

The role of technological innovations in institutional regulation of the financial capital market

Artur Abuzov^{1*}

¹SSEU, Department of Economics, Organization, and Enterprise Development Strategy, 443031 Samara, Russia

Abstract. Financial technologies (fintech) have been actively developing in recent years and are overturning conventional notions about the financial capital market. The article explores the role of technological innovations in institutional regulation of the financial capital market. Thanks to innovations such as blockchain technology, artificial intelligence, and machine learning, market participants are able to make more accurate and faster decisions, ensure transaction security and reliability, and have more transparent and efficient risk management. The article describes some examples of successful implementation of technological innovations in institutional regulation of the financial capital market, such as the use of blockchain in supply chain management, automation of risk management, and real-time processing of large volumes of data. A mathematical model of optimal institutional regulation of the financial capital market is presented. However, in addition to the advantages, the use of technological innovations also carries potential risks such as breach of confidentiality, incomplete information of market participants, and the possibility of technological glitches. Therefore, it is important to develop and effectively implement measures to regulate the use of fintech, which must comply with rules and legislation.

1 Introduction

The financial capital market is one of the most significant elements of the economy in many countries. As a result, institutional regulation of this market plays an important role in ensuring its stability and efficiency. In recent years, there have been numerous new technological innovations that can be used to improve institutional regulation processes. This can include the use of blockchain technology, machine learning, artificial intelligence, and other tools. Although many of these innovations are still only beginning to be used in financial capital market regulation, they have already shown their potential for increasing regulation efficiency and protecting investor interests.

In this article, we will analyze which technological innovations can be applied to institutional regulation of the financial capital market and how they are already being used in different countries around the world. We will also evaluate the advantages and disadvantages

* Corresponding author: abuzov.arthur@mail.ru

associated with the use of these innovations and how they can be used to achieve more efficient institutional regulation in the future.

Technological innovations in the field of financial technology, including blockchain, artificial intelligence, and machine learning, are increasingly being used in the financial capital market. They represent the potential to improve market efficiency, transparency, and security, as well as to ensure compliance with regulatory requirements.

Studies show that the use of blockchain can significantly reduce transaction costs and improve the security of operations in financial markets (Swan, 2015 [1]; Crosby et al., 2016 [2]). In particular, blockchain technology allows for the creation of blockchains that contain information about transactions and other operations. Blockchain can be used to improve transparency and reliability in the securities system and risk management (Vigna & Casey, 2015 [3]). However, as noted by Zhang et al. [4], standardization and integration between different blockchain platforms remain the main obstacles to their widespread adoption. Artificial intelligence and machine learning also have the potential to improve the efficiency and accuracy of decision-making in financial markets (Chen et al., 2018 [5]; Schroeck et al., 2019 [6]). However, as noted by Zhou et al. [7], the use of artificial intelligence can also raise concerns about data confidentiality and discrimination. Therefore, the implementation of artificial intelligence and machine learning in the financial capital market should be accompanied by appropriate measures to protect data and ethical responsibility.

These technologies can be used to analyze large volumes of data and identify trends and risks that may potentially threaten market stability. Additionally, they can help automate some regulatory processes, which can increase efficiency and reduce costs associated with these tasks.

Despite the potential benefits that technological innovations can bring to institutional regulation of the financial capital market, there are also risks associated with their application. For example, issues with data protection and confidentiality may arise, and new types of fraud and cyber-attacks may emerge. Therefore, it is important to strike a balance between the use of new technologies and ensuring the safety and protection of investor rights.

Recent studies also highlight the role of collaboration between the private sector and the government in the development and implementation of technological innovations in the financial capital market. This allows regulators to gain wider access to the expertise and technologies needed for effective market regulation, and also fosters collaboration between the private sector and the government in the development and implementation of technological innovations [8].

Finally, it should be noted that technological innovations in the field of financial technology are still in the developmental stage, and their impact on the financial capital market can be unpredictable. However, as many researchers note, the implementation of technological innovations can lead to significant improvements in the efficiency, transparency, and security of the financial capital market, which can ultimately lead to a more stable and resilient financial capital market as a whole [9].

Thus, there is significant potential for the use of technological innovations in institutional regulation of the financial capital market. However, to successfully realize this potential, it is necessary to consider the risks and benefits of using these innovations, as well as develop appropriate standards and guidelines for their safe and effective use.

2 Materials and Methods

To compile a review of the practices of using blockchain, artificial intelligence, and machine learning in regulating financial capital, the following sources of information were used:

- Scientific articles and reports published in various journals and databases, including Google Scholar and Scopus;

- Official documents and publications of international organizations such as the World Bank, the International Monetary Fund (IMF), the Organization for Economic Cooperation and Development (OECD), among others;

- News articles and blogs published in financial media such as Bloomberg and the Financial Times.

To construct a mathematical model for optimal institutional regulation of the financial capital market, the following mathematical methods were used:

- Functional analysis and optimization theory for formulating the optimization problem;

- Theory of monotone functions for assuming a monotonic increasing relationship between the yield function and the level of regulation and economic growth.

3 Results

The analysis of the role of technological innovations in institutional regulation of the financial capital market has shown that these innovations can provide significant benefits in terms of efficiency, security, and stability of the market.

Figure 1 shows the evolution of digital technologies that have influenced the development of the financial capital market.

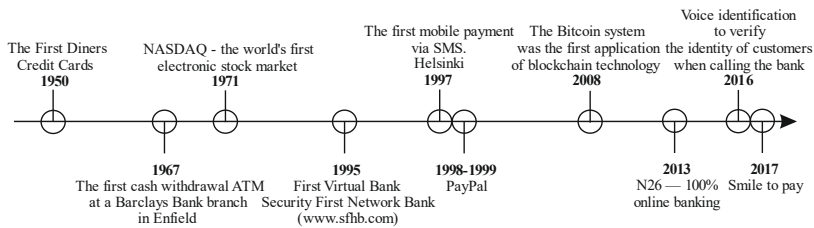


Fig. 1. Evolution of financial technologies.

The blockchain technology has been identified as a promising tool for accounting and transferring securities, managing risks, and reducing transaction costs. The use of smart contracts and digital identities can help to automate many processes and improve the accuracy of transactions. However, the lack of standardization and interoperability of different blockchain platforms remains a major challenge for their widespread adoption.

The use of blockchain technology can lead to a reduction in back-office operations costs by 30-50%. However, these figures apply to the costs of operations related to data processing and transmission and may vary depending on the specific application of blockchain technology [10].

One example of using blockchain in regulating the financial capital market is using the technology to improve investment attraction processes through Initial Coin Offerings (ICO). ICO is a process in which companies attract investments by issuing their own cryptocurrency and selling it to investors. However, this practice poses certain risks for investors, as companies may misuse the funds raised, and there is a risk of fraud.

To address these issues, blockchain can be used to create a secure and reliable platform for conducting ICOs. Blockchain allows creating a chain of blocks with information about all transactions that occur within an ICO. This gives investors the opportunity to ensure that the funds they invest in ICOs are used for their intended purpose and to monitor the project's development process.

Another example is using blockchain to create decentralized exchanges (DEX). Traditional exchanges are centralized, meaning they have a centralized structure and store all data and funds on a central server. This creates security risks, as the server can be hacked or attacked by hackers.

In DEX, blockchain is used to create a decentralized platform on which users can trade without intermediaries. This increases the security and reliability of trading in the financial capital market. In addition, blockchain allows for the creation of smart contracts that are automatically executed when certain conditions are met, making the trading process easier and reducing risks for investors.

The standard scheme of financial transactions includes several stages and intermediary roles:

- Initiation of the transaction: the client initiates the transaction, usually through their bank account, using online banking or a mobile application;
- Verification of client data: the bank verifies the client's personal data and checks whether they have sufficient funds to conduct the transaction;
- Data transfer: the bank transfers data about the transaction to other participants in the financial system, such as payment systems, payment processors, or other banks;
- Processing the transaction: financial system participants process the transaction and confirm it;
- Completion of the transaction: the bank carries out the final transfer of funds to the recipient's account.

The roles of intermediaries in this scheme may vary depending on the type of transaction and the country, but usually include banks, payment systems, payment processors, card networks, and other financial system participants.

Blockchain technology can simplify this scheme by removing some intermediaries and making transactions faster and more secure. For example, blockchain can be used to create a decentralized payment system that allows clients to exchange funds directly without the involvement of intermediaries. In this case, blockchain technology replaces the role of banks and other financial system participants.

In addition, blockchain can improve the security of transactions and reduce the risks of fraud and errors. Blockchain uses cryptography and digital signatures to protect data, and all transactions are recorded in an immutable ledger, making them immutable and more reliable.

Artificial intelligence and machine learning can also provide valuable insights into market trends and risks, and help to identify potential fraud and other illegal activities. The use of advanced analytics and predictive modeling can improve risk management and decision-making, and reduce the impact of market volatility on the overall performance of the market. However, the potential risks associated with the use of AI and machine learning, such as bias and data privacy concerns, should be carefully addressed to ensure their responsible and ethical use.

One example of the application of artificial intelligence and machine learning in institutional regulation of the financial capital market is the use of machine learning algorithms to detect manipulation on financial markets.

For instance, Nasdaq uses AI and machine learning technologies to detect abnormal trading activity and manipulation on stock exchanges. Nasdaq systems employ machine learning algorithms to automatically process and analyze large volumes of trading data and identify anomalies that may indicate manipulation.

Another example is the use of artificial intelligence to assess investment risks. Some companies use machine learning algorithms to analyze data and determine the risks associated with investing in certain assets or markets. This can help investors and regulatory bodies make more informed decisions based on quantitative data [11].

Consider a mathematical model describing the optimal institutional regulation of the financial capital market. Let y be the return on the financial capital market, x be the level of regulation, and z be economic growth.

Then the function of the return on the financial capital market can be expressed as follows:

$$y=f(x,z), \quad (1)$$

Assume that the function f is monotonically increasing in x and z , that is, the higher the level of regulation and economic growth, the higher the return on the financial capital market.

Now suppose that regulatory bodies can control the level of regulation x . Regulatory bodies can choose the optimal level of regulation that maximizes the return on the financial capital market, provided that this does not adversely affect economic growth z .

Mathematically, this can be written as an optimization problem:

$$\max_x f(x,z) \text{ subject to } g(x,z) \geq 0, \quad (2)$$

Where $g(x,z)$ is a constraint function that defines the relationship between the level of regulation x and economic growth z .

Thus, the optimal level of regulation will be the one that maximizes the return on the financial capital market, subject to not negatively affecting economic growth.

Of course, in practice, the level of regulation cannot be chosen simply based on a mathematical model. Many other factors need to be taken into account, such as political and social conditions, external economic factors, etc. However, the mathematical model can be a useful tool for decision-making based on quantitative data and assessing the effectiveness of various regulatory measures.

4 Discussion

Blockchain and artificial intelligence have increasingly been influencing the financial capital market in recent years. Below are some examples of how these technologies have impacted the market:

1. Facilitating trading: Blockchain technology allows for faster and cheaper financial transactions. For example, payments can be made directly between participants without the need for intermediaries such as banks. These speeds up processes and reduces costs.

2. Improving transparency: Blockchain technology can provide a more transparent and secure way of storing and transmitting data. This is particularly important for financial transactions where participants must be sure that the data has not been altered or falsified.

3. Enhancing prediction accuracy: Artificial intelligence can be used to analyze large amounts of data and predict trends in the financial market. This can help investors make more informed decisions and improve their investment outcomes.

Some specific figures that confirm the impact of blockchain and artificial intelligence on the market include:

In 2020, the market volume of blockchain technology in the financial industry was \$4.4 billion. (Source: MarketsandMarkets) [12].

According to Accenture, the use of artificial intelligence could lead to a 22% reduction in financial company costs by 2030 [13].

According to McKinsey & Company, the implementation of blockchain technology could lead to a 30-50% reduction in back-office operation costs [14].

The PwC "Global Fintech Report 2021" states that 88% of financial companies believe that implementing fintech solutions helps improve customer experience. In addition, 77% of companies believe that fintech technologies help increase operational efficiency, and 54% of survey participants stated that they plan to acquire or strengthen their partnerships with fintech companies in the coming years [15].

Also, the KPMG "Pulse of Fintech 2021" report notes that more than \$44 billion was invested in global fintech companies in 2020, despite the COVID-19 pandemic. This

indicates that investors continue to see significant potential in the development of fintech technologies [16].

The prospects for the development of financial technologies (fintech) look promising. With the increasing number of participants in financial markets and growing trading volumes, the use of technology becomes increasingly necessary. Fintech has the potential to lead to the emergence of new financial products and services. For example, microfinance and microcredit are becoming more popular due to the use of technologies that enable the automation and acceleration of the loan issuing process.

5 Conclusion

In conclusion, it can be noted that technological innovations such as blockchain and artificial intelligence are playing an increasingly important role in regulating the financial capital market. These technologies offer a number of advantages, such as increased transparency, easier trading, and improved forecasting accuracy, which help to enhance market processes and ensure the safety and reliability of financial transactions.

Furthermore, the implementation of technological innovations in the financial industry can lead to significant cost reductions, which is an important factor for market participants. However, it is important to also consider the potential risks associated with the use of these technologies and effectively regulate them in accordance with rules and legislation.

Therefore, technological innovations are an important factor in the institutional regulation of the financial capital market, and with consideration of their potential and risks, measures should be taken for their effective use and regulation in accordance with market rules and legislation.

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