges to today's digital transformation of such organizations. The paper analyses possible applications of blockchain as well as explores the practical implementation of a blockchain platform in a petroleum trading company on the example of a payment execution process which involves three parties – client, petroleum trader and bank.

Keywords: digital technology, blockchain system, digital transformation

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ЦИФРОВАЯ ТРАНСФОРМАЦИЯ БИЗНЕСА: ИСПОЛЬЗОВАНИЕ БЛОКЧЕЙНА В НЕФТЕГАЗОВОЙ ПРОМЫШЛЕННОСТИ

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Аннотация. Актуальность данной статьи обусловлена стремительным развитием и распространением современных цифровых технологий во многих сферах человеческой деятельности, в том числе в нефтегазовом секторе. Эффективное общение между нефтетрейдерами и банковскими организациями побуждает обе стороны переосмыслить подход к обмену данными и финансами. Это создает новые проблемы для сегодняшней цифровой трансформации таких организаций. В статье анализируются возможные применения блокчейна, а также исследуется практическое внедрение блокчейн-платформы в нефтетрейдинговой компании на примере процесса исполнения платежа, в котором участвуют три стороны — клиент, нефтетрейдер и банк.

Ключевые слова: цифровые технологии, система блокчейн, цифровая трансформация

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Introduction

In the modern world, the data that companies possess is one of the most valuable assets on a par with the products they produce. Information can and should be used to support internal and external business processes of companies. In the era of Big Data, organizations gain access to a huge amount of data that brings great value in terms of studying, for example, customer preferences or internal performance indicators. Supply chain management concerns four flows: material flow, business flow, capital flow, and information flow. Driven by data, every department in the supply chain can exchange information with the adjacent ones and transfer information between different manufacturers. Quicker response, faster delivery, and more informed decision making can help a manufacturer to enhance the service level (Qi, 2019). So, the application of advanced Big Data analytics in supply chain management can help to improve decision making for all activities across the supply chain. In particular, in inventory tasks, big data can help organizations to design modern inventory optimization systems, predict inventory needs, respond to changing customer demands, reduce inventory costs, obtain a holistic view of inventory levels, optimize the flow and storage of inventory, or even reduce safety stock (Fern ndez-Caram s, 2019). Also, supply chain decision making is increasingly reliant upon access to real-time data. With a better understanding of data, a supply chain manager may effectively replace product flow with information flow, at a considerably reduced cost (Basolea, 2018).

Data flows need to be monitored and managed. Security and privacy preservation are important concerns for Industry 4.0 applications. There may be chances of unauthorized data breaching or information leakage leading to the financial losses to Industry 4.0-based applications. The blockchain technology has the potential to handle various security attacks as it can eliminate the need of the centralized

authority to perform various operations. In the blockchain technology, a number of users participate in transaction verification and validation. It uses a structural distributed database which stores data from all the nodes in an encrypted form validated (Bodkhe, 2020). As the database is distributed, so there is a risk of getting crashed or corrupted. Transactions are linked together with cryptographic keys and immutable ledgers which makes it difficult for attackers to manipulate or delete the recorded information (Amiri, 2021). Data is always stored in an immutable manner using timestamps, public audit and consensus mechanisms. The use of these mechanisms makes security architecture a robust and assures data integrity and privacy (Monrat, 2019).

In this paper, will be discussed the implementation of a blockchain platform in a company that specializes in trading of petroleum products in Russia – Petroleum Trading. With this implementation the process of accepting and processing payments between the company's customers, Raiffeisenbank, as a servicing bank, and the company itself will be automated.

In such a competitive market of petroleum products, mainly due to the strongest positions of such large companies as GazProm, ROSNEFT, Lukoil [1], the success of the players in this segment is influenced not only by the quality of the supplied raw materials, but also by the quality of service – the speed of payment acceptance, the speed of shipment and flexibility in service conditions [2]. Since the current processes of processing interbank transactions (the supplier company and its client do not always have accounts in the same bank), although possible for a certain period of time, they do not allow payments to be made in a matter of minutes, as well as they do not ensure one hundred percent immutability of transactions (the impossibility of forgery of any documents) (Cocco, 2017). These circumstances lead to the issue of optimizing the process of accepting and processing payments for an oil trading company.

With the development of blockchain technology, it has ceased to be associated only with the cryptocurrency, for which it was originally created to support (Monrat, 2019). The most popular niche for the use of blockchain after cryptocurrencies is precisely the financial sector (VK Cloud Solutions, 2019). Taking into account the main characteristics of this technology, which consist in the use of a distributed registry in which each block of information contains a set of confirmed transactions (Cocco, 2017), it can allow not only to exclude some intermediaries from the service payment chain, but also to increase security and transparency for network participants at the same time, reduce human labor costs.

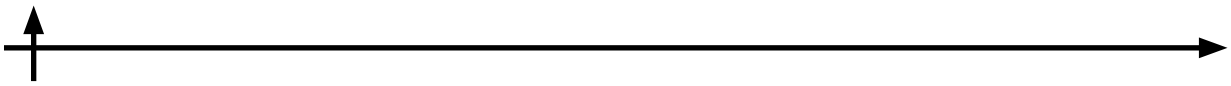
The purpose of this work is to consider the concept of using blockchain in the oil sector from the point of view of Petroleum Trading and its assessment in the context of working with many different clients. In the current conditions, the company and its clients need to constantly monitor the transactions made in order to make various data-driven decisions regarding not only asset allocation, but also logistics. Thus, the integration of the blockchain platform between Petroleum Trading and Raiffeisenbank should be based on the principles of continuous access to transaction information of all deal participants, high speed of document flow and flexibility in the customization of the system for the company.

Materials and Methods

The following was used as methods of research of the given topic: logic, analysis, systematization of data.

The energy sector, in addition to being one of the most important sectors in today's society, is at a time of profound change. This transition is due, among other reasons, to the population's need to consume renewable energies. The population is realizing the impact that the consumption of non-renewable energies has on the environment and is concerned about it. Not only that, but new business models and a new type of digitized and environmentally concerned consumers are also emerging.

Blockchain technology is offering many advantages to the energy sector. On the one hand, new companies are being born whose strategy includes Blockchain as the main element. But, on the other hand, there are already many traditional energy companies that are looking for ways to apply this technology in their activity. For example, Iberdrola at the beginning of 2019 launched a project through which it is



intended to accelerate the decarbonization process. The main objective is to certify that the energy supplied by Iberdrola and the energy consumed by the customer is 100% renewable. The first experience has been carried out with the Spanish bank Kutxabank, "which has been able to trace the origin of the energy supplied by Iberdrola, from the generation asset to the point of consumption" (Iberdrola website, 2019).

Blockchain overview

A blockchain, or "chain of blocks", is a "single source of truth" of shared information, such as data related to financial transactions (eg: an amount in bitcoins), legal contracts, property titles and documents identification. The information is recorded in a database distributed in different transaction three nodes (e.g., a computer) in a network on the Internet and is structured and encrypted in such a way that it cannot be altered without the consent of the majority of nodes in the network (which automatically and simultaneously verify the change compared to the database). Any change, such as payment made from person A's bitcoin wallet to person B's, must be requested by the data owner (person A, in this case) using a combination of public and private keys that validate the identity and legality of the transaction (Huaimin W., 2018).

The greater the number of nodes in a network, the more secure it is, since any fraud attempt would require corrupting the same chain on every node in a network simultaneously during the few seconds that the chain processes the change (Centobelli P., 2022). This process directly affects the underlying theme of trust in society and the business world, which creates the need for validation by a third party (e.g., by banks or lawyers), since the network itself validates the change. When new information is added to the chain, a new block is created, which is connected to the previous one (containing or contract related to it) and, therefore, the historical data remains in the chain and provides an audit trail.

For example, in a relatively simple transaction, such as buying a home, currently, the seller would have their lawyers draw up the paperwork, the terms would be agreed upon, the contracts would be physically signed by both parties, proof of payment would be provided, and, subsequently, the lawyers would be in charge of transferring the property title. Using blockchain technology, the seller could send the contract with the digital certificate of ownership of the house to the buyer through the chain. Once the buyer fulfilled the conditions of the contract and made the payment, the contract would be executed automatically and the digital certificate of ownership would be transferred to the buyer.

The nodes in the blockchain validate the transaction and simultaneously update the database. In this way, the updated entitlement can be checked on any node. The transaction is completed quickly, without the need for a third party to verify the signatures and payment, and the ownership history is kept in a safe and unquestionable place: the chain.

Among the main potential advantages of blockchain technology, it is worth highlighting:

1. time and cost savings;
2. greater transparency for individuals, companies and authorities;
3. a lower risk of fraud and litigation.

Time and cost savings and greater transparency

In complex transactions for the purchase of goods, for example, buyers issue orders; carriers, delivery notes; sellers, invoices; and the banks release the corresponding funds, all of which are formalized through contracts, contractual conditions and numbering systems that allow tracking, delivery and payment (Rahul C.B.M. 2018).

The use of blockchain technology for these activities would drastically speed up the process, eliminating the current need to include the intermediaries for the validation of documents and the release of products and funds. Likewise, it would generate a clear audit trail of documentary blocks marked with the date and time, which could be accessed by the tax authorities, among others, in real time, which would result in greater transparency and reduce the administrative burden for the involved parts (Yu H.,

2021).

Reduced risk of fraud and litigation

Companies have important administrative expenses in order to guarantee trust with their counterparts and reduce costs of possible misunderstandings, litigation and fraud. This covers the drafting and monitoring of all contracts, as well as compliance, reporting and monitoring, both internally and with its service providers, along with supporting documentation. If the documentation and identity of the participants, as well as their location, the type of asset and its value, were recorded and added to the block chain, any litigation that might arise could be settled by the participants, who would only have to consult that single database, instead of reconciling different databases and contracts.

Main uses of the blockchain technology and possible applications for oil and gas companies

The oil and gas sector presents particularly interesting opportunities to take advantage of blockchain technology in view of the high transaction values (and therefore the risks) and economic pressures to reduce costs. A secure system capable of mitigating risk, increasing transparency, providing an audit trail and speeding up transactions at a significantly lower cost could be of interest to oil and gas companies. Next, taking into account the main applications of blockchain technology, we will examine its possible use in this sector.

One of the advantages of cryptocurrencies, such as bitcoin, is the considerable reduction in costs associated with cross-border payments, in addition to the immediacy of transfers, which eliminate the need for intermediaries and the time required for them to validate and release the funds.

Oil and gas are sold in high volumes, representing considerable value, with a size and scale similar to transactions between banks. Likewise, the frequency of transactions is also high. For example, a refinery that produces 300,000 barrels of oil per day will need to use a large tanker each week to maintain adequate volumes, and such transportation can cost up to US $100 million (two million barrels at $50 each).

Oil companies must also take into account the real origin of the crude oil. Sometimes, exporting nations are subject to sanctions that prevent trade in this raw material. Thus, blockchain technology could provide a fully transparent and secure record of the entire supply chain.

When using a distributed database, digital tokens or currencies can be used to represent the asset that is the subject of the transaction. A recognized authority could issue such digital currencies to meet the needs of businesses or participants. For example, if oil and gas companies were to use a blockchain database to trade barrels of crude oil, the transactions could include digital currencies called Brent or WTI. These coins would represent the underlying asset, a barrel of oil, and would remain linked to it digitally through their journey through the supply chain. Currently, around 9% of crude oil transactions are subject to litigation, which amounts to about 150,000 million dollars annually. Through the use of tokens or digital currencies on a blockchain, payments could be processed faster, documentation such as transfers of ownership would be eliminated, and the number of transactions would be significantly reduced.

Smart contracts

Oil and gas contracting can be complex, with lengthy contracts and agreements. Often, a contract is adjusted based on a change order that needs to be tracked, and in some cases, contracts can be agreed years before they are scheduled to be executed.

Smart contracts are self-executing contracts, based on agreed criteria and written in code, which remove ambiguity from the terms and reduce the need for drafting and interpretation by lawyers. When the contract criteria are met, ownership or payment, for example, are transferred automatically. A smart contract could be modified whenever the parties agree, and a record of all its versions and modifications would be kept. Subsequently, it would be executed automatically once the criteria of the latest version were satisfied. Criteria could include payment or even government authorization of the transaction. This could save time and costs when it comes to interpreting legal terms and keeping track of records, and government authorities could access the relevant parts of the contracts to audit or pre-authorize their tax

treatment (Nikolaev A. 2021, Zhang L., 2022).

Joint ventures are common in the oil and gas sector and generally require a series of complex contracts (e.g. relating to the distribution of costs and benefits), which could take the form of smart contracts. Most contracts contain audit clauses that give the parties the right to audit each other to ensure that they are all complying with the contract. Through the introduction of an on-chain database for the recording of joint venture transactions and the use of smart contracts to define, negotiate and execute contractual terms, it will be provided to all parties involved, including tax authorities. This single audit trail, agreed upon by all participants, will considerably reduce the effort required to ensure timely compliance with tax and reporting obligations, as well as the effort expended by tax authorities to understand tax positions (Balcerzak A, 2021).

In the framework of a global sector, companies in the oil and gas sector must consider the consequences related to double taxation and transfer prices. The use of smart contracts for transfer pricing profit allocation is another area with potential for simplification, greater transparency and overall cost reduction.

Results and Discussion

The context of the chosen process

Petroleum Trading is a young independent company that, being a participant in a highly competitive market, tries to implement modern IT solutions in its business processes. The company interacts with both large and small counterparties, selling all kinds of petroleum products - light and dark petroleum products and LPG.

The company's clients strive to receive their petroleum products quickly and continuously under some types of contracts. However, in general, contracts in the petroleum products market have historically been characterized by a large number of identical transactions, for which a significant number of documents are required, which means time and financial costs [3]. It is in such conditions that the company in question should provide fast payment processing (which mostly depends not on itself, but on its bank), and, accordingly, fast shipment of raw materials.

The process of making transactions from a financial point of view involves several parties, which certainly affects the speed of money transfer between counterparties (Asteriou D., 2021). The modern banking system working with large organizations still does not allow fully automating business processes for the rapid receipt, processing and transmission of payment information from the client to the supplier company (Batae O.M., 2021). On the part of sellers and buyers, there is a large number of involved employees, manual work to maintain the workflow, tracking the execution of the contract and processing payments. It is for this reason that the organization in question seeks to automate its processes to eliminate errors related to the human factor, to ensure fast and correct document flow.

The description and analysis of the chosen process

Making payments on transactions is one of the key processes that is implemented before the delivery of ordered products to customers. As a rule, it is a cycle from placing an order to confirming payment and shipment of goods between the buyer company, the supplier company and the banks of these organizations (or one bank, if both organizations are serviced in one place). At each stage of the transaction process, sets of documents confirming the status of the order should be formed not only for the purposes of internal control over its execution, but also due to legal requirements (tax and other reporting). A simplified diagram of this process is presented in Figure 1.

As follows from the diagram, after placing an order by the client through the official website or mobile application, the Petroleum Trading ERP system forms a contract and a document with payment details and sends them by e-mail to the client. The client, for his part, pays for the order through his bank and sends information to the company. Raiffeisenbank, which is the servicing bank of Petroleum Trading, checks the company's current account and transfers funds to it. After the financial transaction, the bank

notifies both parties about the payment status of the order. From this moment on, the supplier company attaches the order payment notification to the existing package of documents and ships the goods.

This process involves a lot of manual labor in the process of communication between the parties to the transaction, the formation and verification of documents. Since payment must be carried out first of all safely and quickly, it is necessary to minimize all possible risks associated with the imperfection of this process using modern approaches and information technologies.

The process of settlement of transactions in the "as is" state has a number of weaknesses that the company seeks to eliminate by implementing an IT solution into its architecture. The key disadvantages are:

1. document flow, partially carried out by employees of the companies involved;

2. high payment processing time by banking organizations and, accordingly, delays in notification of payment status.

These disadvantages include the possibility of making mistakes due to the human factor and the high cost of the process itself due to operating costs and the volume of current assets.

How the process can be improved

The company, already having its own ERP system, seeks to exclude human labor in the process of paying for orders, speed it up and create a common information space for all participants in the transaction.

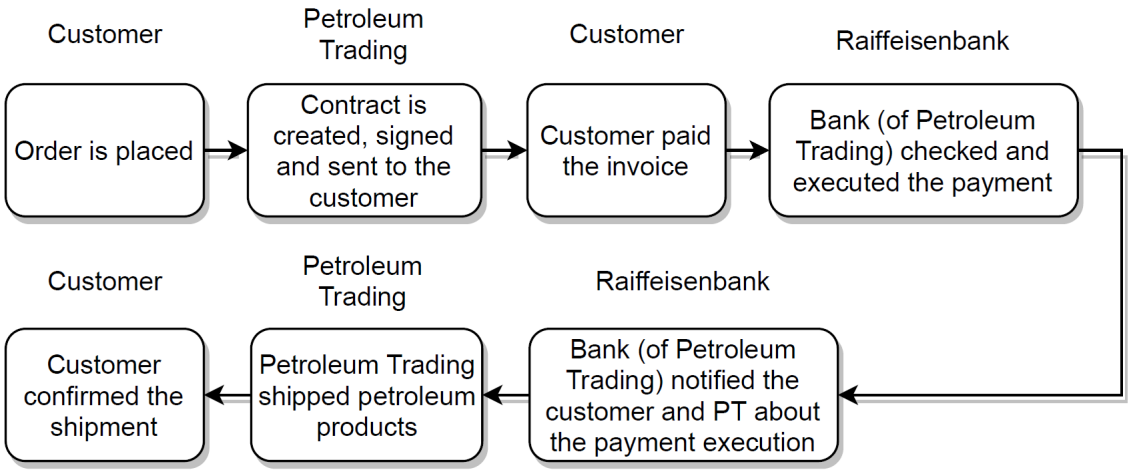


Fig. 1. Payment execution process “AS IS”

A possible option for transforming the order payment process may be to involve a consulting company to conduct research, analyze internal business processes and change them. Such a solution is usually expensive (E&Y company in the Russian market can request up to 200 thousand dollars) and it is possible to deploy it only within the company itself, without the participation of Raiffeisenbank. Also, such a transformation of the business process does not make it flexible in terms of possible changes in the goals and principles of the company. Another possible option is to implement a blockchain platform using smart contracts together with a servicing bank. In this case, the registries of the company and the banking organization are linked for joint fast and automated work. The implementation of the platform requires the active participation of both parties in the project, because it is about the mutual integration of systems sensitive to stored data.

Since Raiffeisenbank is one of the largest banks in Russia, it has sufficient professional resources to develop and deploy a blockchain system and will not require the involvement of third-party specialists (including for security reasons). Petroleum Trading will also involve its own specialists, since the involvement of a third party (that is, a third-party developer company) has some disadvantages:

1. the complexity of supporting the developed solution;

2. the complexity of making changes to an already developed product;

3. the probability of a significant change in cost and execution time during the project.

Thus, the payment process in the "as it should be" state will be a sequence of iterations depicted in Figure 2.

The description of the to be applied technology

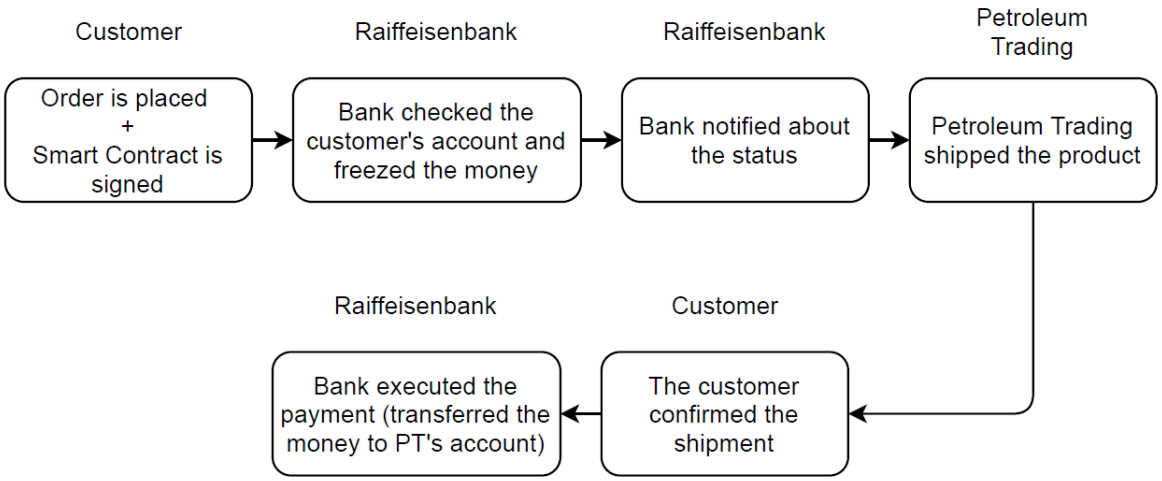


Fig. 2. Payment execution process “TO BE”

Petroleum Trading and Raiffeisenbank have come to an agreement to create a blockchain platform for automating settlements with customers using smart contracts. Smart Contract is a computer protocol designed to verify or execute the terms of a contract in digital form. They help people safely use their assets in an open, conflict-free ecosystem based on blockchain, in other words, they are automated digital versions of traditional real contracts (Zheng Z., 2020).

Any blockchain platform in a broad sense includes many components that determine a number of parameters of the target system – the degree of privacy, stability, speed, bandwidth, and so on.

To determine the functionality necessary for the implementation of the platform, the following initial conditions were set:

1. The execution of the transaction is accompanied by the exchange of documents between the parties.

2. The main settlement of the transaction is made through the usual (fiat) settlement channels.

3. All transactions on the transaction must be legally confirmed as much as possible based on. the current regulatory documents and regulatory provisions.

4. All operations and signals of transitions between operations should be automated as much as possible.

The analysis of the initial conditions implies the need to use the following functional components:

1. Blockchain - as a trusted register of transactions and the execution environment of smart contracts that ensure the transaction.

2. Decentralized File Storage (DFS) - as a medium for storing and sharing files related to a transaction.

3. Certified SCSI - as a means of providing additional encryption, legally significant electronic signatures and protected timestamps. In addition, it can be used to organize an additional virtual file access distribution layer if DFS does not support multi-user access mechanisms.

4. Oracles and providers of external requests - for access to the bank's accounting systems and sources

of events from the outside environment (BlockchainHub, 2019).

5. Document analyzers - for automatic analysis of documents submitted by the parties to confirm the terms of execution of the transaction.

During the preparation and execution of the transaction, the platform components actively interact (Figure 3).

Client software (for example, mobile banking). It is used to enter the initial information on the transaction, create the necessary smart contracts and manage the status of smart contracts at manual stages of the business process. It should be noted that the manual stages of the business process can mean both those stages at which real "personal" user actions are required — for example, attaching documents to a smart contract, and in general any stages at which the status of a smart contract is changed without using its internal logic - outside the blockchain. The latter case can be attributed to the verification of documents attached to the smart contract on the bank's accounting systems, which can occur automatically, but outside the blockchain.

The files attached to the smart contract are signed by an enhanced qualified EDS (electronic digital signature) of the creator for his unambiguous legally significant identification. Further, the files are encrypted with the formation of a crypto package that can be decrypted only by the participants of the transaction. The resulting cryptographic package is placed in DFS, while the hash of the source file is stored on the context of the smart contract, as well as the address (link, manifest) of the storage object given to DFS. The address of the storage object allows you to extract a cryptographic message from DFS, decrypt it (to the participants of the transaction) and process it properly.

When processing transactions, a smart contract can use the information of broadcast oracles, for example, control the date of receipt of a transaction by calendar, use exchange rates, etc.

When switching to a certain status, a smart contract can send a certain request for an expected external event or an order for the execution of an external action to the Provider of external requests. When external events "ordered" by the smart contract occur, the Provider sends a transaction with information about the event to it. Based on the results of processing this transaction, the smart contract can switch to a new state or remain in the same state pending the occurrence of subsequent events.

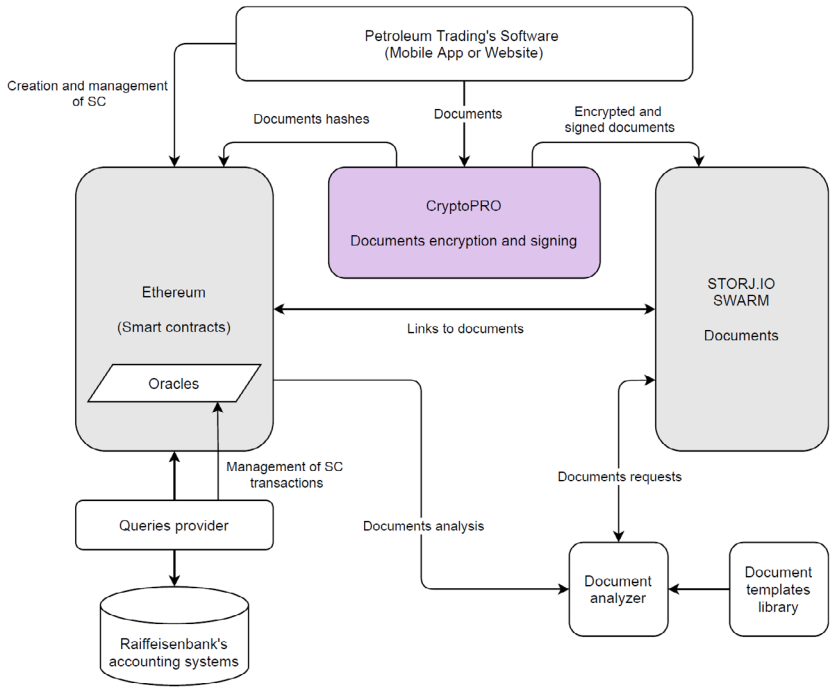


Fig. 3. Platform scheme

Similarly, to external requests, when attaching certain formalized documents to a smart contract, the smart contract can send them to the Document Analyzer for analysis, followed by waiting for a transaction with the results of the analysis.

Implementation including indication of the costs/time, cost benefit analysis and break-even point

The main purpose of the implementation of the blockchain platform between Petroleum Trading and Raiffeisenbank is to reduce the time for making payments, automate the workflow of transactions. This implies, first of all, a reduction in the cost of personnel performing documentation and control tasks and costs associated with a reduction in current assets (about $ 50 000). Development and implementation tasks were carried out by full-time programmers of Petroleum Trading (labor costs for 150 hours about $ 7 500), and Raiffeisenbank developers also participated; their work is paid for the license and maintenance for the company ($15 000 and $ 1 000). A comparison of financial results is presented in Table 1.

Since the transformation of the order payment process affects only indirectly affects the increase in the company's revenue (improving the reputation, improving customer experience, and so on), it is more correct to determine the changes in the company's costs.

Table 1. Financial results analysis

Parameter	Before implementation	After implementation
Revenue (per month)	$ 42 000 000	$ 42 000 000
Costs (per month)	($ 41 900 000)	($ 41 850 000)
Platform investment costs	–	($ 22 500)
Platform operating costs	–	($ 1 000)
Net Profit	$ 100 000	$ 126 500

To calculate the effectiveness, it is necessary to calculate the static indicators IRR (Internal Rate of Return) and PP (Payback Period):

$$IRR = \frac{NP_2 - NP_1}{TIC}$$

$$IRR = (126500 - 100000) * \frac{12}{22500} = 14.13(\frac{1}{year})$$

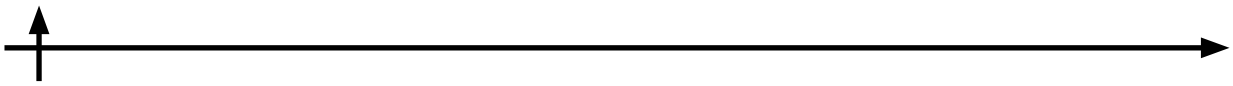
$$PP = \frac{TIC}{NP_2 - NP_1}$$

$$PP = \frac{22500}{126500 - 100000} = 0.85(months)$$

These indicators mean that the development and implementation of the blockchain platform will bring the company about $14 additional profit per year for every dollar of investment costs, and it will pay off in about 0.85 months.

Conclusion

The potential uses of block chain technology are numerous and varied, and it is starting to catch on. In the oil and gas sector, as in many others, companies could be faced with the dilemma of adopting new technologies in a pioneering way and, in doing so, revolutionizing their own sector and business model, or continuing to focus on their main areas of activity and wait for other players to revolutionize the market. The rate at which blockchain technology is adopted and markets transfigured remains to be seen, and to some larger companies, which will need to work side by side to drive innovation and solutions, given the global and collaborative nature of this technology. For their part, oil and gas companies



could consider establishing or becoming part of working groups to explore blockchain technology and its possible applications or start testing it with a trusted partner to better understand this technology and the value it brings.

This paper explored the implementation of a blockchain platform for payment process automation between a supplier and buyers. The creation of such a platform is the result of the joint work of Petroleum Trading and Raiffeisenbank. From the point of view of efficiency, the introduction of blockchain in this process has had a positive impact on the company's financial results. Taking into account the focus of Petroleum Trading on the implementation of innovative solutions in internal business processes, it was able to achieve a significant reduction in the time of payments execution with customers, simplifying document flow and thereby reducing its costs.

Blockchain is a modern tool for supporting many business processes. It ensures data security, connects various process participants with a single information field and reduces the time for performing various operations. For this reason, the company under consideration can expand the functionality of the blockchain platform to transform its processes.

It should also be noted that Raiffeisenbank also benefited from the integration of the platform in the company, because it not only strengthened partnerships with a large client, but also gained the opportunity to attract new customers from among the customers of Petroleum Trading.

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DEVELOPMENT OF BUSINESS MODELS OF SERVICE COMPANIES: THEORETICAL AND METHODOLOGICAL ASPECTS

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Abstract. This article discusses the theoretical and methodological aspects of the development of business models of service companies. In the course of the research, a terminological analysis of the concept of "business model" was carried out, two main approaches to the definition of a business model were identified: the first involves focusing on the value that the company creates for its external customers, and the second directs the focus of attention inside the company, on the flow of its business processes. As a result of the study, various options for the application of business models are considered, the main stages of their life cycle are illustrated. Based on the consideration of various theoretical and methodological concepts of building business models, an example of how a strategic canvas could look like in the service market is presented. As a result of the study, it was revealed that currently the most optimal for service companies are component approaches to the development of business models, which suggest considering the company as a set of interacting and complementary elements, since for successful business in modern conditions, the company must have the ability to see and recognize what is happening outside its own market, in particular including its closest competitors.

Keywords: business model, business concept, component approach, consumer value, business architecture, operating model, revenue model

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РАЗРАБОТКА БИЗНЕС-МОДЕЛЕЙ СЕРВИСНЫХ КОМПАНИЙ: ТЕОРЕТИЧЕСКИЕ И МЕТОДОЛОГИЧЕСКИЕ АСПЕКТЫ

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Аннотация. В данной статье рассмотрены теоретико-методологические аспекты разработки бизнес-моделей сервисных компаний. В процессе исследования проведен терминологический анализ понятия «бизнес-модель», выявлено два основных подхода к определению бизнес-модели: первый предполагает ориентацию на ценность, которую компания создает для своих внешних клиентов, а второй направляет фокус внимания внутрь компании, на протекание ее бизнес-процессов. В результате исследования рассмотрены различные варианты применения бизнес-моделей, проиллюстрированы основные этапы их жизненного цикла. На основе рассмотрения разнообразных теоретических и методических концепций построения моделей бизнеса представлен пример того, как могла бы выглядеть стратегическая канва на рынке сервисного обслуживания. В результате исследования выявлено, что в настоящее время наиболее оптимальными для сервисных компаний являются компонентные подходы к разработке бизнес-моделям, которые предлагают рассматривать компанию как совокупность взаимодействующих и взаимодополняющих элементов, поскольку для успешного ведения бизнеса в современных условиях, компания должна обладать умением видеть и распознавать то, что происходит за пределами собственного рынка, в том числе своих ближайших конкурентов.

Ключевые слова: бизнес-модель, бизнес-концепция, компонентный подход, потребительская ценность, бизнес-архитектура, операционная модель, модель дохода

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Introduction

The high level of competition, the growing needs and expectations of customers, the rapid development of the IT infrastructure, the sharp aggravation of the economic and political instability of the country force the company to continuously update and improve its activities in order to instantly adapt to changes in the external environment and improve the effectiveness of its activities.

Today, it is becoming increasingly difficult for most organizations to maintain a competitive advantage. A wide range of products and services offered, the use of advanced technologies, high quality of service and other factors of maintaining competitiveness have long been transformed into minimal conditions of presence on the market. To date, the solution of issues of improving the efficiency of the functioning of economic entities is not possible without the formation of their effective business model.

In this context, the company's competitiveness is higher the better it is able to take into account not only the changing market conditions, but also analyze and adjust its internal business environment to market requirements, represented by various elements that are aimed at creating value and turning this value into profit.

In order to develop a unified understanding of the mechanism of operation of a particular business

unit, it is necessary to understand what actions and in what sequence are performed in the company on the way to creating a useful product for consumers and achieving the desired results of activity. This helps the company to identify and analyze the business processes that form the basis of its business model.

It is the description of the processes taking place in the organization that allows you to see a holistic picture of its work, identify the reasons that hinder the achievement of the goals set, and develop recommendations for their elimination to improve the financial and economic performance of the company as a whole.

The modern theory and practice of business management has a large number of different approaches, methodologies and methods that allow organizing the company's activities in the most effective way. One of the most effective tools for describing the basic principles of the creation, development and successful functioning of an organization is the business model. It not only allows you to visualize and analyze the complex mechanism of the company's work, but also to identify its strengths and current problems, to find opportunities for optimization and improvement of activities.

Despite the fact that the real interest in this approach in scientific circles appeared in the mid-1990s, to date, scientists have not yet come to a single and generally accepted definition of the concept of "business model". Table 1 provides examples of interpretations of this term.

Table 1. Terminological analysis of the definition of "Business model"

Author	Definition
V. Jang Kim, Mauborn Rene (2005)	A business model built in the following sequence – exceptional utility, strategic pricing and target cost (profit) – leads to value innovation (Kim Chan, 2017).
Henry Chesbroke (2006)	A business model is a way that a company uses to create value and generate profit.
Kotelnikov V.Yu. (2007)	The business model of an enterprise is a representation of a business (enterprise) that actually exists or is planned in the future in a form that can clearly demonstrate all the significant properties and features of the company associated with its ability to make a profit and be competitive.
Hamel G. (2007)	A business concept and a business model are made of the same test: a business model is just a business concept put into practice (Hamel, 2007).
Markides K. (2010)	The business model is the sum of the answers to three main questions. Who is my target audience? What products or services will be my value proposition and what will be its competitive advantage? How can I do this effectively (Markides, 2008).
A.Osterwalder, I. Pinier (2010)	A business model –is a representation of how an organization makes (or intends to make) money. It describes the value that the company offers to various clients, reflects the capabilities of the organization, the list of partners, the capital relations necessary to obtain sustainable income streams (Osterwalder, Pinye, 2013).
Shubin A. (2016)	The business model is a comprehensive view of how a company chooses its customers, how it differentiates its offer and through which channels it brings it to target customers, which business processes are key for the company, how resources are used, and finally, how it makes a profit for owners (Shubin, 2016).

Summarizing the definitions presented in the table, it should be noted that they are all distributed according to two approaches: the first involves focusing on the value that the company creates for its external customers, and the second directs the focus of attention inside the company, on the flow of its business processes.

The optimal interpretation is one that combines two visions and may sound like this: "A business model is a visual and logical description of how a company builds its processes in order to create value for customers and profit from it."

Despite the fact that the number and composition of the elements of the business model allocated by the authors vary, four key components can be identified that determine the content of the model of any

organization:

1. the value for external customers that the company offers based on its products and services;
2. a system for creating this value, including suppliers and target customers, as well as value chains;
3. assets used by the company to create value;
4. the financial model of the company, which determines both the structure of its costs and the ways of making a profit (Barjaev, 2020).

Materials and Methods

In this study, analytical methods were used, such as description, grouping of data, causal analysis, evaluation. The use of these methods allowed us to link disparate facts about the current situation in the development and evaluation of the success of business models of service companies in modern economic conditions. The methodological base of the study contains theoretical provisions of public sector economics and management, data from official sources of state authorities and includes methods of critical analysis, theoretical modeling and formalization.

Results and Discussion

There are many options for applying business models. Someone uses them to analyze the effectiveness of their business in comparison with competitors, some companies use this approach to assess their potential and investment attractiveness in the future. For operating firms, the business model is the most important tool of strategic management, which is used to find new growth points, analyze the external environment, develop value propositions and determine the best practices for business development.

Like any product put on the market, a business model has its own life cycle (Tleuba, Seken, Eshenkulova, 2019). If the turning points of the cycles are not identified in time and changes are not implemented in accordance with strategic, tactical and organizational requirements, the company may lose its value. In general, the lifecycle of a business model is illustrated in Figure 1.

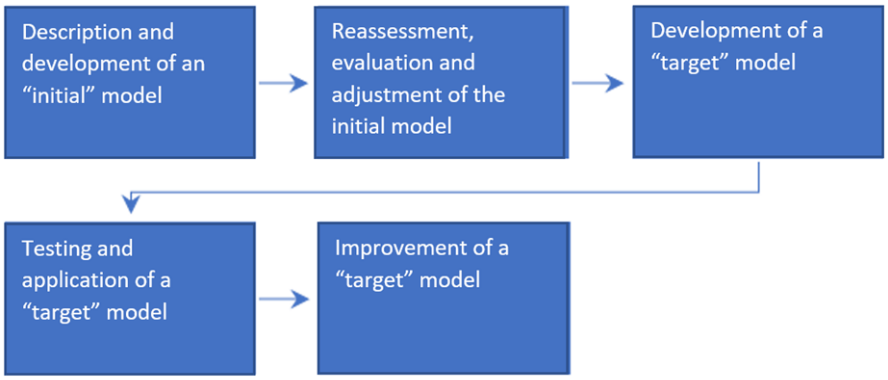

Fig. 1. Business model lifecycle

The construction of any business model is preceded by a thorough analysis of the company's activities, the industry and the industry business system. This is necessary to describe each component of the model with which the company creates consumer value and receives income from it.

If any shortcomings are identified in the course of the company's work, the business model is reviewed and clarified. Taking into account the identified weaknesses, the management develops the "as it should be" model, describing the desired state of the business in the future, and implements it into work.

Back in the 1950s, the pioneers of business modeling - Toyota and McDonalds - proved that continuous improvement of the business model ensures stable profits and cost growth (Slywotzky, 2006). A

model developed once is not the end point on the way to success. In order to maintain its competitiveness and keep up with the times, the company must constantly adapt to the changes taking place in the external environment, revising, updating and improving the components of the business model.

There are many different ways to present a business in the form of a simplified scheme. The tool that management chooses for modeling will affect not only the understanding of the mechanism of the company's functioning, but also the quality of decisions made in the future (Kostin, Shildt, 2020.).

In the management literature, you can find a large number of the most diverse theoretical and methodological concepts of building business models. One of the first approaches, which appeared at the beginning of the XXI century, was proposed by Chang Kim and Rene Mobarn in the book "The Strategy of the Blue Ocean" published in 2005.

The main idea promoted by the authors is that the business world can be conditionally divided into two market spaces – scarlet and blue oceans. To become truly successful, a company should not focus on competitors operating in the scarlet waters and offering similar services and goods. It should look at the market more broadly, go beyond the existing demand and form a strategy that offers value innovation.

At the same time, it should be understood that in order to turn value innovation into a working strategy, the company needs to apply a systematic approach that combines the unity of utility, benefit and human factor (strategic coherence) with a focus on differentiation and cost reduction (without compromise between them) (Dashkov, Chernikova, 2021).

In this concept, the company's business model is presented in the form of a value curve. It forms the basis of such a tool as the "strategic outline", the essence of which is to graphically display the comparative effectiveness of the company, taking into account various factors of competition (Markides, 2010).

Figure 2 shows a conditional example of what a strategic outline in the service market could look like.

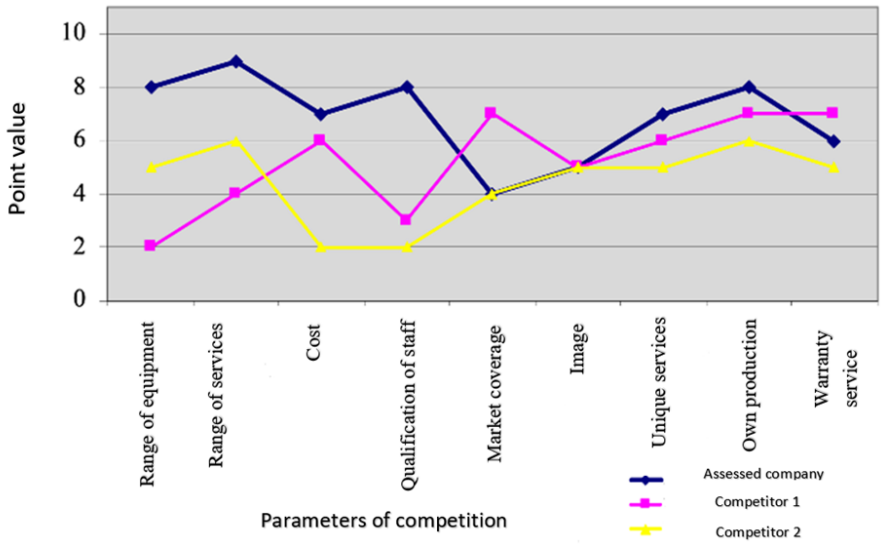

Fig. 2. Strategic outline of the industry

The construction of this model allows the company to see its weaknesses in relation to competitors, which it must overcome in order to improve the value proposition and increase the efficiency of its activities.

Conclusions

In order to create an updated, more competitive value curve, the firm must decide which elements of value for the buyer it should reconstruct. To do this, the four-action model helps, which offers the owners of the company to answer four fundamental questions concerning the strategic logic inherent in

this industry and the principles of doing business:

1. What factors need to be reduced compared to existing industry standards?

2. What factors that the industry takes for granted should be taken out of the spotlight?

3. What factors need to be significantly improved compared to existing industry standards?

4. What factors can be created from those that have never been offered on the market before (Dukki, 2012)

To date, the component approaches to the development of a business model have received the greatest support among researchers and consultants, which suggest considering the company as a set of interacting and complementary elements.

For example, in his work M. Johnson, K. Christensen and X. Kagermann identified four components of the business model:

1. The value offered to consumers (customer value preposition). It includes analysis of key consumers and needs that need to be met, as well as the development of a company's offer based on the desired value.

2. Profit formula. It consists of a revenue generation model, cost structure, marginal profit model and resource circulation rate.

3. Key resources, namely: personnel, products, applied technologies, equipment, information, partnerships, supply channels, etc.

4. Key processes. It includes indicator systems, company rules and established norms (Voronova, Ilyin, 2019.).

The developed offer and the profit formula determine, respectively, the value for consumers and the company, and the key resources and processes indicate how this value will be delivered both to external customers and to the company itself.

The strength of this concept is due to the fact that all the elements of the model are closely interrelated with each other: that is, drastic changes in any of the four components will undoubtedly affect the other three and the entire mechanism of the company as a whole (Charikov, 2021.).

An American management consultant, Gary Hamel, highlighted in his book "At the Head of the Revolution" the following elements of the business model:

client interface;

– key strategy (i.e. choosing the way to compete);

– strategic resources (the company's competitive advantages are based on them);

– value network (what surrounds the company complements and reinforces its resources) (Vostroknutov, Loyko, 2018).

At the same time, all components are connected by three intermediaries, or connecting elements, and the factors that determine the profitability potential of the company act as the basis of the business model (see Fig. 3).

According to the author, the only way for the company to get away from the high pressure of competition is to create a business model completely different from everything that was before and exists to this day. For real success, one cannot limit oneself to smooth growth, it is necessary to grow faster than the market by creating a completely new business concept. And each of the components of the model can be used as a lever for these breakthrough changes (Kusakina, 2018).

Despite the wide variety of business modeling concepts, the most optimal and understandable for perception today is the approach proposed by A. Osterwalder and I. Pinier in the book "Building Business Models".

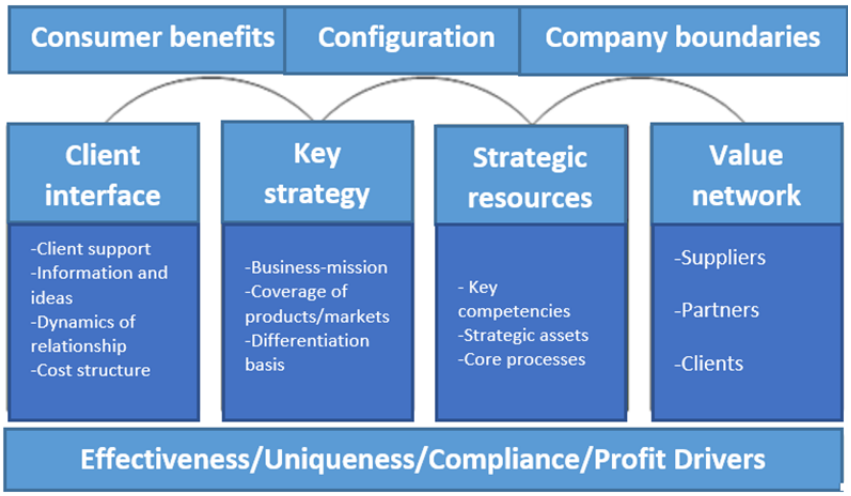

Fig. 3. Elements of G. Hamel's business model

In their work, the authors propose to decompose the company's business model into separate components - structural blocks – reflecting the logic of the organization's actions aimed at meeting the needs of customers, making a profit and ensuring competitiveness in the market with the help of the proposed competitive advantages.

To construct a business model, it is proposed to use a template - a universal language for describing the mechanism of the company's work (Voronova, Orlova, Sheleyko, 2022; Digital economy of Russia, 2024). This template consists of nine blocks reflecting the four main areas of business: customer interaction, supply, infrastructure and finance (see Figure 4).

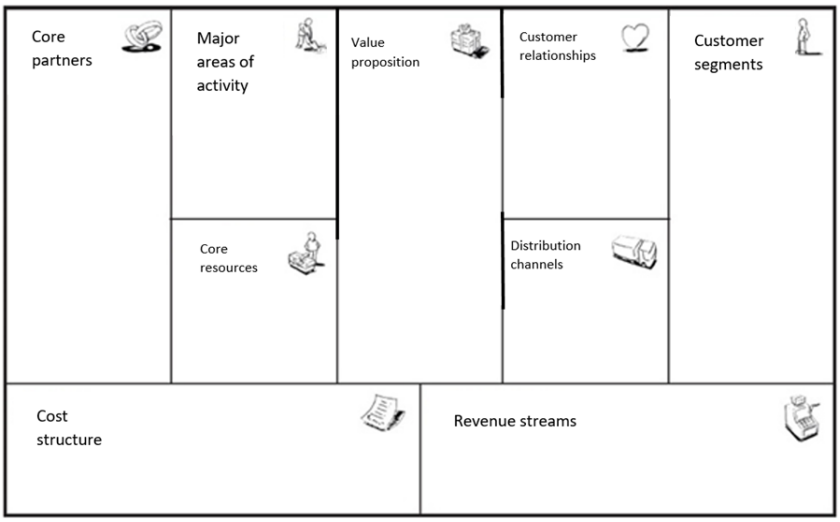

Fig. 4. Business model template by A. Osterwalder and I. Pinier

1. Consumer segments. This block decides which customer segments the company expects to attract and serve. It makes sense to divide customers into different groups if differences in their needs lead to differences in offers.

2. Value propositions. The block includes a description of products and services, as well as distinctive features (competitive advantages) that determine their value to the consumer.

3. Sales channels. This is a block about how a company delivers its value propositions to customers (information channels, delivery, sales channels, after-sales service, etc.).

4. Customer relationships. This block describes the principle by which the company builds relation-

ships with consumer segments.

5. Revenue streams. This block includes all sources of profit from all segments of consumers (taking into account various pricing mechanisms).

6. Key resources. The block is devoted to the description of the most important assets of the company necessary for the successful functioning of the business model (material and intellectual resources, personnel, finance).

7. Key activities. This block contains the main directions of the company's work, without which its effective existence is impossible.

8. Key partners. The block includes the main suppliers and partners involved in the development of the company.

9. Cost structure. This block allows you to describe the main focus of the company's business model. This can be either a focus on maximizing consumer value, or maintaining a minimum cost structure, or a combination of the two listed directions.

It is worth remembering that a one-time analysis and description of the business model is not enough for the successful functioning of the company. It is also necessary to regularly evaluate and update it in order to objectively assess its position in the market and adapt accordingly.

The undoubted advantage of this model over others is its simplicity and visibility. Special knowledge and skills in the field of strategic planning are not required for its construction. Each block can be analyzed separately from the other, and also see how changes to one of the elements will affect the rest. And the information summarized in the scheme gives the management a clear understanding of where there are "bottlenecks" in the company, what is unprofitable to work with, and what, on the contrary, can be improved or radically changed in order to increase customer satisfaction and improve the company's position in the market (Johnson, Christensen, Kagermann, 2009).

If A. Osterwalder and I. Pinier proposed a general concept suitable for all organizations, then A. Shubin adapted the classic outline of the authors' business model for medium-sized and niche retail companies.

According to Shubin, if we present the business model of a retail company at the conceptual level, then it will be based on three interrelated elements:

– interface with suppliers (joint creation of added value: logistics, inventory, personal relationships, shared resources, etc.);

– customer interface (value proposition as a result of correlating the desires of target customers and the company's capabilities);

– an operational model (a system of business processes through which suppliers' goods reach customers and additional value is created) (Denisov, Velinov, Viter, Busalova, 2019.).

To become successful, a company must have the ability to see and recognize what is happening outside its own market, including its closest competitors. A clear understanding of her business model and its constant adaptation to ensure future success will help her in this.

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ASSESSMENT OF STATE REGULATION METHODS IN THE APARTMENT MARKET OF THE RUSSIAN FEDERATION: TRENDS AND DEVELOPMENT PROSPECTS UNDER DIGITALIZATION

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Abstract. The St. Petersburg apartment market is a relatively new and rapidly developing segment of real estate. To choose the right direction of development and the subsequent development of tasks that contribute to the overall economic and social development of the city, it is necessary to correctly classify apartments and identify their trends and prospects. The purpose of the study is to evaluate the methods of state regulation of the apartment market in the Russian Federation in the context of digital transformation, as well as to identify factors that hinder and contribute to their development. In the course of the research, the concept of "apartment" is considered, the classification is carried out and the main differences with related concepts are identified, the main methods of state regulation of apartments in the conditions of digital transformation are considered. As a result of the study, trends in the development of the apartment market have been identified and solutions to the identified problems have been proposed.

Keywords: apartments, residential premises, real estate, government regulation, restrictions, strategy

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ОЦЕНКА МЕТОДОВ ГОСУДАРСТВЕННОГО РЕГУЛИРОВАНИЯ РЫНКА АПАРТАМЕНТОВ РОССИЙСКОЙ ФЕДЕРАЦИИ В УСЛОВИЯХ ЦИФРОВОЙ ТРАНСФОРМАЦИИ: ТЕНДЕНЦИИ И ПРОБЛЕМЫ РАЗВИТИЯ

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Аннотация. Рынок апартаментов Санкт-Петербурга является относительно новым и быстро развивающимся сегментом недвижимости. Для выбора верного направления развития и последующей разработки задач, способствующих общему экономическому и социальному развитию города необходимо верно классифицировать апартаменты и выявить их тенденции и перспективы. Целью исследования является оценка методов государственного регулирования рынка апартаментов российской федерации в условиях цифровой трансформации, а также выявление факторов, сдерживающих и способствующих их развитию. В процессе исследования рассмотрено понятие «апартамент», проведена классификация и выявлены основные отличия со смежными понятиями, рассмотрены основные методы государственного регулирования апартаментов в условиях цифровой трансформации. В результате исследования выявлены тенденции развития рынка апартаментов и предложены решения выявленных проблем.

Ключевые слова: апартаменты, жилое помещение, недвижимое имущества, государственное регулирование, ограничения, стратегия

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Introduction

For the Russian Federation, apartments are a relatively new segment that has not been fully studied. In view of this, there is no clear definition of their concept. To form a definition, we turn to various foreign and domestic sources. In Europe and the USA, the terms "flat" and "apartment" are often used synonymously.

In America, the following definitions of the concept of "apartments" are given:

– Several rooms for living on the same floor (level) of a building or house (Cambridge Dictionary)

– Flat

– A general term for all categories of housing located in an apartment building

The American approach uses the concept of "apartment" to generalize the general definition of a place to stay. In cases where the value "flat" is used, we are talking about elite class housing. The legislation mainly uses the definition of "apartment" (Kovalev, 2020).

In the UK, the approach is different: "apartment" is equated to high-class housing, and "flat" means any ordinary housing located in an apartment building. However, there is no official concept of "apartment" in Europe, and there are also no regulations governing this definition, which allows us to draw a parallel with Russian legislation.

Turning to the various definitions of the concept of "apartment" in our country:

– One or more premises intended for human habitation. The apartment has a plumbing unit, a

kitchen, one or more living rooms. They can be located in residential buildings or commercial buildings, depending on the type.

– Non-residential premises that can be used for temporary residence, as a hotel or rental.

– Premises or complexes of premises arranged in a separate building, having access to common property and the full range of amenities inherent in the apartment.

– A room in a means of accommodation consisting of several rooms with kitchen equipment.

It is important to highlight the general definition of the concept of "apartment": an apartment is a non–residential premises located in a residential complex or in a commercial building, equipped with everything necessary for living, intended for rental or independent living (Kuracheva, 2020).

For a more precise definition, we will conduct a comparative analysis of the characteristics of the apartment and the apartments, which is presented in Table 1.

Table 1. Comparative characteristics of “apartments” and “flats”

Comparison Parameter	Apartment	Flat
Possibility of registration	Temporary, and only if the apartment is a hotel room	Constant
Maintenance of common property	Everything is regulated by the management company	The decision is made by the owners' meeting
The amount of utility payments	On average, it is 15-20% higher compared to the apartment. May be changed by the management company	In accordance with the officially adopted in the region
Main use	Accommodation/income generation	Accommodation
State support	Missing	Use of maternity capital, preferential mortgage conditions, subsidies
Construction	They can be built, as well as under Federal Law 214, and at the developer's own expense	Only under Federal Law No. 214 on Shared-equity construction with the help of project financing
Technical requirements	Missing	SanPiN 2.1.2.2645-10 Requirements for living conditions in residential buildings and premises, Decree of the Government of the Russian Federation of 28.01.2006 N 47 (ed. of 17.02.2022) "On approval of the Regulations on the recognition of premises as residential premises, residential premises unsuitable for habitation, an apartment building in emergency and subject to demolition or reconstruction, a garden house as a residential house and a residential house as a garden house".
Social burden	Is not mandatory. However, developers are trying to ensure the presence of nearby hells, shops, schools, etc.	In accordance with state requirements
Cost	From 250 thousand/m2	From 200 thousand/m2
Property tax	0.1% of the cadastral value	0.5% of the cadastral value
Major repairs	At the expense of the owners	General house contributions and/or at the expense of the regional budget
Management company	Provides a high level of infrastructure: laundry services, cleaning of common areas and rooms, providing areas for work, recreation, etc.	Performs minimal functions for communal maintenance and cleaning

Analysis and identification of differences between an apartment and an apartment is necessary for several reasons:

1. Identify risks and possible consequences resulting from the use, purchase and sale of real estate;

2. Understand the methods of regulating activities and the requirements that affect the issues of residence, income generation, operation and maintenance of premises;

3. Identify the main purpose of buying real estate: own living or income generation;

4. Plan the future "fate" of the property: the possibility of resale, payback period, development trends, etc. (Yakubovich, 2019)

Let's highlight the main advantages of an apartment in comparison with an apartment:

1. Lower property tax;

2. The management company can take on all the burden of maintenance, both for a specific unit and for the complex as a whole, which will ensure a high-quality infrastructure corresponding to the Western level of service.;

3. A new segment in the real estate market, which continues to develop and attracts a large number of investors and tenants in the case of renting an apartment (Kostrikin, Buadze, 2013.).

For further analysis of the concept of "apartments", it is necessary to classify this segment of commercial real estate. Types of apartments:

– recreational;

– non-service/"pseudo-housing";

– service (Kraev, 2021).

Figure 1 shows the percentage of apartments in St. Petersburg by format at the end of 2021.

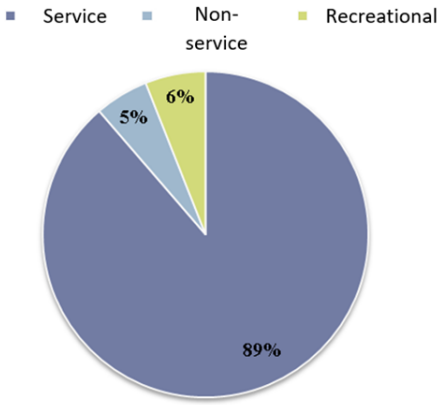


Fig. 1. Percentage ratio of apartments by type in St. Petersburg, %

Recreational apartments are located in the resort areas. As a rule, swimming pools, recreation areas, medical offices, spas are located in such territories. This type of apartment is intended exclusively for recreation. For the most part, such projects appear on the site of former sanatoriums or rest homes, where, according to the requirements of the legislation, it is required to preserve the original purpose of the land with a recreational status. Despite the climate of St. Petersburg, which is dominated by the number of cloudy and rainy days, this type of apartment is at an acceptable level of development: since the beginning of the Covid pandemic, an increasing number of residents of the city have begun to move out of town. This type of apartment allows you to combine outdoor recreation with a high level of service (in comparison with country houses and dachas) (E-Journal RBC, 2022).

Non-service apartments, or, as they are sometimes called, "pseudo-housing" perform all the same functions as residential real estate. Such real estate was built as apartments for permanent residence, but on a plot of land intended for non-residential development. This type of apartment was the first to appear during the crisis of 2008-2009. At that time, developers bought land for the construction of

non-residential facilities, which freed them from the requirements for the availability of social infrastructure, simplified the possibility of construction, which did not have to meet the standards of residential premises, which allowed to reduce the cost of costs. Buyers, in turn, were attracted by a lower purchase price compared to similar apartments. Now these are projects of comfort and business classes, which are located in successful locations, near the metro and/or reservoirs. Most often, non–service apartments are purchased for their own living, less often for renting (Manaenkov, 2019; Zheksembayeva, 2021).

The main difference between service apartments and non–service apartments is the availability of internal infrastructure and a number of services similar to hotel ones. At the same time, service apartments are an investment product with various profitability programs. The peculiarity of this type of apartment is the presence of a professional management company (CC), which takes over the maintenance of the complex, provides the implementation of hotel services and the loading of the room stock to maintain a high level of payments for investors who have purchased apartments. Very often, people who stay in such apartments do not even know that each room has its own owner. They see only an ordinary hotel with an appropriate set of services. In turn, for investors, this type of apartment may have certain purchase conditions: the impossibility of independent living, a mandatory lease agreement with the management company, the inability to terminate this agreement, the mandatory purchase of a tenant package, etc. (Panteleeva, Dmitriev, 2019)

There is often a confusion of concepts between apartments, apart-hotels and hotels. A comparative analysis of these types of real estate is presented in Table 2.

Table 2. Comparative characteristics of the hotel, apart-hotel and apartments (MINSTROY Russia, 2022; St. Petersburg Administration, 2022)

Comparison Parameter	Hotel	Apart-hotel	Apartments
Services	Organized meals in the hotel cafe; reception; additional.services (excursion, currency exchange, taxi order), daily cleaning	Close to the hotel: Cleaning 1 time/3-4 days; breakfast, change of towels, laundry; reception	There is no daily cleaning, usually only the final one. There is no reception
Rules of accommodation	Check-in from 14, check-out until 12. It is forbidden to: find guests after a certain time, hand over keys, pets, noise	Check-in from 14, check-out until 12. The rules of accommodation are less strict than in hotels. For example, pets may be allowed for an additional fee, the possibility of guests staying	Landlords practically do not restrict guests with conditions, there is no ban on accommodation with animals. A deposit may be charged upon arrival, which will not be refunded in case of damage to the property
Infrastructure	Shops, laundries, hairdressers, gyms, swimming pool, conference rooms	Similar to a hotel	It depends on the specific complex: there may be several buildings with all the necessary shops, beauty salons. There may be a separate building near which there is no developed infrastructure
Room equipment	There is no kitchen. Small room size depending on the category. Standard amenities for short-term stays: bed, shower, armchair/chair	Kitchen or small kitchen corner. It is similar in size and equipment to a hotel room	Apartment-type room with kitchen, refrigerator, storage closet
Cost/payment procedure	Daily payment (in output is increased). Discounts and promotions for regular customers and group arrivals	Daily payment (increased on weekends). Discounts and promotions for regular customers and group arrivals	Most often, a lease agreement is concluded for medium and long-term accommodation. The guest also pays for the CU separately (Tanina, Kalmykova, 2020).

It follows from the table that the biggest and most significant differences between a hotel and a separate apartment. An apartment hotel is a mixed concept between a hotel and an apartment, it is a complex with separate apartments, but at the same time it has all the necessary hotel infrastructure and a set of services that can provide a high level of hotel service and profitability for investors.

Materials and Methods

The methodological basis of the research consists of various general scientific methods: collection and analysis of information, comparison, description, classification and generalization of thematic material.

Results and Discussion

Despite the constant development and some uncertainty regarding the new segment of real estate – apartments, the main system of their regulation is included in the general system of regulation of the real estate market of the Russian Federation.

State regulation of the real estate market is carried out using two main methods: administrative and economic.

Let's analyze in more detail each of these methods in the context of the apartment market.

Administrative methods are implemented through the influence of executive power structures. They represent the interrelation of methods and mechanisms of the impact of legal norms and legal requirements. The list of these methods for regulating the apartment market is shown in Figure 2.

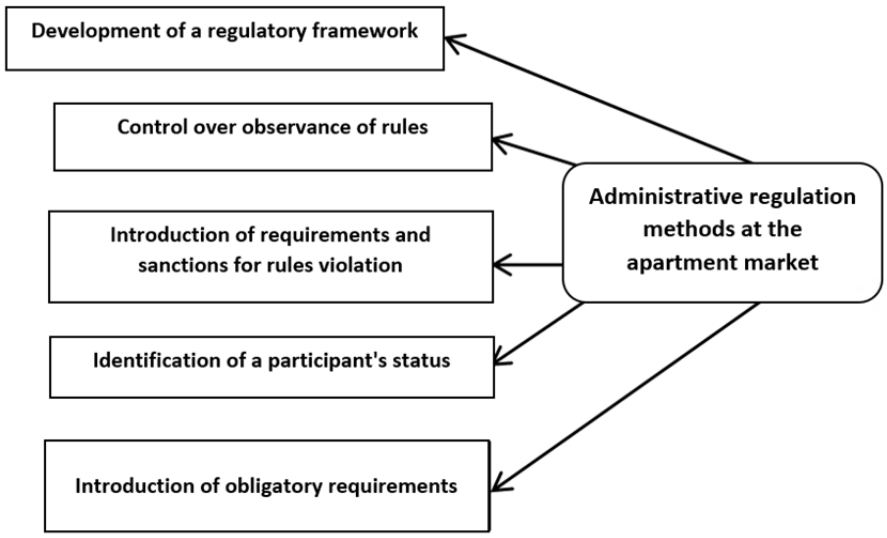


Fig. 2. The content of administrative methods of regulating the apartment market

It is essential to analyze in more detail the regulatory framework of the apartment market, which includes: Legal framework for mortgages (No. 102-FZ "On Mortgage (pledge of real estate)" dated 16.07.1998; No. 122 -FZ "On State Registration of Rights to Immovable Property and Transactions with it" dated 21.07.1997).

It should be noted that due to the different types of apartments, there may be different mortgage conditions. For example, if the apartments are serviced and the lease agreement is mandatory, some banks will not give a mortgage under such conditions. This is due to the fact that the unit, which is collateral for obtaining a mortgage, has an encumbrance for the bank in the form of a long-term lease agreement, which may make it difficult to sell it if the borrower does not pay the loan (Lazarenkova, Alekseeva,

2020).

For the most part, there are 3 types of contract when buying an apartment. An equity participation agreement (valid under Federal Law No. 214 of 2004), which is concluded if the apartment complex is being built from scratch or from the pit. In this case, the equity participation agreement is first registered, after the completion of construction and the signing of the act of acceptance and transfer, the transfer of ownership takes place (Zheksembayeva, 2021).

This type of contract was adopted after frequent cases of fraud by shareholders who transferred their funds to an unscrupulous developer, who subsequently did not fulfill his obligations to deliver the object. The security of shareholders is provided by "escrow accounts", a bank account from which funds become available to the developer only after the completion of construction and commissioning of the facility. Thus, the developer is an interested person in the rapid delivery of the complex. For the construction and the right to sell apartments on "escrow accounts", the developer must provide documents: a construction permit, a feasibility study of the project, constituent documents, accounting reports, etc. (Tanina, 2020)

The preliminary contract of sale is typical for apartments, the construction of which does not happen from scratch, but occurs as a result of the redevelopment of the building. In this case, the buyer signs a preliminary contract of sale, which specifies the conditions for carrying out the procedure of the building (floor), as a result of which there will be a separate cadastral number for each individual apartment. After fulfilling this condition, the main contract of sale is signed, as a result of which the buyer becomes the sole owner of the premises. If at the time of the conclusion of the contract, separate cadastres have already been allocated for each apartment, a purchase and sale agreement is signed with the developer immediately (Mokhov, Dement'eva, 2021).

The contract of sale of premises is a document confirming the mutual consent of the seller and the buyer for the transfer of ownership. This agreement confirms the rights and obligations of both parties that must be fulfilled in order to complete the transaction. Mandatory information that should appear in the contract is: the characteristics of the premises, the justification for the emergence of the seller's ownership, the cost and form of payment. The forms of payment can be:

1. Transfer of cash from the buyer to the seller directly "into the hands" before or after the transfer of ownership (depending on the terms of the contract);

2. The transfer of cash using a bank cell, which can be "opened" by a bank employee accompanied by the participants of the transaction only if certain conditions are met (most often the transfer of ownership, but there may also be other conditions);

3. Transfer of cash by receipt, which indicates the data of the person who received and transferred the money, the exact amount and date of transfer;

4. Transfer of funds by wire transfer to the seller's current account;

5. By means of a letter of credit – a bank account, the condition for disclosure of which is a registered contract. The main difference from a safe deposit box is that the funds are first transferred to a bank account and stored in it until the conditions for the transfer of ownership arise, and only then become available to the seller (Tsokur, 2020).

A cession agreement arises if a client who has concluded an equity participation agreement or a preliminary purchase and sale agreement (i.e. the ownership right has not yet been received) has decided to assign his rights to a future purchase to another citizen. In this case, it is necessary to take into account that the new contract is not concluded with another person, but only passes to him. That is, all encumbrances (if there were any), unpaid contributions to the developer or the bank are transferred to the assignor (the one to whom the rights are transferred) from the assignee (the one who cedes the rights) (Kurakin, 2019).

Non-residential premises for rent

It is regulated by Section 4 of Chapter 34 of the Civil Code of the Russian Federation and Articles 650 (drafting a lease agreement), 651 (registration of a lease agreement), 654 (transfer of an object and

payment establishment).

Depending on what the main goal of the apartment owner is: income generation or own accommodation, the lease agreement with the Management Company can be either short-term (up to 1 year) or long-term (more than 1 year). Also, instead of a lease agreement, the following can be used: an agency agreement, a management agreement.

Execution of the transaction

A purchase and sale agreement, an equity participation agreement, a long-term lease agreement and an assignment agreement (with an equity participation agreement) are subject to mandatory registration in Roseestr. You can transfer documents using the multifunctional center (MFC). On average, it takes 9 working days to register a transaction, and now it is also possible to sign contracts using an electronic digital signature (EDS) and register electronically via the Kontur-Crypto service.

To register transactions, it is necessary to provide documents certified by a notary, among which may be: the consent of the spouse to purchase real estate, a copy of the marriage contract, a notarized translation of the passport (for non-residents).

The various forms of payment described above are also required to rely on a certain sequence of actions, as well as the rights and obligations of the seller, which are most often regulated by the Civil Code of the Russian Federation.

Economic methods of regulating the apartment market will include taxation systems. The following taxes are provided for the apartments:

– Immovable property tax (0.1% of the cadastral value of the premises. Most often it is about 2 times lower than the market price);

– Sales tax. It is 13% for individuals and 6% for Individual entrepreneurs of the total cost of the sale. It should be borne in mind that there are no special tax reduction conditions for apartments compared to apartments. For example, the minimum term of ownership, a large family, a tax deduction.

– Income tax. If the apartment was rented out and the owner received income, he needs to pay 13% or 6% (for sole proprietors) of the profit received. Due to the fact that the apartments are non-residential premises, it is not possible to rent them to the self-employed and pay a 4% tax, since this amount of tax can be paid by renting only apartments.

One of the ways to reduce income tax is to switch to the patent taxation system (PSN). In this case, the tax is also 6%, but the object of taxation is the potential, not the real annual income of the entrepreneur. Switching to this system is not always advisable. Tables 3-4 present a comparison of USN and PSN, depending on the level of income from apartments.

Table 3. Comparison of taxation systems for sole proprietors for an apartment with an area of 37.4 m2 (Apartment analytics, 2022)

	USN Revenue	PSN
the area is 37.4 sq.m., the average monthly income is -73000 rubles	876 000.00	561 000.00
Insurance premiums (SV)	40 874.00	40 874.00
Insurance premiums in the amount of 1% if the income exceeds 300 thousand rubles	5 760.00	5 760.00
Tax rate	6%	6%
Tax	52 560.00	33 660.00
Tax minus SV	5 926.00	0.00
Total taxes	52 560.00	46 634.00
Saving on taxes		-5 926.00

Table 4. Comparison of taxation systems for sole proprietors for an apartment with an area of 22.3 m2

	USN Revenue	PSN
area-22.3 sq.m., average monthly income-43400 rubles	520 800.00	334 500.00
Insurance premiums (SV)	40 874.00	40 874.00
Insurance premiums in the amount of 1% if the income exceeds 300 thousand rubles (for yourself)	2 208.00	2 208.00
Tax rate	6%	6%
Tax	31 248.00	20 070.00
Tax minus SV	0.00	0.00
Total taxes	43 082.00	43 082.00
Saving on taxes		0.00

It can be seen from the tables that the transition to the patent taxation system does not always reduce the amount of tax paid. PSN will be beneficial if the actual income is more than the potential possible. Also, in case of an increase in profit, the value of the patent remains unchanged, and under the simplified taxation system, the amount of tax will increase, which will also help reduce payments.

Another economic method of regulating the apartment market by the state is the implementation of state targeted programs.

Since apartments do not belong to residential premises, standard housing programs, as well as preferential and subsidized mortgages do not act as a regulator of the market of this segment. However, it is possible to single out Federal programs that can have an impact:

– Federal target program "Development of the unified state system of registration of rights and cadastral registration of real estate" from 2013 The main objectives: to increase the number of subjects of the Russian Federation in whose territories the Unified State Register of Real Estate has been introduced, to reduce the waiting time in the queue when applying for registration, to shorten the period of state registration of rights; to increase the share of services provided through information technology;

– The direction "Improving the level of comfort of living in St. Petersburg" from the Socio-economic strategy of the city's development until 2035. The main goal is to create a humane and comfortable living in St. Petersburg that meets the principles of a "smart city" in terms of spatial development and diversity of the urban environment.

Conclusions

Conclusions based on the conducted analysis system are the basis for further study of the specifics of the legal status of apartments and their place in the current legislation of the Russian Federation, as well as for improving the legal regulation of new "unique" types of real estate. Despite the fact that people live in many apartments as in ordinary apartments, at the moment the status of this type of real estate is non-residential. The study of the introduction of the legal status of apartments cannot be carried out without an analysis of the housing legislation of the Russian Federation:

"A residential premise is an isolated room that is intended for the residence of citizens, is immovable property and is suitable for living."

Housing, in its standard sense, must meet the requirements:

– Location in houses that are located in a residential area in accordance with urban zoning;

– Load-bearing and enclosing structures are in good condition;

– Security of engineering systems (power supply, cold and hot water supply, sanitation);

– Protection from rain, melt and ground water.

Analyzing the problem of assigning the legal status of apartments, it is necessary to take into account

their classification and divide their purpose according to the type. Accordingly, there are the following solutions to this issue:

1. Apartments related to "pseudo-housing" should be transferred to the status of residential premises, for which it is necessary to carry out a thorough check: provide social infrastructure, if necessary, carry out repair and finishing works that will fulfill all the requirements that comply with the current legislation of the Housing Code.

2. Service apartments, which are hotel rooms, are regulated by laws related to tourism activities. For example: The Rules for the provision of hotel services in the Russian Federation, approved by the Decree of the Government of the Russian Federation dated October 9, 2015 No. 1085, the Law "On Consumer Rights Protection", the Law "On the Basics of Tourist Activity in the Russian Federation" dated 11/24/96 No. 132-FZ (with amendments and additions effective from 11/01/2012), the Order July 21, 2005 No. 86 "On approval of the classification system of hotels and other accommodation facilities") (IbGroup consulting company, 2022).

Determining the legal status of apartments has been an unsolved problem for 10 years, since the construction of the first complex of this type of real estate. However, the legislation makes attempts to resolve this issue. At the moment, there are the following options:

1. A bill describing the construction of multifunctional buildings. According to him, it was proposed to introduce the concept of "multifunctional building". The authors proposed to consider a multifunctional building in which two or more groups of residential and/or non-residential buildings are connected to each other through public spaces. At the same time, residential and non-residential premises should not be located on the same landing, access of owners and users of non-residential premises to residential premises should be limited.

2. Regulation of the status of apartments should be divided into already built objects and those that are only at the development stage. In this case, it will be necessary to create a new division on the basis of the Construction Committee, which specializes directly in apartments (i.e. to create appropriate requirements for them), which will decide whether the apartments belong to the living space or not. Those apartments that have already been built should be designated with the statuses: "service apartments" or "residential apartments".

3. Equate apartments with second-category housing that are not provided with kindergartens, schools and polyclinics, but at the same time they have the opportunity to register. This status can be designated only those premises that comply with urban planning standards. To implement the idea, it is advisable to create a register of apartments distributed by category.

4. Recognize the apartments as rental housing, which will allow people arriving for a long time to register in them.

The adoption of these draft laws and/or other regulatory legal act defining the legal status and legal norms in relation to apartments may lead to the following consequences:

– There will be a possibility of permanent registration;

– The risk of losing the right to property in connection with the bankruptcy of the developer will be reduced, since the rights of purchasers of both apartments and apartments will be equally protected;

– There will be benefits for utilities;

– Property tax will be reduced;

– There will be additional social services;

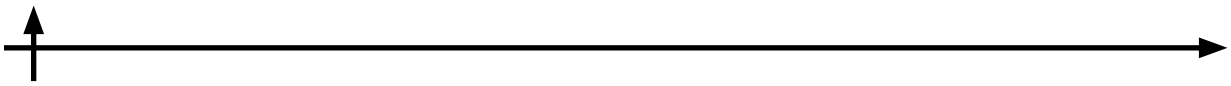
– Tax revenues to the budget will be reduced;

– The increase in the cost of apartments for the buyer;

– Creation of a new body/unit that controls the construction and operation of apartments;

– Closure of complexes that do not comply with the norms

The real estate market, which includes apartments, is one of the most traditional areas of the economy, and at the same time, one of the most developing. Therefore, it is so important to understand the



factors of development of this segment.

The following factors influence the apartment market:

1. Economic;
2. Socio-cultural;
3. Scientific and technical;
4. Political;
5. Demographic.

Economic factors are expressed by the level of economic development of the state, monetary policy, inflation rates, purchasing power of the population. Since February 2022 and to date, the influence of this factor has become especially vivid. The dollar exchange rate ranges from 75 rubles to 120 rubles, which leads to an increase in prices for construction materials, the cost of essential goods also increases. In this regard, citizens began to open deposits at 20% per annum in comparison with the purchase of apartments, the yield of which in unstable times is about 6%. The interest rate on loans is currently kept at 15%, which also reduces the demand for the purchase of apartments.

Socio-cultural consist of the income level of the population, the education and interest of citizens in the little-studied sphere of apartments, the ability of consumers to perceive a new segment, the increasing needs associated with the developed infrastructure of residential and non-residential complexes. The impossibility of forecasting real estate prices (in the context of the situation for April 2022) casts doubt on the issue of the liquidity of apartments and reduces the level of purchase needs, because some citizens are trying to keep their accumulated savings and wait for a calmer situation.

Scientific and technical factors are related to the information and technological development of the provision of services and construction: the use of energy-intensive materials in construction, the use of smart home systems in commercial real estate.

Political factors are formed by the restrictions imposed by politics, which are aimed at the activity of the real estate market. After a number of new restrictions related to the inability to use foreign accommodation booking portals (AirBnb, Booking), the flow of both foreign and Russian tourists has decreased (due to the inability to even just book accommodation on familiar sites), because of this, the level of occupancy of apartment hotels and the profitability of units for investors is decreasing.

It is also possible to designate another group of factors related to real estate and transactions with it:

– Terms of sale/purchase (availability of different payment options: installments, credit, possibility of sale);
– Location;
– Qualitative features (year of construction of the complex, finishing options, materials used);
– Financial requirements (profitability, payback period, liquidity).

The main problem hindering the development of this segment at the theoretical and regulatory level is the uncertainty of the status of this type of real estate. The legal status of the apartments should be determined in the near future. The solution of this issue may lead to an increase in the cost of apartments, as well as change the direction of supply and demand for service and non-service apartments. It can also be an incentive for the development of the market.

Due to the different areas of activity and development of the real estate segment, it is advisable to develop an orderly strategy, i.e. a plan of actions and tasks for the apartment segment in St. Petersburg. The strategy of managing the development of the apartment market for the period up to 2035 can be a fundamental document of strategic planning and development of the real estate market of St. Petersburg, it will allow you to determine the priorities, goals and objectives of one of the segments of the real estate market in the long term.

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ANALYSIS OF THE RELATIONSHIP BETWEEN TRAITS THAT ARE MEASURED ON A NOMINAL SCALE

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Abstract. The article reviews an important section of economics - correlation analysis: the terminology is given, the properties of the nominal measurement scale are considered, methods of revealing and evaluating the degree of correlation between phenomena - correlation coefficients are given. On the basis of the collected information, a study of the consistency of S.G. Svetunkov's new correlation coefficient for nominal data has been made. Calculation of the coefficient values on various data allowed us to conclude about its consistency.

Keywords: correlation analysis, nominal scale, correlation coefficient, contingency table, Yule's coefficient of association, Yule's association coefficient, Pearson correlation coefficient

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АНАЛИЗ ВЗАИМОСВЯЗИ МЕЖДУ ПРИЗНАКАМИ, ИЗМЕРЯЕМЫМИ ПО НОМИНАЛЬНОЙ ШКАЛЕ

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Аннотация. В статье рассмотрен важный раздел экономической науки - корреляционный анализ: дана терминология, рассмотрены свойства номинальной шкалы измерения, приведены методы выявления и оценки степени корреляции между явлениями - коэффициенты корреляции. На основе собранной информации выполнено исследование состоятельности нового коэффициента корреляции С.Г. Светункова для номинальных данных. Расчет значений коэффициента на различных данных позволил сделать вывод о его согласованности.

Ключевые слова: бизнес-модель, бизнес-концепция, компонентный подход, потребительская ценность, бизнес-архитектура, операционная модель, модель дохода

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Introduction

The study of dependencies and relationships between processes and phenomena plays a crucial role in economics. It gives an insight into the deep interrelationship of relationships and the cause-and-effect relationship between phenomena. The possibility to quantitatively and qualitatively measure the depth of cause-and-effect relationships and to identify their mutual influence on each other plays a great role. This will provide a more accurate understanding of the phenomena under study and interrelations and the choice of the right options for management decisions.

To identify the types, forms, influences and their strength, correlation analysis is actively used. Correlation analysis helps to investigate related factors, allows you to adjust economic processes, which leads to the desired result (Svetunkov, Chanysheva, 2022).

This article discusses the basic provisions of correlation analysis: terminology, nominal measurement scale and its properties, various correlation coefficients are given, the applicability of the new correlation coefficient is examined using examples, the conclusion about the consistency of the proposed coefficient is made.

Materials and Methods

Nominal measurement scale

A measurement scale is a homomorphic image of the measured object (Baker et al. 1966). Any measurement scale is defined by four characteristics:

– description,
– order,
– distance,
– starting point.

The simplest scale is the nominal scale. This scale has only the characteristic of description - a set of items is given, of which one item should be specified, and not as a result of comparison, but as a result of identification. The mathematical actions in this scale: equality and inequality (Li R., 2022). The numbers on this scale cannot be compared to each other. In the nominal scale, they work not with the numbers (data) themselves, but with the number of observations of these data, which is expressed in the metric scale, but in it you can perform any action. In this case, most often we speak not about data, but about attributes, because it's this property that is recorded during the observation of objects.

An important way to analyze information quantitatively is to establish the relationship between a series of properties using contingency tables. Which uses the information about the number of observed features (Narkevich, 2022). These quantitative values allow us to assess the possibility of the existence of a relationship between the two observed features, using a conjugacy table:

Table 1. Contingency table

Value	x_0	x_1	Result
y_0	a	b	a + b
y_1	c	d	c + d
Result	a + c	b + d	N = a + b + c + d

If the table contains probabilistic values, then they can be processed using statistical methods. If the table contains probabilistic values, then they can be processed using statistical methods.

Correlation Analysis

Correlation analysis is a statistical method for studying the relationship between two or more random variables. Correlation analysis is a very popular method of analytical statistics. According to A.M. Grzhibovsky (Billard et al., 2003), in Russian scientific publications, correlation analysis is in second place among the methods used in scientific articles, after Student's criterion. Correlation or correlation dependence is a kind of dependence of two or more random variables. The essence of correlation analysis is to find the relationship between these variables. Paired correlation studies the relationship between two random variables, multiple correlation studies the relationship between a large number of random variables. (Correlation and regression analysis)

The peculiarity of the analysis is that the presence of a relationship is characterized by how pronounced it is. The main task of correlation analysis is to identify and assess the relationship between random variables.

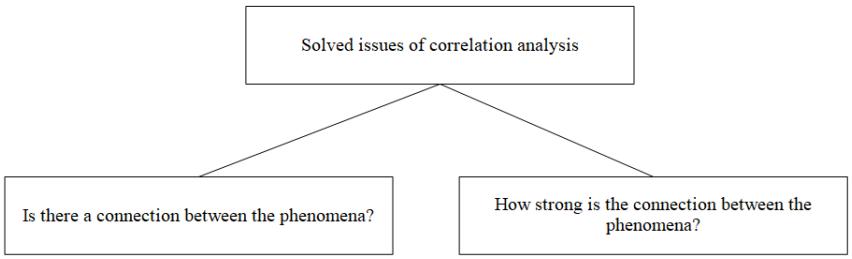

Fig. 1. The essence of correlation analysis

Despite the apparent simplicity of correlation analysis, there are a number of points worth paying attention to:

First, it is necessary to fulfill the condition of having a sufficient number of observations to study. In practice, it is believed that the number of observations should be at least 5-6 times greater than the number of factors (also there is a recommendation to use a proportion of not less than 10 times greater than the number of factors). Secondly, the initial set of values should be qualitatively homogeneous (Bonett, 2007).

Types of correlation coefficients

An indicator that reflects the closeness of two correlated quantities is a certain criterion, called the correlation coefficient. The correlation coefficient can take values from -1 to +1. The closer in modulo its value is to unity, the stronger is the connection between the values. A value of zero or close to it indicates a lack of connection. The presence of correlation may indicate that one of the highlighted phenomena is the cause of the other, or these phenomena are the consequences of common causes. The generally accepted gradation of the strength of the connection is represented by the Chertok scale.

Table 2. Scale of Chertok

№	Correlation coefficient	Characteristics of the strength of the connection
1	$\|r_8\| < 0,1$	Practically no connection
2	$0,1 < \|r_8\| < 0,3$	Weak connection
3	$0,3 < \|r_8\| < 0,5$	Moderate correlation
4	$0,5 < \|r_8\| < 0,7$	Medium strong correlation
5	$0,7 < \|r_8\| < 0,9$	Strong link
6	$0,9 < \|r_8\| < 1$	Very strong link

The correlation relationship cannot be absolutely complete and accurate. Detection of correlation doesn't give us grounds to assert a causal relationship of phenomena, but gives us the right to judge about a certain relationship between the factors. The main disadvantage of the methodology is the complexity of interpretation and the search for causal relationships and their interpretation (Yadov, 1998).

The choice of correlation coefficient depends on several factors:

1. The type of scale of the variable.

2. If both variables are quantitative, then the choice of coefficient is explained by the form of distribution and other characteristics.

Yule's coefficient of association

The easiest to use when examining the correlation of data measured on a nominal scale is Yule's coefficient of association. It, taking into account the introduced notations, has the form:

$$Q = \frac{ad - bc}{ad + bc} \quad (1)$$

A modification of this coefficient is the Yule's colligation coefficient:

$$Q = \frac{\sqrt{ad} - \sqrt{bc}}{\sqrt{ad} + \sqrt{bc}} \quad (2)$$

These coefficients vary from -1 to +1. The closer the coefficient is to unity in modulo, the stronger

the connection between the measured attributes. If it has a negative value, then this indicates that an increase in the values of one attribute leads to a decrease in the values of another attribute (Eliseeva et. al., 2002.). The disadvantage of Yule's coefficient of association is that it's still not a very precise assessment of the relationship between the factors, since if, for example, at least one cell of the contingency table will be zero, the Yule's coefficient of association will be equal to one, but it does not indicate an unambiguous correlation between the factors. The Pearson correlation coefficient is free from this disadvantage (Shulenin, 2020).

Pearson correlation coefficient

Pearson correlation coefficient is the most popular correlation coefficient among others in scientific publications, although it has significant limitations.

$$\chi = \frac{ad - bc}{\sqrt{(a+c)(b+d)(a+b)(c+d)}} \tag{3}$$

The disadvantage of using the Pearson correlation coefficient is its strong sensitivity to outliers. In the presence of a single outlier in the sample, the value of the Pearson correlation coefficient can significantly decrease (Bolshakova, 2021). The Pearson correlation coefficient is always smaller than the Yule's coefficient. Usually, a relationship is said to be confirmed if Yule's coefficient modulo is greater than 0.5 and Pearson's contingency coefficient modulo is greater than 0.3 (Chen, 2019).

Often researchers encounter a situation where completely unrelated factors have a high value of the pairwise correlation coefficient. This phenomenon is called "false correlation". The term was suggested by K. Pearson himself, who justified the formula for the paired correlation coefficient. To demonstrate this phenomenon K. Pearson showed that if two factors x_{1i} and x_{2i} independent of each other have a common denominator x_{3i}, then between series $\left\{\frac{x_{1i}}{x_{3i}}\right\}$ and $\left\{\frac{x_{2i}}{x_{3i}}\right\}$ the pair correlation coefficient will be calculated, far from zero, and testifying to the presence of a linear relationship between factors (Ivanovna, 2021).

In some cases, these coefficients fail the task of correlation analysis. S.G. Svetunkov gives examples when the coefficients (1) – (3) incorrectly reveal the correlation between the features. This proves the relevance of the task of finding new approaches and methods for identifying and evaluating the degree of correlation between nominal data. He proposed a new coefficient, the essence of which is as follows (Mogilko, 2022).

Considering the contingency table graphically in three-dimensional space. Its axes are the signs x and y, and the number of observed occurrences of each sign n. Four points in the three-dimensional space are projected onto each of the planes that make up the space. The planes of interest are $n0y$ and $n0x$. On which the angles of the lines ac, bd, ab, and cd are calculated (Knight et.al., 2001). If at least one of the features doesn't react to changes of the conjugate feature, and remains constant, then a straight line passing through the projections of such points will be characterized by the fact that the tangent of such an angle will be equal to zero (no correlation). Taking into account this fact and the generally accepted representation, correlation coefficients varying from -1 to +1, S.G. Svetunkov proposed the following coefficient: (Dmitriev, 2018):

$$S_{gs} = \left(\frac{a-c}{|a-c|}\cdot\frac{b-d}{|b-d|}\cdot\frac{a-b}{|a-b|}\cdot\frac{c-d}{|c-d|}\right)\sqrt[4]{(a-c)\cdot(b-d)\cdot(a-b)\cdot(c-d)} \tag{4}$$

The author of the coefficient performed preliminary research. A comparative analysis of such a coefficient study on two examples is presented in Table 3.

Table 3. Comparative analysis of correlation coefficient calculations

Name of the coefficient	The value of the coefficient in the absence of correlation	The value of the coefficient in the presence of correlation
Yule's coefficient of association	-0,905	0
Yule's colligation coefficient	-0,635	0
Pearson correlation coefficient	-0,510	0
Coefficient S_{gs}	0	0,369

It follows from the examples that the new coefficient shows the presence of connection where there is one, and signals the absence of connection where there is none.

Interpret the strength of the relationship depending on the S_{gs} coefficient values as follows:

$|S_{gs}| \leq 0,199$ – the absence of relationship between the considered features;

$0,199 \leq |S_{gs}| \leq 0,414$ – weak correlation relationship;

$0,414 \leq |S_{gs}| \leq 0,668$ – medium level correlation;

$0,668 \leq |S_{gs}|$ – strong correlation.

Results and Discussion

Comparative analysis of the calculation of correlation coefficients

Since the coefficient has been recently introduced into the scientific circulation, it is necessary to investigate the possibility of its practical use. Our study will compare the calculated values of Yule, Pearson and Svetunkov coefficients (1) - (4) on real examples of phenomena with actually established relationship, as well as on phenomena, the relationship between which is only assumed (Yadov, 2007).

Consider *Example 1* (table 4). In the contingency table we enter data on the frequency of recommendations of strength exercises in the specialized literature and on Web sites.

Table 4. Contingency table

Significance of signs	x_0 – recommended	x_1 – not recommended	Result
y_0 – book	52	9	61
y_1 – web-site	32	7	39
Result	84	16	100

Both the first and second conjugate signs y_0 and y_1 react to the transition from feature x_0 to feature x_1. The table shows that regardless of the source of information about the strength exercise, this source is more likely to recommend it than not. Substituting the values from Table 4 into formulas (1) – (4) to calculate the correlation coefficients, we estimate their consistency (Svetunkov, 2020).

Table 5. Comparative analysis of the calculation of correlation coefficients

Name of the coefficient	The value of the coefficient according to Table 4
Yule's coefficient of association	0,116564
Yule's colligation coefficient	0,058481
Pearson correlation coefficient	0,042503
Coefficient S_{gs}	0,27693

In this example, we see that the coefficient S_gs=0,27693 shows a weak direct correlation relationship (0,199 <=|S_gs |<0,414), while all other studied coefficients do not reveal any correlation.

Example 2. Consider the data for the first attempt of the test as a function of students' attendance at lecture classes that we have collected. The data to calculate correlation coefficients for the two features – attendance of lectures and passing the test are presented in the contingency table (Ye, Zhang, 2021).

Table 6. Contingency table

Significance of signs	<<Eqn037.eps>> – passed the test the first time	<<Eqn038.eps>> – failed the test on the first time	Result
<<Eqn039.eps>> – student attended lectures	34	3	37
<<Eqn040.eps>> – student didn’t attend lectures	5	26	31
Result	39	29	68

When examining Table (6), it becomes almost obvious that attending lectures has a positive effect on passing the test at the first attempt. By substituting the values from Table 4 into formulas to calculate correlation coefficients, we will evaluate their consistency (Yadov, 2013).

Table 7. Comparative analysis of the calculation of correlation coefficients

Name of the coefficient	The value of the coefficient according to Table 6
Yule's coefficient of association	0,96663
Yule's colligation coefficient	0,769500
Pearson correlation coefficient	0,762969
Coefficient S_{gs}	0,75500

In Example 2, each of the coefficients under consideration is far from zero and, to some extent, close to one, which confirms the strong correlation between the traits, which we observed from the data in the contingency table. At the same time, the coefficient S_gs shows a minimum value. But since according to S.G. Svetunkov's scale at 0.668 <=|S_gs | a strong correlation relationship is diagnosed, it should be noted that in this case it is above the limit, indicating a strong correlation. Consequently, only two coefficients are in the situation of a strong.

Example 3. Let's test whether a student's affiliation with a particular department affects a positive outcome of the test. After surveying 359 students in the Sociology and Psychology departments, we will record the data on the contingency table.

Table 8. Contingency table

Value	x_0 – psychologists	x_1 – sociologists	Result
y_0 – pass	45	54	99
y_1 – fail	171	79	250
Result	216	133	359

Table 8 shows that on the transition from the feature x_0 to the feature x_1 the first conjugate feature y_0 reacts by a slight increase in the number of observations, and the second conjugate feature y_1, on the contrary, reacts by a significant decrease in the number of observations. All three coefficients (1)-(3) react equally badly to this relationship between the signs, they are far from the maximum value equal to one and show an inverse relationship between the signs.

Table 9. Comparative analysis of the calculation of correlation coefficients

Name of the coefficient	The value of the coefficient according to Table 8
Yule's coefficient of association	-0,39497
Yule's colligation coefficient	-0,205853
Pearson correlation coefficient	-0,185447
Coefficient S_{gs}	-0,248386

The S_{gs} coefficient, as well as coefficients (1) – (3) show a weak correlation relationship between the signs. Consequently, the new method of identifying and assessing the degree of correlation between nominal data is viability.

Conclusion

In this article we have considered the main provisions of correlation analysis: terminology, nominal measurement scale and its properties, described the types of correlation coefficients - methods for identifying and evaluating the degree of correlation between signs. Based on the information collected, we considered the applicability of the new correlation coefficient by S.G. Svetunkov for nominal data. Calculation of the coefficient values on various data examples allowed us to make a conclusion about its validity.

According to the results of the study it can be stated that:

Competent correlation analysis should rely on different correlation coefficients, which have their own specifics and many conditions of application. The ability to correctly interpret the indicators of the coefficients, the difference between them will allow a deeper understanding of the dependence and the relationship in a given sample.

Interpretation of the results obtained is not simply to mention in the text of the article the obtained correlation coefficient, it is necessary to draw a conclusion and justification of the results obtained.

Making research on concrete examples, we made consideration of a new coefficient, which behaves very differently on different data. In some examples (1 and 3) we observe its superiority (the most accurate measures of the strength of the relationship) over the other coefficients under consideration (Yule, Pearson). In some cases, it diagnoses the same strength of correlation as the other coefficients. This shows that the Sgs coefficient can be recommended for detecting correlation between nominal data presented in conjugation tables with two nominal numbers of each trait.

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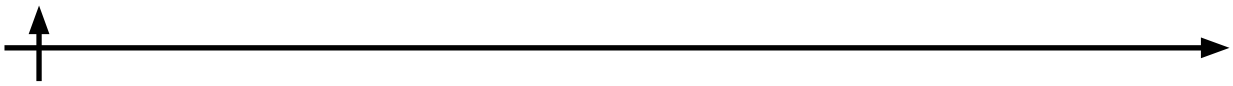

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"LEAN PRODUCTION" IN WAREHOUSE REAL ESTATE MANAGEMENT: RUSSIAN AND FOREIGN EXPERIENCE OF IMPLEMENTING DIGITAL TECHNOLOGIES AT WAREHOUSE FACILITIES

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Abstract. In modern economic conditions, warehouses are one of the most stable segments of commercial real estate. warehouses are among the most important and in-demand elements of the functioning of large non-food manufacturers, logistics operators, retailers and distributors, transport and pharmaceutical companies. The purpose of the study is to evaluate the Russian and foreign experience of implementing digital technologies at warehouse facilities as part of the formation of the concept of lean manufacturing. in the course of the research, the concept of "lean production" within the management of warehouse real estate is considered, the share of non-forced operations performed during production and expressed in the form of losses is revealed, the classification of non-forced losses in production is given, the principles of lean warehousing and the stages of implementing the principles of lean production within the framework of warehouse activities are considered. as a result of the study, an assessment of the Russian and foreign experience of the introduction of digital technologies in the framework of the formation of lean culture is given.

Keywords: lean manufacturing, lean production, lean technologies, digital technologies, commercial real estate, distribution center, warehouse facility

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КОНЦЕПЦИЯ «БЕРЕЖЛИВОГО ПРОИЗВОДСТВА» В РАМКАХ УПРАВЛЕНИЯ СКЛАДСКОЙ НЕДВИЖИМОСТИ: РОССИЙСКИЙ И ЗАРУБЕЖНЫЙ ОПЫТ ВНЕДРЕНИЯ ЦИФРОВЫХ ТЕХНОЛОГИЙ НА СКЛАДСКИХ ОБЪЕКТАХ

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Аннотация. В современных экономических условиях складские помещения – один из самых стабильных сегментов коммерческой недвижимости. Склады относятся к важным и наиболее востребованным элементам функционирования крупных производителей non-food, логистических операторов, ритейлеров и дистрибуторов, транспортных и фармацевтических компаний. Целью исследования является оценка российского и зарубежного опыта внедрения цифровых технологий на складских объектах в рамках формирования концепции бережливого производства. В процессе исследования рассмотрена концепция «бережливого производства» в рамках управления складской недвижимости, выявлена доля невынужденных операций, совершаемых в ходе производства и выражаемых в виде потерь, дана классификация невынужденных потерь на производстве, рассмотрены принципы бережливого складирования и этапы внедрения принципов бережливого производства в рамках складской деятельности. В результате исследования дана оценка российского и зарубежного опыта внедрения цифровых технологий в рамках формирования lean-культуры.

Ключевые слова: бережливое производство, lean production, lean технологии, цифровые технологии, коммерческая недвижимость, распределительный центр, складской объект

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Introduction

The real estate market is extensive and includes many areas, divided into several segments, which in turn consist of sectors. In the real estate market, not only production activities are carried out, but also management and investment. Real estate market research involves the study of theoretical foundations about the features and structure of the real estate market, and it is also necessary to study classifications. It is also impossible to draw a conclusion about the structure of the real estate market without studying its dynamics. With the help of graphical interpretation of market indicators, it is possible to draw a conclusion about positive or negative trends.

During the covid-19 pandemic in 2020, warehouse real estate became one of the most stable markets, as there was an increase in demand for the services of logistics and distribution companies from retailers and representatives of online commerce, who are the main users of warehouse real estate. The warehouse real estate market is experiencing an increase in rental rates, an expansion of the range of warehouse services, and there are also more and more participants in this segment. Therefore, in the current

period, it is especially important to increase the competitiveness of warehouse real estate market objects.

In modern economic conditions, warehouses are one of the most stable segments of commercial real estate. Warehouses are among the most important and in-demand elements of the functioning of large non-food manufacturers, logistics operators, retailers and distributors, transport and pharmaceutical companies.

Despite the low economic growth rates of the Russian Federation in recent years, the commercial real estate market continues to demonstrate an increasing need for high-quality storage facilities. The need to meet the needs of the population in constantly changing market conditions pushes large corporations, retail and online stores to expand their logistics complexes, allowing them to receive, store and distribute a variety of products. This was one of the reasons for the rapid growth of warehouse real estate throughout Russia.

The growing retail turnover forces consumer market participants to expand their product storage capabilities, which, in turn, makes the warehouse real estate segment attractive to investors and developers (Keyes, Barner et. All, 2021).

Until recently, the construction of warehouse complexes was considered by market players as the least attractive opportunity compared to the retail and office segments. But with the development of the market, tenants' requirements for the quality of warehouse premises are increasing, and there is also a need for professional logistics services.

In this situation, the repurposed warehouse buildings of former production facilities and built-in storage facilities presented on the market in large numbers no longer meet the increased requirements of tenants. Therefore, modern warehouse complexes that meet international standards are becoming more and more in demand, and therefore more attractive from the point of view of investment.

According to the center for investment real estate Becar Asset Management, the level of profitability of warehouse real estate is 14-20% if the object is built to generate a permanent income. With a speculative transaction, the yield is 25-40%, depending on the stage of entry into the project – design, construction or ready-made business

For the owner of the company, one of the main tasks is to maintain the effective functioning of the system, which allows to fully meet the needs of customers, reduce costs and increase the profitability of the business.

Improving the efficiency of business processes is a special driver of the growth of the Russian economy. Such a segment of commercial real estate as industrial and warehouse facilities are no exception in matters of efficiency of the organization of functioning and management (Cai, 2011).

There is a need to modernize and optimize storage facilities, so you should turn to the concept of lean manufacturing, which has proven to be an effective tool for managing production, logistics chains and warehouse centers.

Materials and Methods

The following research methods were used to implement the tasks: analysis and synthesis, coefficient and comparative methods, SWOT analysis, economic calculations, etc.

The information basis for writing the work was: special literature, federal evaluation standards, reference books, collections, scientific works of such authors as Faber N, Kindeeva, E. But. Borovkova V.A., Pirogova O.E. and others, as well as Internet resources: reviews and research of analytical companies, statistical data, warehouse real estate portals and other sources. Analytical reports and industry reviews by Colliers, an international company providing real estate and investment services, as well as Knight Frank real estate agencies (Faber, 2002) were also used as an information base.

Results and Discussion

A unified system of lean production was formed in the 1990s thanks to the work of Japanese scien-

tists. This enterprise management system is based on improving the quality of the product while reducing production losses.

The task of lean manufacturing is the continuous elimination of unnecessary losses, while achieving an increase in the competitiveness of products by reducing cost and improving quality.

Among the business processes of the enterprise there are three categories:

– operations that add value to the final product,

– forced operations necessary for the implementation of the production activities of the enterprise,

– non-forced operations, which are expressed in various types of production losses (see Figure 1).

As we can see, the share of processes that add value to products is small and amounts to only 5%. Most operations are losses for production, while some operations cannot be abandoned, since they relate to forced processes. However, usually 60% of losses are unconstrained, which opens up the possibility of reducing the cost of production.

Thus, lean production is a concept of management of a manufacturing enterprise, which is aimed at eliminating all types of losses that arise when performing operations or actions that do not bring profit (Cherkasskaya, 2017).

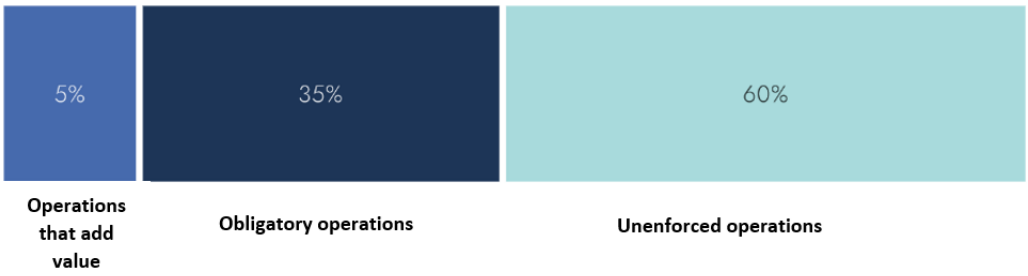

Fig. 1. The share of non-forced operations performed during production and expressed as losses

Within the framework of the concept of lean production, seven main types directly related to the company's activities are attributed to unforced losses (Frolov, 2021):

– excess stocks, which can be expressed by low-liquid inventory values,

– unnecessary human movement on production sites between technological zones,

– excessive processing of products or document flow,

– excessive transportation,

– low accuracy of operations and defects,

– excessive waiting and disruption of flow rhythmicity,

– overproduction,

– unrealized human potential (see Figure 2).

It should be noted that the last type of production losses appeared recently. This is due to the fact that much attention has been paid to labor productivity in recent years. If the human potential is not fully realized, then we can talk about unintentional losses (Mayer, DeWitte, 1998).

The principles of the concept apply not only to the management of manufacturing companies, but also to the management of warehouse real estate.

In the course of managing industrial and warehouse real estate, the manager faces many tasks, ignoring or irrational solution of which can lead to additional non-production losses.

Let's list the main losses of the warehouse:

– storage of excess stocks and the cost of maintaining additional storage space,

– zeroing of orders due to the lack of inventory items in the required volume,

– large time costs for registration and collection of accompanying documentation,

– excessive movement of vehicles due to irrational placement of technological zones,

– damage to goods and materials during transportation,

– processing of employees due to the irregular flow of goods and materials,
– storage of unclaimed goods and leftovers,
– imperfect methods of input control, defects and deviations from the assortment,
– time spent on inventory and inventory search.

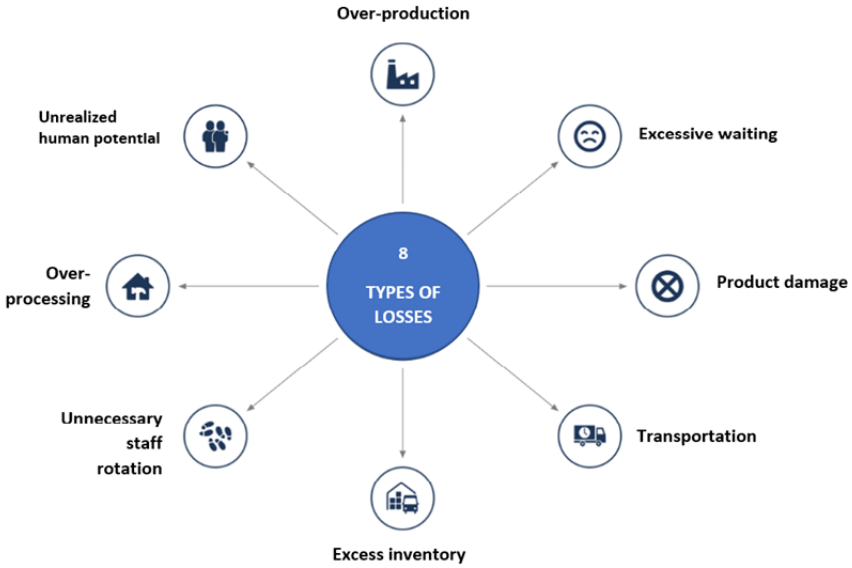

Fig. 2. Type of involuntary losses in production

The lean warehousing system, as it is one of the directions of lean manufacturing, should take into account three important aspects: optimization of the work of warehouse employees, increasing the speed and rhythm of product movement and the use of relevant lean technologies to eliminate losses in the warehouse.

Non-production losses of a warehouse may arise in principle due to an ill-conceived warehouse management concept, but there are also special cases, such as seasonal or unstable demand, an increase in the number of SKUs (commodity item), a shortage of warehouse space for the placement of goods and materials, an increase in the cost of labor, urgent orders, an increase in operating costs, an increase in the number of orders, the appearance of new delivery channels and the need for timely and rational management, and others (Kindeeva, 2018).

To optimally solve the problems faced by an ordinary warehouse manager and eliminate non-production losses when implementing a new management system, it is necessary to apply not only economic analysis of logistics processes, but also the principles of a lean warehouse (see Figure 3).

The main principle of lean warehousing is sorting, which provides for the removal of illiquid, outdated and damaged goods, reduction of unnecessary movements and travel time of loaders, as well as digitalization of data collection.

The second principle implies compliance with the order and effective organization of product placement and movement. To implement this principle, the following actions may be useful: prioritization of technological zones and placement of the most used goods in an easily accessible place, placement of navigation schemes, use of digital technologies for quick search of goods (Voronova, Khareva et all., 2022).

Keeping warehouses clean is the third principle of lean warehousing. Regular cleaning and inspection of warehouse areas will allow timely detection of defects, damages or any errors.

Standardization is one of the key principles of lean warehousing. Creating standards for all work areas will allow you to optimize and control all actions in the warehouse.

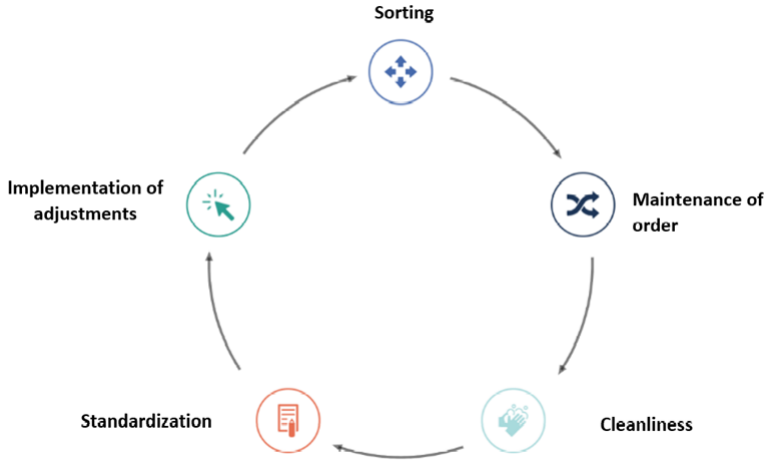

Fig. 3. Principles of lean warehousing

After the introduction of a new management system of an industrial warehouse facility, it is necessary to constantly analyze the results and make adjustments to the warehouse operation, this is the last principle of lean manufacturing – improvement.

There are 3 stages of implementing the lean warehouse concept: diagnostics of the current state of the warehouse, the implementation stage, the creation of a control system (see Figure 4).

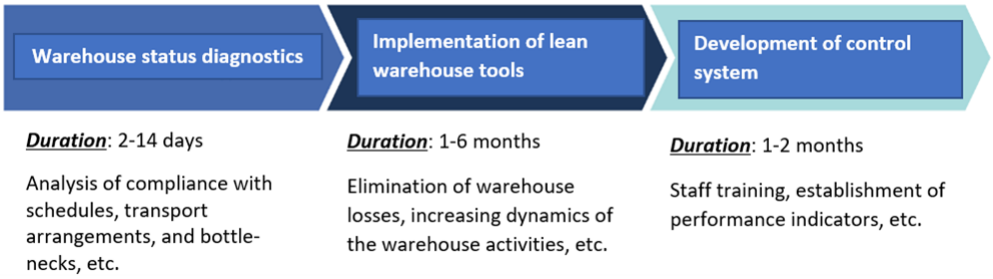

Fig. 4. Stages of implementation of lean manufacturing principles in the framework of warehouse activities

The first stage involves the diagnosis of the current state of warehouse and transport logistics, which consists of an analysis of the calendar activity of the warehouse and the demand for inventory items, providing ABC and XYZ methods. Also at this stage, the calculation of the main economic indicators is carried out, the rhythmicity of traffic flows is assessed, the "bottlenecks" of the warehouse are assessed, losses are determined, measures are developed to improve the efficiency of the warehouse and prioritization of tasks. Depending on the volume of available commodity items and the complexity of the material flow, the duration of the stage ranges from several days to several weeks (Grigoryants, Akopyan, 2020.).

The results of the first stage can be digitized stock flow maps, reports on non-production operations and unforced losses, as well as a list of identified weaknesses that disrupt the rhythm and continuity of warehouse activities. In addition, a checklist of planned improvements is formed, most often presented by the Kaizen method (Voronova, Il'in et all., 2021).

At the second stage, the implementation of lean warehouse tools is carried out, taking into account the identified "bottlenecks" of the warehouse and the resulting losses. According to the results of the stages, an increase in the speed and rhythm of the warehouse operation should be achieved, as well as the elimination of non-production losses. Depending on the specifics of the warehouse and its scale, the process of preparation and implementation can last from one month to one year (Renigier-Bi ozor,

Wisniewski et all., 2018).

The final stage of implementing the lean manufacturing concept consists of establishing the KPIs of the warehouse operation, developing control methods, including frequency, type of control, as well as a map of those responsible and their powers. At the last stage, a system of employee motivation is formed, the organization of favorable working conditions, as well as training of warehouse complex employees. The duration of the stage is on average from 1 to 4 months.

In order to develop an investment project to implement the principles and technologies of lean manufacturing, it is necessary to consider existing lean tools and specific digital solutions that can increase the efficiency of the warehouse and minimize costs that are not involved in the formation of the value of products.

Experience shows that many lean manufacturing tools can be effective in warehouse activities, for example, the "Just-in-Time", "5S", "Kanban" and "Kaizen" systems. The use of these tools can contribute to achieving noticeable results, such as reducing all types of losses, rational use of technological zones and increasing labor productivity. To begin with, let's focus on standard tools that are closely related to warehouse activities.

The "Just-in-Time" system is one of the most common concepts of the organization of production and warehouse activities, which is based on the release of only those products for which there is a request from the consumer in exact quantity and at a specific time. This tool allows you to effectively meet the needs of customers, reducing the cost of maintaining a large assortment and low liquid stocks. At the same time, there are risks of the formation of unintentional losses during the changeover of equipment, assembly and assembly of goods.

The Kanban system is often used, which helps to control the volume of stored products in the right quantity and in the right time. This tool is quite difficult to implement, however, it has a number of advantages:

– reduction of losses from overproduction and excess inventory,

– increasing the company's flexibility to changing demand,

– maintaining the rhythm of the material flow,

– standardization of product information, etc.

Also, the 5S system, considered earlier, can act as the main lean production tools within the framework of warehouse activities. The methodology includes 5 consecutive steps: sorting, maintaining order, maintaining cleanliness, standardization and continuous improvement of processes (Wader, 2020).

The Kaizen system is based on continuous improvement of the production or warehousing process by considering individual processes and developing measures to improve them. The key objective of this tool is to increase the share of operations that add value to the product, while minimizing losses generated during non-forced operations. The advantages of the system include the following characteristics:

– ensuring the rapid implementation of improvements in individual areas, maintaining the continuity of the entire warehouse complex,

– elimination of unnecessary human movements and reduction of the waiting period,

– involvement of employees at all levels helps to comprehensively approach the analysis of activities and identify hidden losses (Lawin, 2018).

Within the framework of the Kaizen system, the use of the Deming wheel tool or the PDCA/SDCA cycle is often found (see Figure 5).

The PDCA (plan-do-check-act) cycle is a popular tool within the framework of continuous process improvement and consists of four stages: planning, implementation, verification and analysis, as well as the reaction stage, which provides for an assessment of the entire procedure and making changes.

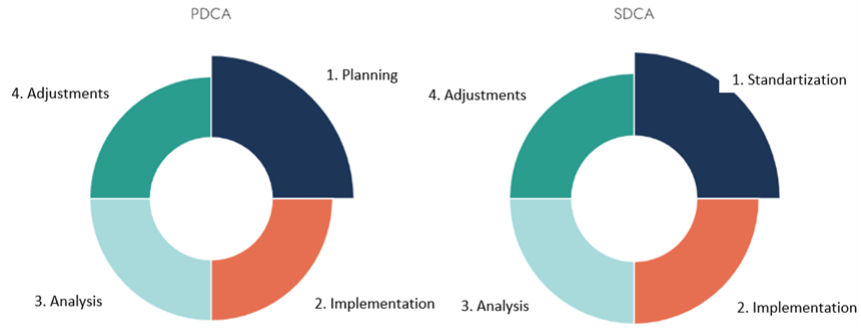

Fig. 5. Process improvement and standardization cycle

Next, the procedure goes through the SDCA standardization cycle, which provides for making proposals for standardization of processes, direct implementation, analysis of results and proposal of changes. This tool, demonstrating the continuity of the process of improving operations, can also be used in the course of improving the activities of the warehouse complex (Voronov, Lassal et all., 2021).

Lean culture is the organization of a multi-stage system of planning, analysis and implementation of changes that affect productivity improvement and reduction of unforced losses, the share of which in the entire set of operations of the enterprise can be about 60%.

It should be noted that lean manufacturing is a continuous process, and examples of lean tools only form a philosophy and help organize the process of managing warehouse facilities in the most efficient way.

At the same time, solving specific problems, eliminating bottlenecks at an industrial facility requires specific measures that are based on the introduction and application of digital technologies that help increase the efficiency of the entire logistics chain and a specific industrial and warehouse facility. Before turning to the Russian and foreign experience of using digital technologies in the framework of warehouse activities, let's consider the classification of technological solutions and their essence mainly for companies related to retail, FMCG segments (fast moving consumer goods - fast–turn consumer goods), and for logistics operators (Yakhyaeva, 2020).

It is necessary to start with complex solutions that require considerable effort in the preparation and implementation of changes, but having the most significant effect on the performance of the warehouse facility.

Smart slotting ("smart slotting") is the process of maximally efficient zoning of the warehouse and finding a suitable place for each SKU unit, taking into account the specifics of the products and their demand. The mechanism of this tool involves 3 stages of implementation:

- digitization of the 3D model of the warehouse taking into account technological zoning,
- simulation of the current work of the warehouse, taking into account human movements and the movement of vehicles,
- formation of an optimal product placement model.

Creating a 3D model of a warehouse allows you to create arbitrary configurations, put forward hypotheses and test them in a virtual environment, which corresponds to the philosophy of lean manufacturing and helps to continuously analyze the activities of the warehouse and, if necessary, make adjustments. The result of using this tool can be a reduction in the distance of movement, which leads to significant time savings for employees and a reduction in the mileage of equipment (see Figure 6).

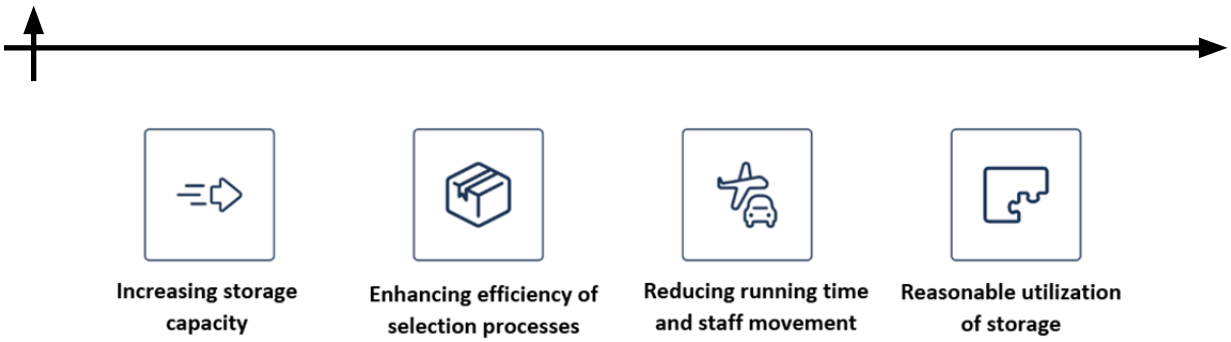

Fig. 6. The effect of creating a 3D model of the warehouse and the introduction of Smart Slotting technology

This technology is based on the creation of a digital double of a warehouse. With the help of simulation modeling, it is possible to avoid experiments in a real warehouse and protect the management of the complex from erroneous decisions (Seng, 2000).

There is a separate direction of technologies that contribute to the improvement of processes in which direct participation of warehouse employees is required. Man-to-product technologies allow you to increase the speed of order collection and picking and at the same time minimize employee involvement (see Figure 7).

Pick-by-Voice (voice selection of goods) is a technology that allows you to automate the identification of goods in a warehouse using voice control. When using Voice Picking tools, the employee puts on a special headset with which the computer sets the route when completing the goods. Thus, the technology frees the employee from having to carry a tablet or a mobile terminal. The build process is simplified and increases productivity, as well as reduces the number of errors to minimum values.

In addition, voice technologies can be used during the unloading and shipment of goods, inventory, movement inside the warehouse and packaging of products in prefabricated batches.

Pick-by-Vision is a technology based on the use of augmented reality smart glasses, which simplifies the movement of employees around the warehouse and reduces errors about picking and inventory. According to the mechanism of operation, the technology is similar to Voice Picking tools, but here the main sources of information are a virtual three-dimensional display located in glasses, which reflects the necessary route, information about products transmitted via a server via a Wi-Fi system.

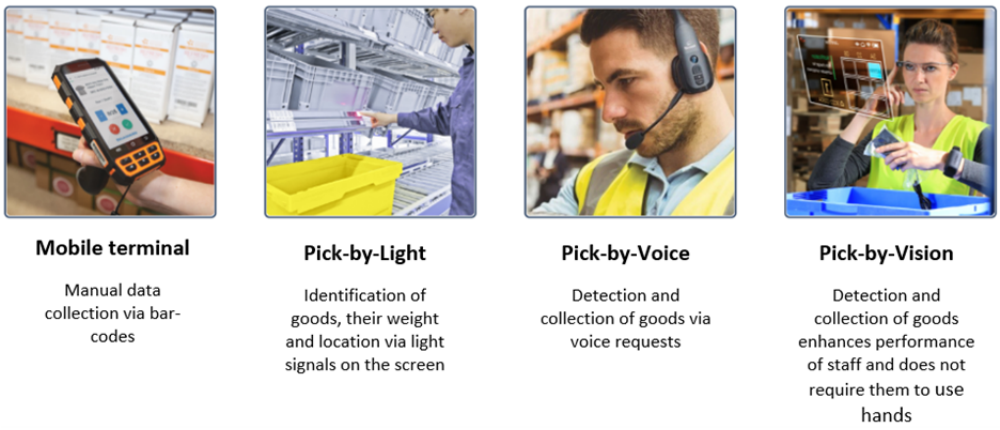

Fig. 7. Digital technologies "person to product", allowing to optimize the work of employees in the warehouse

Vision Picking technologies also make it possible to free an employee from the need to have a tablet or mobile terminal with him, which increases employee productivity and reduces the number of errors and unforced losses. In addition, Pick-by-Light technologies are distinguished, which allow identifying the product, its weight, quantity and location by a light signal that is displayed on a digital display.

The concept of Smart Glasses ("smart glasses") is also used to train new employees and reduce equipment downtime due to changeovers and repairs due to augmented reality and remote access. So, with

the help of remote communication, an employee located at another location can instruct an employee how to perform certain actions in order to eliminate a malfunction of the equipment. This technology is becoming especially relevant in the context of a general lockdown during the covid-19 pandemic, as the mobility of employees has decreased (Yakhyaeva, 2021).

Quick-Pick Remote is a remote lifting technology that significantly simplifies the process of picking orders. During the order collection, the operator makes many movements among the racks. When using loaders, the employee is forced to return to the cab of the transport every time and move it to the next reference point. Remote control technology allows you to eliminate most of these operations by using a wireless remote control. This technology accelerates the work of employees, reducing the volume of human movement, reducing physical stress on a person and injury risk. Also, with the help of remote access, you can adjust the required height of loading or unloading (Womack, 2003).

Biotelemetric technologies are tools that track critical indicators of the condition of employees. First of all, these are technologies for adaptive intelligent load distribution between existing employees by reading the bio-telemetry indicators on fitness bracelets, in particular the employee's pulse. The fitness bracelet, which is on the employees' hand, transmits information about the status of the warehouse employee to the automated control system. Based on the data obtained, the system adjusts the workflow and, if necessary, redistributes the load between employees. The technology makes it possible to optimize the physical load on employees, ensure control of important indicators of the condition of workers and ultimately avoid a decrease in overall labor productivity during the working day.

The next category of innovations in warehouse logistics includes "goods to people" technologies, the purpose of which is to simplify the accounting, placement and picking of orders.

It is difficult to imagine a large warehouse complex without modern technologies for tracking inventory.

RFID tags (Radio Frequency Identification) are widely used in folding activities and in the coming years this technology will become more and more perfect. The advantage of such labels in comparison with conventional barcodes is the content of more information about products, while scanning by means of radio waves allows you to receive information about the cargo without opening the package, which increases the speed of material flow.

The use of radio frequency identification includes more complete control and transparency of inventory, as well as greatly simplifies the inventory process and reduces the risks of theft at the warehouse facility.

Automatic Guided Vehicle (AGV) - automatic transport systems make a significant contribution to the automation of the warehouse facility and the reduction of unforced losses. Most often, an AGV is understood as an electrically driven conveyor designed to move goods, however, a separate employee is not required for its maintenance. "Robotkars" move without human intervention along a pre-programmed route, and also performs the necessary actions with the goods, for example, capturing, moving and installing cargo.

Separately, we note the possibility of using autopilot drones to conduct a quick and high-altitude inventory. Robotic drones, flying along the warehouse areas, read the markings on pallets with an accuracy of more than 99% in offline mode, which significantly speeds up the inventory process, reduces the risks of human injury and saves employees' working time.

In order to assess the applicability of the above technologies used to optimize warehouse activities, it is necessary to study the practical experience of Russian and foreign companies.

The American company Amazon is the largest player in the e-commerce market, having more than 100 warehouse complexes in the USA alone, with an average area of 50-60 thousand square meters. m., in Germany, for example, there are 13 such facilities. Despite the fact that the head of the Robotics Fulfillment company, Scott Anderson, said that there are no plans to launch fully automatic warehouses in the next 10 years, Amazon is a world-famous user of industrial warehouse real estate, setting trends in

the industry. At the moment, the company is actively using robotic loaders, the number of which tends to 15 thousand worldwide. This allows you to significantly reduce time costs, as well as human efforts in the movement, loading and unloading of goods and materials.

The largest retail chain in the world, Wal-Mart Stores, is represented by 12 thousand outlets in 28 countries, so the logistics function and warehouse activities are extremely important for the effective functioning of the company. With the development of online trading in 2020, the company began using Alphabot robots in the warehouse to assemble orders. The first tests showed that robots are now collecting orders 10 times faster than a human, which opens up good prospects for further robotization of the company's warehouse activities

The logistics infrastructure of the Russian supermarket chain "Lenta" includes 13 large distribution centers, each of which serves a dozen cities and up to 100 retail outlets. One of the key business processes in warehousing is the shipment and unloading of inventory. To speed up these processes, the company exchanges information with its partners and suppliers using the EDI (electronic data exchange) system. This allows you to reduce the time of acceptance of the goods by 1.5-2 times. Indirect effects from the use of EDI technology: acceleration of information exchange, minimization of errors and inaccuracies in document flow, automation of acceptance and loading of goods.

X5 Retail Group, one of the leading food companies in Russia, operates outlets of various formats: Karusel hypermarkets, Perekrestok supermarkets and Pyaterochka convenience stores. There are 20 warehouse complexes and more than 3 thousand retail outlets on the territory of Russia. For effective inventory management, the company uses digital technologies to reduce time and labor losses in the warehouse. For example, X5 Retail Group uses a Pick-by-voice system that helps manage warehouse operations using voice commands. The introduction of this technology allowed for a 10% increase in employee productivity and a 2-fold reduction in the number of errors when picking orders.

Conclusions

The concept of lean production is aimed at improving the activities of companies, including those involved in working with warehouse real estate. It is based on the continuous improvement of processes and the elimination of unforced operations that do not add value to products, but are net losses of production or warehousing. The concept of lean warehousing identifies 8 main types of losses: excessive overproduction, expectations, excessive transport and human movements, excessive processing, excess inventory, defects and inaccuracies in processing and unused human potential. Within the framework of warehouse activities, excessive storage of stocks, long waiting for assembly and completion of shipment, inefficient use of technological zones, etc. are most often singled out.

Despite the fact that the concept of lean manufacturing was formed at the end of the last century, Russian companies began to apply this practice only since 2008, when large corporations such as Sberbank, Russian Railways and Russian Post acted as flagships. At the same time, most of the industrial and warehouse real estate still does not use the principles of lean manufacturing and digital technologies that can reduce the level of unintentional losses in the course of warehouse activities. This is the reason for low throughput and many types of losses during warehousing activities.

As we can see from the analysis of the stages of implementing the principles of lean manufacturing, modernization and automation of the warehouse complex requires not only significant financial investments, but can often last from several months to 1 year, which limits the activities of the warehouse and requires time and labor costs. Thus, each project providing for an increase in the efficiency of warehouse activities and reduction of unforced losses should be thoroughly worked out, investment-attractive, timely and reasonable.

The use of lean tools in the management of industrial and warehouse real estate can help to form a lean culture at the enterprise, that is, the commitment of employees to the concept of lean production,

namely, to continuous improvement and improvement of business processes.

In the course of the research, the range of digital solutions that can be used by the company to reduce unforced losses in the framework of warehouse activities was considered. Within the framework of warehouse activities, 3 groups of digital technologies were identified: integrated solutions, technologies "person to product" and "product to person.

Fig. 8. Classification of digital technologies aimed at the formation of lean culture in the framework of warehouse activities

The introduction and application of digital solutions listed in this study makes it possible to improve the activities of the warehouse complex by eliminating unnecessary losses, such as excessive waiting during acceptance and shipment, unnecessary human movement and excessive mileage of vehicles, unprofitable zoning, temporary losses on equipment and others.

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THEORETICAL ASPECTS OF INVESTMENT ATTRACTIVENESS: CONTENT OF THE CONCEPT, FACTORS AND METHODS OF EVALUATION

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Abstract. In the modern world, investments are becoming an increasingly popular tool for the development of companies, so such concepts as investment attractiveness and investment valuation have confidently entered the daily routine of entrepreneurs. The purpose of the study is to assess the theoretical aspects of the investment attractiveness of apartment hotels. Throughout this research such methods were used as: the method of analysis (the analysis and study of individual parts of the phenomenon), a systematic approach (consideration of an object or phenomenon as a system), the classification method - grouping phenomena by certain characteristics and the method of abstraction - the study of a specific property of a phenomenon without taking into account its other characteristics, SWOT-analysis, economic calculations, etc. Four methods for assessing investment attractiveness were analyzed in this study, and three main areas of investment attractiveness assessment were discovered.

Keywords: investment attractiveness, investments, degree of innovation, level of diversification, commercial real estate, apartment hotels, impact factors, assessment methods

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ТЕОРЕТИЧЕСКИЕ АСПЕКТЫ ИНВЕСТИЦИОННОЙ ПРИВЛЕКАТЕЛЬНОСТИ: СОДЕРЖАНИЕ ПОНЯТИЯ, ФАКТОРЫ И МЕТОДЫ ОЦЕНКИ

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Аннотация. В современном мире инвестиции становятся все более популярным инструментом для развития компаний, поэтому в ежедневный обиход предпринимателей уверенно вошли такие понятия как инвестиционная привлекательность и инвестиционная оценка. Целью исследования является оценка теоретических аспектов инвестиционной привлекательности апарт-отелей. Данное исследование было проведено с использованием таких методов, как метод анализа (анализ и изучение отдельных частей явления), системный подход (рассмотрение объекта или явления как системы), метод классификации – группировка явлений по определенным характеристики и метод абстракции – изучение конкретного свойства явления без учета других его характеристик, SWOT-анализ, экономические расчеты и т.д. В рамках данной статьи были проанализированы четыре метода оценки инвестиционной привлекательности, а также выявлены три основных направления оценки инвестиционной привлекательности.

Ключевые слова: инвестиционная привлекательность, инвестиции, степень инновационности, уровень диверсификации, коммерческая недвижимость, апарт- отели, факторы воздействия, методы оценки

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Introduction

In the modern world, investments are becoming an increasingly popular tool for the development of companies, so such concepts as investment attractiveness and investment valuation have confidently entered the daily routine of entrepreneurs. There are many different views on the value of investment attractiveness, some of them are presented in Figure 1 below.

The collected data demonstrate the regularity that the concept of investment attractiveness in the works of many scientists and scientists is similar in terms of the perception of this term as a set, combination or complex of certain criteria and factors. However, in the concepts listed earlier, there is very little specificity in the field of indicators that affect their results. This is due to the fact that investment attractiveness is a somewhat abstract phenomenon that strongly depends on the area in which it is applied (Ajimijere, Yudin, 2021).

Analyzing the international market, investment attractiveness is usually understood as a set of non-commercial risks of an investor at the initial stage, that is, uncertainties associated with government actions that may affect the investor's ability to perform any actions with the object of investment.

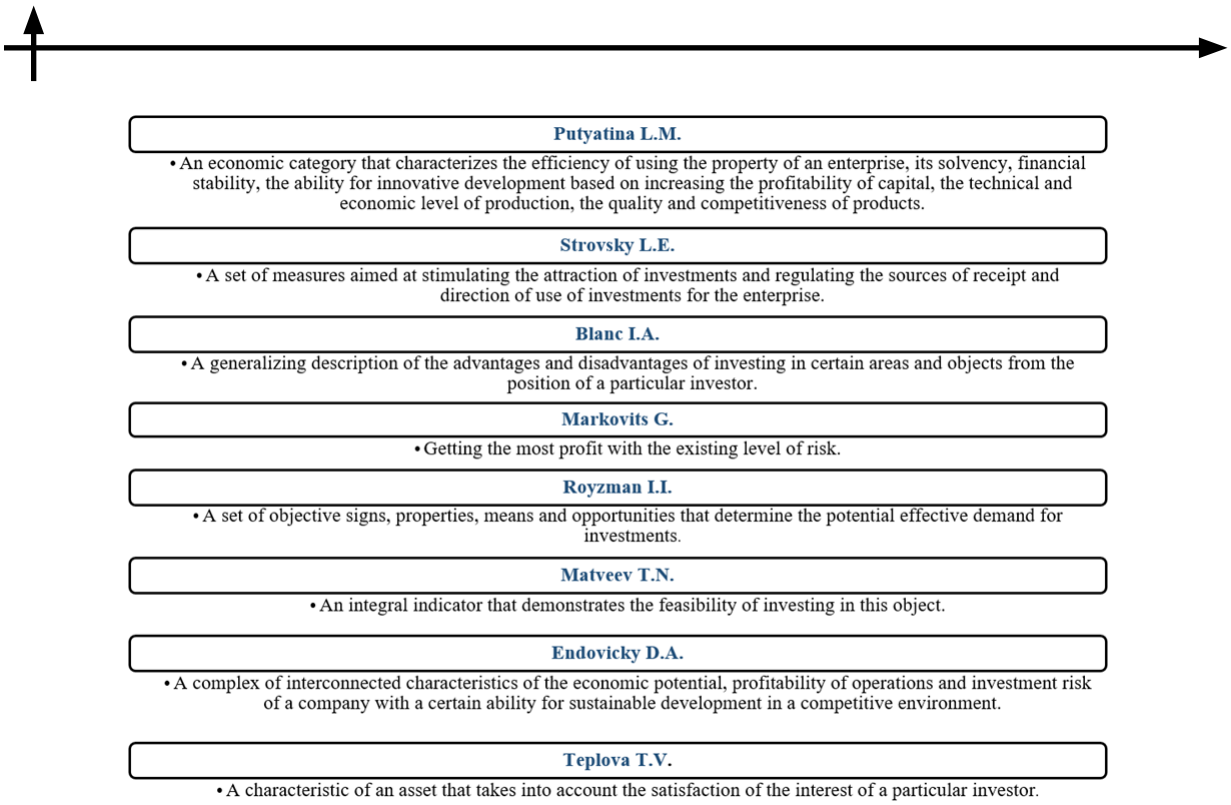

Fig. 1. Interpretation of the concept of "investment attractiveness"

In general, among all approaches to the interpretation of investment attractiveness, the following key reference points can be distinguished:

– potential and sustainability;
– profitability;
– risk and expediency;
– environment and climate (Arkhipkina, 2019).

Nevertheless, based on the analysis carried out earlier, it is possible to form a general concept that is most applicable within the framework of this work. Investment attractiveness is a set of financial and non-financial indicators that make it possible to assess the situation, the situation on the market, as well as potential risks and profitability of the investment object in question (Goldobina, 2022). At the same time, it should be taken into account that investment attractiveness is not so much a financial and economic phenomenon as a model reflecting the real quantitative and qualitative indicators of a company or object and its position in the industry.

Materials and Methods

For the implementation of the tasks set, such research methods were used as: the method of analysis (the analysis and study of individual parts of the phenomenon), a systematic approach (consideration of an object or phenomenon as a system), the classification method - grouping phenomena by certain characteristics and the method of abstraction - the study of a specific property of a phenomenon without taking into account its other characteristics, SWOT-analysis, economic calculations, etc.

The information basis for writing the work was special literature, as well as Internet resources: reviews and studies of analytical companies, statistical data.

Results and Discussion

Turning to the analysis of factors influencing investment attractiveness, it should be mentioned that, as in the situation with the interpretation of concepts, there are extremely many views on the gradation and division of factors among scientists and analysts. However, the most common grouping is by the

degree of influence of the company.

Thus, investment attractiveness is influenced by two main groups of factors – external and internal. External factors reflect those features that the company cannot influence in the Arctic, at least in the short term. Internal indicators are factors that can be directly adjusted by the enterprise (Endovitsky, Babushkin et all., 2010).

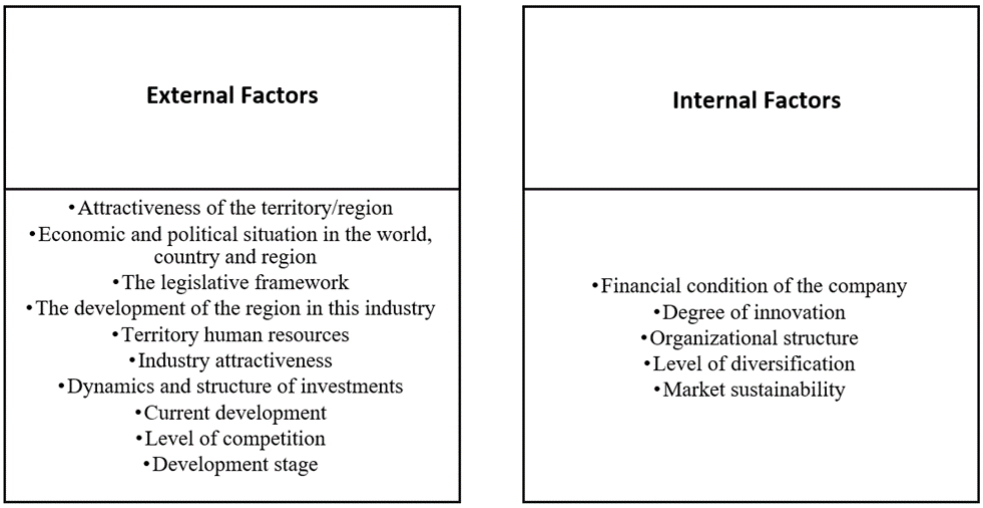

Fig. 2. Factors affecting investment attractiveness

It is important to consider each factor separately:

1. Economic and political situation in the world, country and region.

This factor has a huge impact on investment attractiveness, as it affects all participants in this process. First of all, economic instability or crisis negatively affects the solvency of the investor, which causes a decrease in demand for development projects (Sokolova, Kuleshov et all., 2020). In addition, the decrease in solvency does not bypass the population, which entails a decrease in potential income and in the long term increases the payback period of the project (Gorshenin, Pershin, 2020). However, a favorable political and economic environment can fruitfully influence investment demand and, as a result, there is an increase in competitiveness (Kozin, Astarkina, 2010).

2. Legislative framework.

Legal regulation cannot but affect the attractiveness of a company or an object, as this is the main documentary support for all activities in this area. In addition to the existence of a system of budgetary, credit and tax mechanisms and an established state system for managing the investment process, the legislative framework should regulate the procedure for the implementation of each stage of the implementation of investment activities (Koryt rov , 2021). Currently, the regulatory legal acts in the field of investment activity of the Russian Federation include:

– The Constitution of the Russian Federation;

– The Civil Code of the Russian Federation;

– Decrees of the President of the Russian Federation;

– Federal Law "On Investment Activities in the Russian Federation Carried Out in the Form of Capital Investments";

– Federal Law "On Investment Funds" (Batekhin, Gorbunov et all., 2022).

3. Development of the region in this industry.

The investment environment in the region affects the attractiveness from the point of view of attracting third-party investors, since investment-developed regions often become the objects of the greatest attention, as well as analysis (Neshataeva, Grischuk, 2022). Nevertheless, the success of a development

project can grow significantly if it is implemented in a region with a lagging investment climate. The investment climate refers to a complex characteristic of economic, social, political and other factors that determine the investment position of a region or entity.

4. Human resources of the territory.

This factor is highly underestimated by many analysts, nevertheless it has an impact on investment attractiveness. Human resources refers to the demographic characteristics of the region, the level and quality of life of the population, which implies the impact on solvency, the average income level of the population, the cost of producing a particular product / service, the level of qualifications (Kotlyarova, 2018).

5. Attractiveness of the industry.

Analysis of the dynamics and structure of investments, the level of current development and competition and the stage of development allows you to use such an important tool in investing as forecasting. It is extremely important for an investor to understand what trends are currently being traced in the industry, in which direction everything is moving, where it may come, what risks need to be assessed, as well as what forecasts based on analytics exist.

6. Financial condition of the company.

Tracking the dynamics of the financial condition allows you to make a conclusion about the current position of the company or the state of the object. In addition, the results of accounting reports and other financial documents demonstrate how efficiently and efficiently the company manages and disposes of existing resources (Ozerov, 2007). Such calculations are also important at the design stage, since they allow us to assess the predicted success of investments.

7. Degree of innovation.

The degree of innovation of a company or an object has recently gained particular popularity in the investment environment, because in addition to financial indicators, it is important for an investor to invest in a project of particular importance, and the innovation of this object can be an excellent opportunity for this (Panteleeva, Dmitriev, 2019). Also, the use of new technologies allows you to attract the attention of not only investors, but also consumers of a product or service, which in the long term will favorably affect development.

8. Organizational structure.

A well-formed organizational structure and its successful management influences the contribution of each employee, the return on the use of resources, as well as the possibility of attracting other sources. Mistakes in personnel management can lead to irreparable detrimental changes and jeopardize the entire project (Savitskaya, 2018).

9. Level of diversification.

This indicator is especially important because it allows you to judge the risks of investments, since diversification refers to the ability of an enterprise to use various sources of funds (Pupentsova, 2007). The main goal is to minimize risks and reduce losses.

10. Market stability.

The stable position of the company in the market reduces the risks for the investor, which leads to an increase in the investment attractiveness of the enterprise. However, the assessment of this factor is extremely difficult, so judgments about the stability or instability of the company are always supported by a comprehensive analysis (Shimko, 2022).

Methods of assessing investment attractiveness. Since there is no single concept of investment attractiveness and a list of factors that have a direct impact, it is impossible to single out a unified approach to assessing this indicator. Table 2 shows the most common ways to analyze investment attractiveness.

Table 1. Methods for assessing investment attractiveness

Method	Author	Advantages	Disadvantages
Seven factor model	Edward Altman	Captures the main financial indicators and their dynamics	It is based solely on profitability, only the financial component is taken into account
Method of discounting cash flows	–	The most transparent way of evaluation by the investor	Only the financial component is taken into account, it very much depends on the input data, which may lead to a decrease in practical applicability
Kozhukhar 's method	V.M.Kozhukhar	The use of a large number of factors, as well as taking into account the innovative component of the development of the enterprise	The volume of the analysis, a lot of subjective characteristics
Kazakova's methodology	N. A. Kazakova	It has a practical orientation, as a comprehensive assessment is carried out	Labor intensity

Each method should be described separately. The seven-factor model implies the use of the following groups of factors that affect the attractiveness of the project:

1. production factors;
2. financial situation;
3. enterprise management;
4. investment activity of the enterprise;
5. innovative activity of the enterprise;
6. stability;
7. legal factors (Shumakova, 2019).

The method of discounting cash flows. assumes accounting for receipts during the period of ownership and income from reversion. The following calculation stages are distinguished:

1. choosing the duration of the forecast period;
2. cash flow calculation for each period;
3. calculation of the discount rate;
4. calculation of the cost of reversion;
5. income discounting;
6. calculation of market value (Savitskaya, 2018).

Thus, this method is based on the fact that a potential investor will not invest in the project an amount greater than the current value of the future income of this company.

Kozhukhar's method is particularly popular and represents an assessment of the factors presented in Figure 2.

Exogenous factors are understood as characteristics that companies are unable to significantly influence, and endogenous factors are those factors that are directly managed by the enterprise (Sheina, Izmodenov et all., 2020).

The last analyzed method of calculation is an analysis in three directions, namely:

1. economic potential and financial condition of the enterprise;
2. operational efficiency and business activity;
3. characteristics of the business development of the enterprise (Sabirov, 2020).

Within each direction, a number of indicators are allocated that form the final values that are fed up with a comprehensive assessment.

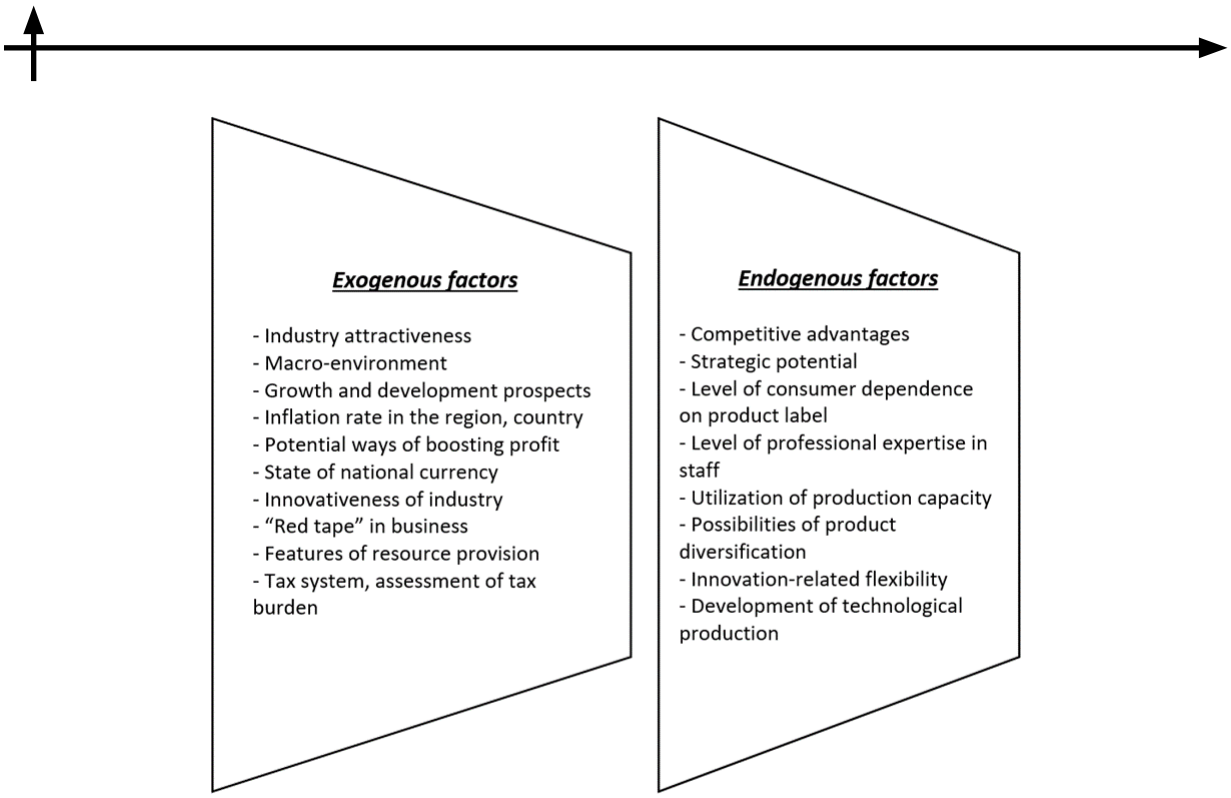

Fig. 3. Factors of Kozhukhar's methodology

Conclusions

The study analyzed four methods for assessing investment attractiveness, but their number is constantly increasing and the choice of one or another method should be based on the investment object, the investor's requests, as well as a number of other factors.

Currently, there is no single unified way to assess investment attractiveness, however, they are all based on three main areas, namely:

– financial condition and potential;

– market environment and competitiveness;

– characteristics of the company's business development.

The choice of such indicators for investment analysis is determined by the need to comprehensively evaluate the company for the most reliable results, as well as the possibility of practical application of the findings. However, the evaluation of the company should begin with an analysis of the group of profitability coefficients, as well as with the calculation of the risk of bankruptcy.

The calculation of profitability coefficients includes the following indicators, shown in the figure below. It should be noted that the goal of all enterprises is to increase profitability in order to increase their value and attractiveness to investors.

Investments in commercial real estate, which include apartment hotels, have been demonstrating sustainable development over the past few years. According to the forecasts of many experts, the volume of investments in this industry will reach record levels this year, which will certainly attract more investors, which means that it will increase the demand for investment objects. Such changes can be tracked by paying attention to the dynamics of the size of investments in the Russian commercial real estate market over the past 4 years, shown in the figure below.

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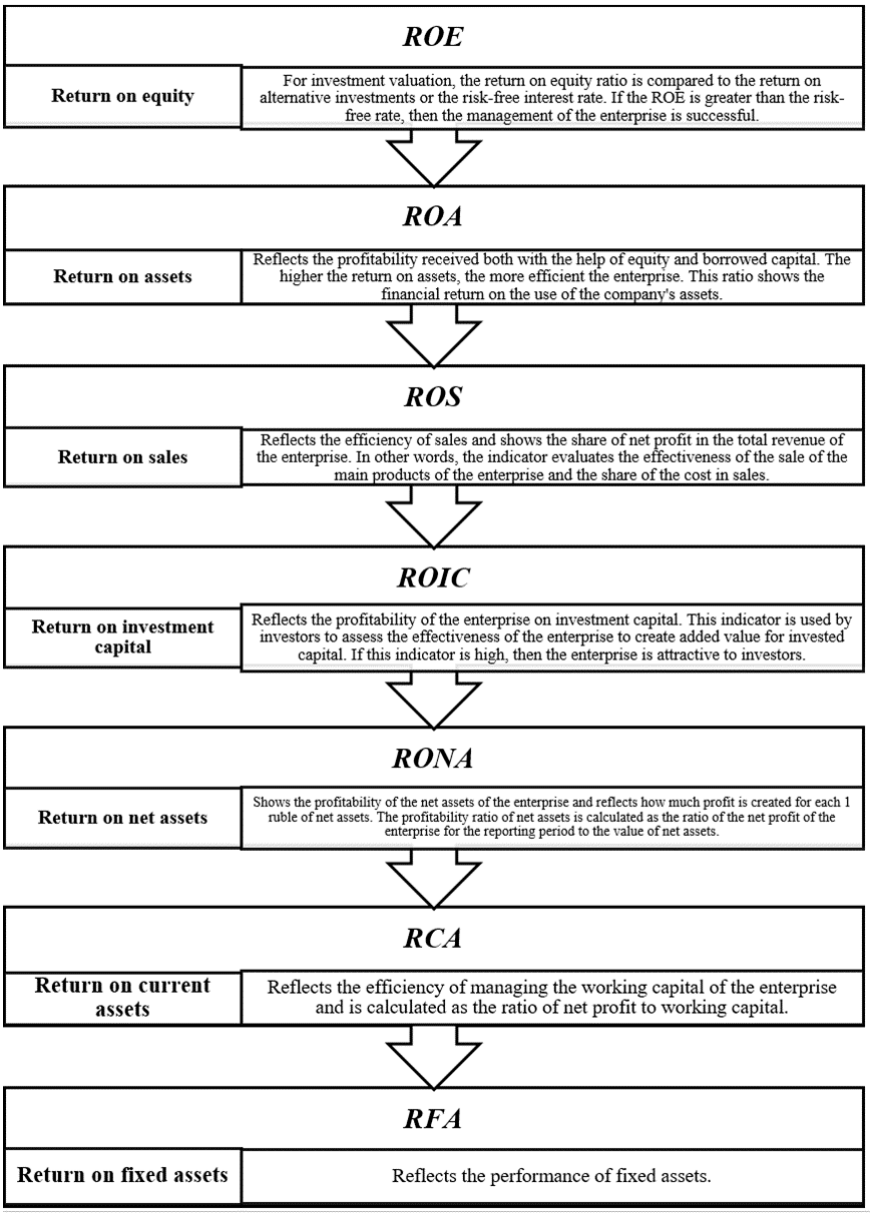

Fig. 4. Profitability coefficients

tors, which means that it will increase the demand for investment objects. Such changes can be tracked by paying attention to the dynamics of the size of investments in the Russian commercial real estate market over the past 4 years, shown in the figure below.

However, given the expectation of a further increase in the key rate of the Central Bank of the Russian Federation, investment activity may noticeably decline during 2022. Both in Moscow and St. Petersburg, the rate of return on an available number is gradually increasing, but has not yet reached the pre-pandemic level. This year, a further increase in the indicator is expected, which will primarily be due to an increase in the load, and not the average tariff, since the limited, not yet recovered, volume of demand constrains the possibility of price increases. In general, now the St. Petersburg hotel real estate market is quite dynamic: investors are saturated with standard offers and locations, so construction and management companies are trying in every way to differ from competitors, which significantly increases the possibility of choosing among the objects for investments. As a result, the quality of facilities, fore-

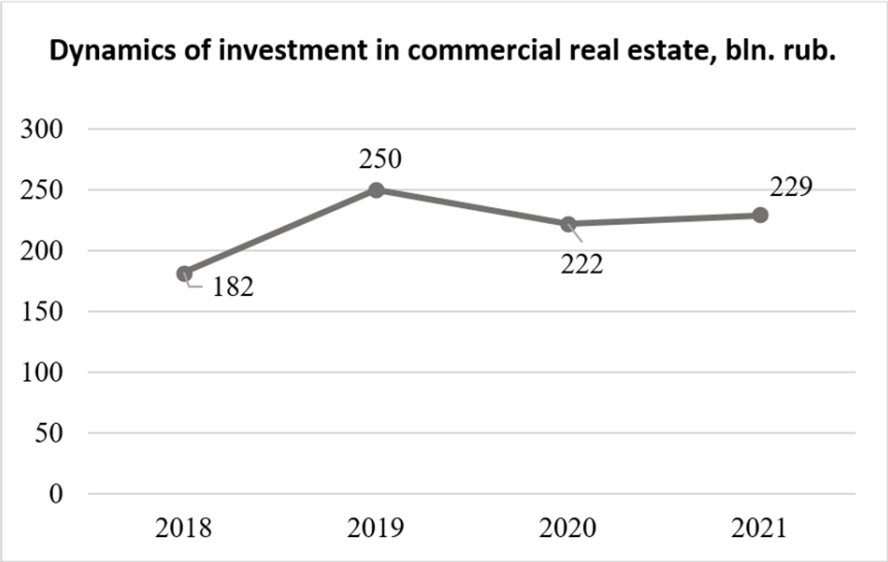

Fig. 5. The size of investments in commercial real estate in the period from 2018 to 2021

casts of their financial condition and the success of projects are playing an increasingly significant role. At the moment, it is safe to say that, starting in 2020, apartment hotels occupy a strong position as an investment tool.

The construction of apartment hotels will be actively developing for several more years before the market is completely saturated with the offer. The demand for accommodation in such types of hotel real estate is growing every year, which is due to the development of the domestic tourist market and the attractiveness of the region for both tourists and businessmen. Of course, this also affects the growth of the number of competitors in the analyzed market, which leads to a fierce struggle for the leadership positions of investment projects. Analyzing the investment climate of St. Petersburg, it can be concluded that in 2020-2021, the decline in investment activity caused by restrictions to prevent the spread of a pandemic of a new coronavirus infection slowed down, and the index of the physical volume of investments shows a symbolic increase. It is also worth noting that the hotel infrastructure is one of the priority areas of economic activity of the subject. Nevertheless, the largest sectors of the city's economy showed a drop in real estate transactions.

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