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CONTACTS

Phone: **+998 50 737 87 88**

Website: <https://ist-journal.uz>

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DECENTRALIZED TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE AS DRIVERS OF CROWDFUNDING EVOLUTION

Karimova Aziza A'zamiddin qizi

Doctoral Researcher at Tashkent State University of Economics
azizakarimova271199@gmail.com, ORCID: 0009-0009-1516-3690

Abstract. The article analyzes the transformation of crowdfunding under the influence of technological innovations, primarily blockchain and artificial intelligence. It examines how the integration of smart contracts, big data analytics systems, and decentralized financial models is reshaping established approaches to collective financing. The article demonstrates that the adoption of these technologies contributes to reducing transaction costs, increasing the transparency of investment processes, and establishing new mechanisms of trust among participants. Particular attention is paid to the evolution of crowdfunding toward Web3, asset tokenization, and decentralized autonomous organizations. It is concluded that the further development of crowdfunding will be determined by the depth of technological integration and the ability of regulatory systems to adapt to new realities.

Keywords: crowdfunding, blockchain, artificial intelligence, smart contracts, decentralized finance, tokenization, digital transformation, investment platforms.

Annotatsiya. Maqolada kraudfandingning texnologik innovatsiyalar, avvalo blokcheyn va sun'iy intellekt ta'sirida transformatsiyalanishi tahlil qilinadi. Muallif smart-kontraktlar, katta ma'lumotlarni tahlil qilish tizimlari va markazlashmagan moliyaviy modellarning integratsiyasi jamoaviy moliyalashtirishga oid shakllangan yondashuvlarni qanday o'zgartirayotganini ko'rib chiqadi. Maqolada ushbu texnologiyalarni joriy etish tranzaksiya xarajatlarini kamaytirish, investitsiya jarayonlarining shaffofligini oshirish hamda ishtirokchilar o'rtasida yangi ishonch mexanizmlarini shakllantirishga xizmat qilishi ko'rsatilgan. Kraudfandingning Web3, aktivlarni tokenlashtirish va markazlashmagan avtonom tashkilotlar tomon evolyutsiyasiga alohida e'tibor qaratilgan. Xulosa qilinishicha, kraudfandingning keyingi rivojlanishi texnologik integratsiyaning chuqurligi va tartibga solish tizimlarining yangi sharoitlarga moslasha olish qobiliyati bilan belgilanadi.

Kalit so'zlar: kraudfanding, blokcheyn, sun'iy intellekt, smart-kontraktlar, markazlashmagan moliya, tokenlashtirish, raqamli transformatsiya, investitsiya platformalari.

Аннотация. В статье анализируется трансформация краудфандинга под влиянием технологических инноваций, прежде всего блокчейна и искусственного интеллекта. Автор рассматривает, каким образом интеграция смарт-контрактов, систем аналитики больших данных и децентрализованных финансовых моделей изменяет сложившиеся подходы к коллективному финансированию. В статье показано, что внедрение данных технологий способствует снижению транзакционных издержек, повышению прозрачности инвестиционных процессов и формированию новых механизмов доверия между участниками. Особое внимание уделяется эволюции краудфандинга в направлении Web3, токенизации активов и децентрализованных автономных организаций. Сделан вывод о том, что дальнейшее развитие краудфандинга будет определяться глубиной технологической интеграции и способностью регуляторных систем адаптироваться к новым условиям.

Ключевые слова: краудфандинг, блокчейн, искусственный интеллект, смарт-контракты, децентрализованные финансы, токенизация, цифровая трансформация, инвестиционные платформы.

INTRODUCTION

The digital transformation of financial markets over the past decade has taken on the character of a systemic shift, affecting all stages of the investment and lending chain. In this context, crowdfunding has evolved from a marginal means of raising funds for creative projects into a fully-fledged institution of alternative financing, mobilizing significant volumes of capital. However, as researchers rightly note, the potential of crowdfunding can be fully realized only through the integration of advanced technological solutions (Vorobyeva et al., 2025; Nikitina & Anisimov, 2025).

The aim of this article is to examine the impact of technological innovations on the transformation of crowdfunding and to identify promising directions for its development in the context of the digitalization of financial markets. The article addresses the following objectives: analyzing the theoretical foundations of crowdfunding, assessing the impact of blockchain technologies on transparency and trust, determining the role

of artificial intelligence in reducing information asymmetry, and identifying new financing models emerging at the intersection of crowdfunding and decentralized finance.

LITERATURE REVIEW

The academic literature considers crowdfunding an important form of alternative financing that connects project initiators with a broad group of investors through digital platforms. Mollick (2014) and Belleflamme et al. (2014) examined the fundamental characteristics, models, and institutional role of crowdfunding, while Kirby and Worner (2014) emphasized its growing importance in alternative financial markets. More recent literature focuses on the technological transformation of crowdfunding. Schär (2021) and Zetsche et al. (2020) highlight the role of blockchain and smart contracts in improving transparency, reducing transaction costs, and automating financial obligations. Studies on decentralized finance and DAOs demonstrate the potential of Web3 technologies to create new forms of collective investment and governance. At the same time, artificial intelligence and machine learning are increasingly used for project evaluation, risk assessment, investor targeting, and personalized recommendations. Overall, the literature indicates that the future development of crowdfunding is closely associated with the integration of blockchain, AI, tokenization, and decentralized financial mechanisms.

RESEARCH METHODOLOGY

The article applies a qualitative and comparative analytical approach to examine the technological transformation of crowdfunding. The methodological framework is based on the analysis and synthesis of academic publications, reports of international organizations, and relevant theoretical approaches concerning crowdfunding, blockchain, artificial intelligence, decentralized finance, tokenization, and DAOs. Comparative analysis is used to identify differences between traditional and technology-based crowdfunding models in terms of transparency, transaction costs, investor control, fraud protection, and financing mechanisms. The article also employs conceptual and graphical analysis to illustrate the functioning of blockchain-based crowdfunding, the impact of artificial intelligence on platform efficiency, and the evolution of crowdfunding toward Web3-based models. Based on the findings, key technological trends, limitations, and prospective directions for the further development of crowdfunding are identified. Artificial intelligence tools were used for up to 10 percent of the preparation of this article.

ANALYSIS AND RESULTS

1. Crowdfunding as an Object of Technological Transformation

1.1. Evolution of the Concept and Essential Characteristics

Crowdfunding, which emerged as a means of raising funds from a broad audience through Internet platforms, has evolved within a relatively short period from experimental projects into an institutionalized form of financing. As demonstrated in the study by Mollick (2014), crowdfunding was initially viewed primarily as a tool for supporting creative initiatives; however, over time, its application expanded to entrepreneurial projects, social initiatives, and scientific research.

From a theoretical perspective, crowdfunding can be conceptualized through several approaches. The institutional approach interprets it as a form of financial intermediation in which platforms perform the functions of aggregating the demand for and supply of capital. The behavioral approach focuses on the motivations of participants, including both project initiators and investors. The technological approach emphasizes the determining role of digital platforms as the infrastructural foundation of crowdfunding (Belleflamme et al., 2014).

The International Organization of Securities Commissions (IOSCO) defines crowdfunding as “an umbrella term used to describe the use of small amounts of money, obtained from a large number of individuals or organizations, to finance a project, business, or personal loan through an online web-based platform” (Kirby & Worner, 2014, p. 4). It is important to note that this definition captures the key characteristics of the phenomenon: Internet-mediated interaction, a multiplicity of investors, and the targeted nature of the funds raised.

1.2. Classification of Crowdfunding Models

The academic literature has established a classification of four basic crowdfunding models, differentiated by the nature of the reward received by investors. The donation-based model involves the provision of funds without compensation and is primarily oriented toward social and charitable initiatives. The reward-based model provides non-financial compensation in the form of a product or service and is most widespread in creative and consumer-oriented projects. The equity-based model provides investors with an ownership stake in a company's share capital and is subject to the most stringent regulation. The lending-based model involves the repayment of invested funds with interest, bringing it closer to conventional bank lending (Mollick, 2014).

Researchers note that the choice of a particular model is determined not only by the nature of the project but also by the level of technological development of the platform. In particular, the implementation of blockchain technologies and smart contracts significantly expands the possibilities for implementing equity-based and lending-based models by reducing the costs associated with legal formalization and monitoring the fulfillment of obligations.

2. Blockchain Technologies as a Factor in Enhancing Transparency and Trust

2.1. Smart Contracts and the Automation of Obligation Fulfillment

Blockchain technology, initially associated exclusively with cryptocurrencies, is finding increasingly broad application in the field of collective financing. Its key advantage lies in the creation of a decentralized, immutable, and publicly accessible database, which fundamentally changes the nature of interaction among participants in crowdfunding relationships.

The most significant tool in this context is smart contracts — self-executing programs in which the terms of an agreement between the parties are directly encoded. As demonstrated in the study by Schär (2021), smart contracts enable the automatic fulfillment of obligations upon the occurrence of predetermined conditions, thereby substantially reducing the risks of non-performance and fraud.

For a visual representation of the mechanism through which blockchain technology functions in crowdfunding, Figure 1 presents an author-developed flowchart illustrating the interaction among the key participants in the process and the role of smart contracts in automating the distribution of funds.

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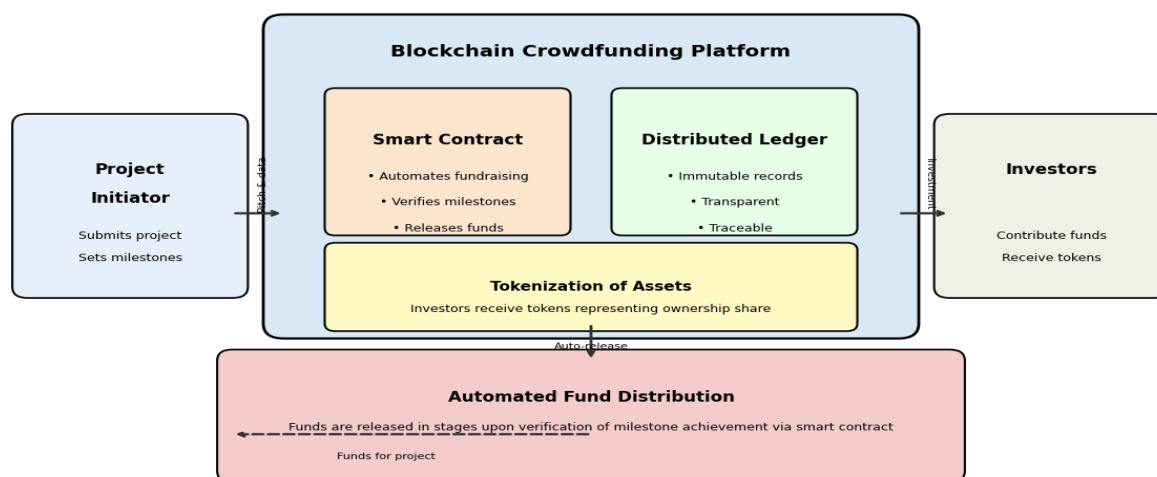


Figure 2 – Mechanism of Blockchain Technology Functioning in Crowdfunding
Source: compiled by the author.

Figure 2. Mechanism of Blockchain Technology Functioning in Crowdfunding¹¹

The investment process illustrated in Figure 2 is based on smart contracts. The project initiator defines the project stages, while investors contribute funds that are held within the system until the completion of the respective tasks is confirmed. The smart contract automatically transfers the funds as the established milestones are achieved, recording all transactions on the blockchain. Through tokenization, investors receive digital assets representing their stake in the project. This makes investments more liquid and the transfer of rights faster and more transparent.

In the context of crowdfunding, this means that funds raised for projects can be transferred to the initiator not as a single payment but in stages, as intermediate milestones are achieved. On the one hand, such a mechanism protects the interests of investors; on the other hand, it encourages project initiators to take a more responsible approach to project implementation. According to researchers, the use of smart contracts can reduce transaction costs by 70–80%, making blockchain-based platforms attractive for projects with relatively small budgets (Zetsche et al., 2020).

2.2. Asset Tokenization and the Transformation of the Investment Model

Another important area of blockchain technology application in crowdfunding is asset tokenization. This process involves the issuance of digital tokens, each of which certifies a right to a specific share in a project or asset. Tokenization makes it possible to address the problem of capital fragmentation by making investments accessible to a broad range of individuals while simultaneously increasing liquidity, as tokens can be traded on the secondary market.

The Cambridge Centre for Alternative Finance considers tokenization to be one of the key drivers of growth in alternative finance markets. Indeed, unlike traditional models, in which an investor receives either a symbolic reward or an ownership stake in a company that is difficult to liquidate, the tokenized model provides a transparent and liquid instrument for participation in a project.

It is important to emphasize that tokenization changes the very nature of investment relationships. Investors gain the ability not only to monitor the use of funds in real time but also to participate in project governance (in the case of DAO structures) or exit their investment by selling their tokens. This fundamentally distinguishes tokenized crowdfunding from conventional models, in which investors generally have neither the ability to control the use of funds nor the opportunity to sell their stake before the completion of the project.

2.3. Decentralized Finance and Crowdfunding: Points of Convergence

In recent years, there has been an increasing convergence between crowdfunding and the decentralized

finance (DeFi) ecosystem. As noted in the OECD report, DeFi not only reduces transaction costs and improves access to financial services but also offers fundamentally new models for organizing investment processes (OECD, 2022).

In the context of crowdfunding, this entails the emergence of decentralized platforms operating without centralized management. Financing decisions are made collectively by token holders, while all transactions are automatically recorded on the blockchain. Such a model not only enhances transparency but also reduces dependence on intermediaries, which is particularly relevant for projects operating in jurisdictions with underdeveloped regulatory environments.

Particular attention should be paid to decentralized autonomous organizations (DAOs), which represent a fundamentally new form of collective governance of investment processes. As demonstrated in Buterin's work (Buterin, 2014), DAOs enable mechanisms for direct investor participation in decision-making, thereby fundamentally transforming the relationship between project creators and those who finance them.

3. Artificial Intelligence as a Tool for Reducing Information Asymmetry

3.1. Automation of Project Evaluation

Information asymmetry has traditionally been regarded as one of the key constraints on the effectiveness of crowdfunding. Investors generally do not have sufficient information to assess the actual quality of a project, which creates risks of adverse selection. In this regard, the implementation of artificial intelligence tools represents an important direction for enhancing the efficiency of crowdfunding platforms.

Machine learning algorithms make it possible to automate the project screening process by analyzing numerous parameters that may indicate the quality of an initiative, including the creator's reputation, the quality of presentation materials, social proof, the history of previous campaigns, and other relevant factors. As demonstrated in the study by Courtney et al. (2017), projects that undergo automated screening demonstrate higher success rates compared with those evaluated using traditional methods.

To quantify the impact of AI on crowdfunding platform efficiency, Figure 3 presents a summary of improvements across five key performance metrics based on empirical studies.

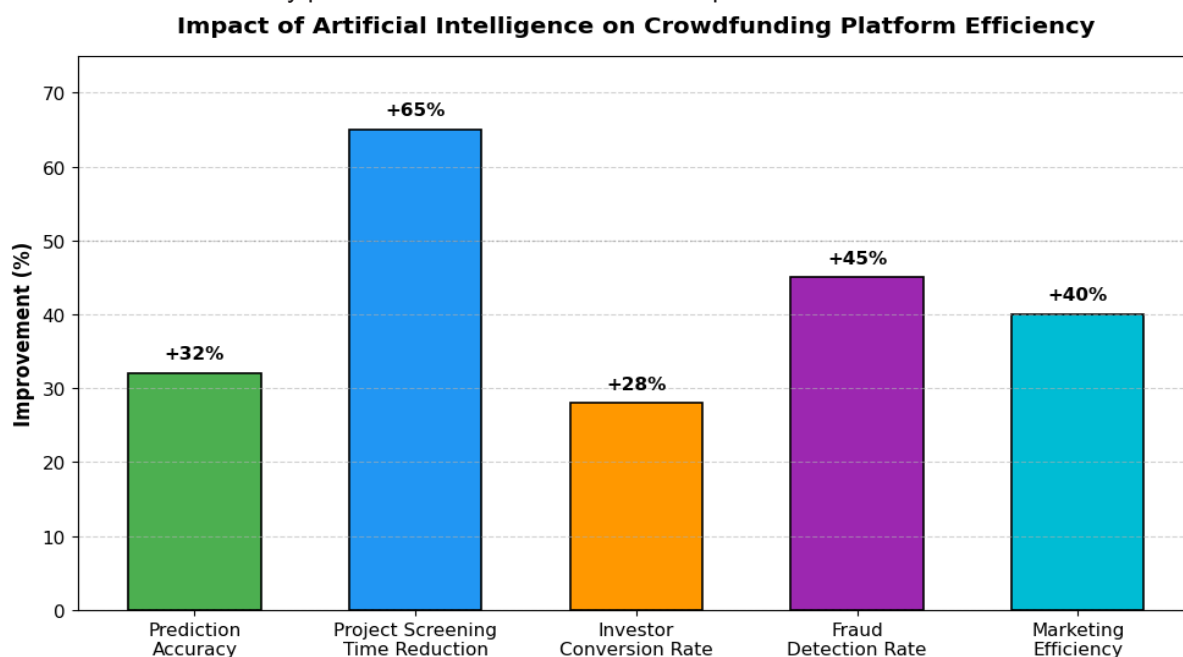


Figure 3. Impact of Artificial Intelligence on Crowdfunding Platform Efficiency¹¹

It is important to note that the use of AI is not limited to the formal verification of compliance with platform requirements. Modern algorithms are capable of predicting the probability of campaign success based on the analysis of potential investors' behavioral patterns, identifying hidden risks, and recommending specific measures to project creators to enhance the attractiveness of their offerings.

3.2. Personalization and Improving Marketing Effectiveness

Another significant area of AI application in crowdfunding is the personalization of interactions with investors. The analysis of investment preferences and previous behavior makes it possible to recommend projects that best correspond to users' interests and risk tolerance. Such an approach not only increases the likelihood of investment but also contributes to the development of long-term loyalty to the platform.

It should be noted that the effectiveness of personalized recommendations is supported by empirical data.

According to estimates from some platforms, the implementation of machine learning-based recommendation systems can increase conversion rates by 20–30% without additional marketing costs. This is particularly important for small platforms that cannot afford large-scale advertising campaigns.

3.3. Limitations and Risks of AI Application

At the same time, the limitations and risks associated with the application of artificial intelligence in crowdfunding should not be underestimated. First, machine learning algorithms require large volumes of data for training, which may pose a challenge for new or small platforms. Second, there is a risk of algorithmic bias, particularly when training data contain systematic distortions. Third, the automation of decision-making may create an illusion of objectivity, whereas, in reality, the quality of recommendations depends on the quality of the data and the algorithms selected.

As researchers rightly note, technological solutions should complement rather than replace human expertise. This is particularly relevant for projects in the fields of art and social initiatives, where formal success criteria may not adequately reflect the actual value of a project (Ibadulla & Lalayan, 2023).

4. New Financing Models in the Web3 Era

4.1. From Centralized Platforms to Decentralized Ecosystems

The evolution of crowdfunding toward Web3 is characterized by a transition from centralized platforms controlled by operators to decentralized, community-governed ecosystems. This transition has affected all key aspects of their functioning, from methods of raising funds to decision-making mechanisms and the distribution of responsibility.

In a decentralized model, the platform operator ceases to be the sole arbiter determining the rules of the game. Instead, decisions are made collectively by token holders, while key functions — from project verification to dispute resolution — are automated through smart contracts. This approach undoubtedly enhances the resilience of the system and reduces the risks of abuse by intermediaries.

To trace the evolutionary path of crowdfunding models, Figure 4 presents a comparative timeline spanning three decades of development.

As shown in Figure 4, the evolution of crowdfunding can be divided into three distinct phases. Phase 1 (2000–2010) represents the traditional model, characterized by direct fundraising from the crowd, minimal platform regulation, and limited investor protection. During this period, crowdfunding primarily served creative projects and social initiatives, with platforms acting as simple intermediaries between project creators and backers.

Phase 2 (2010–2020) marks the emergence of platform-based crowdfunding, driven by the rise of digital platforms. This period saw the development of centralized platforms, the emergence of regulatory frameworks, and the involvement of professional intermediaries. Platforms such as Kickstarter and Indiegogo established themselves as market leaders, offering structured processes for campaign creation and management.

Phase 3 (2020–2030+) represents the current and future trajectory toward Web3 and decentralized finance (DeFi) crowdfunding. This phase is characterized by decentralized platforms, smart contracts and tokenization, and DAO governance. Blockchain technology, artificial intelligence, and decentralized financial instruments are fundamentally reshaping the landscape of collective financing.

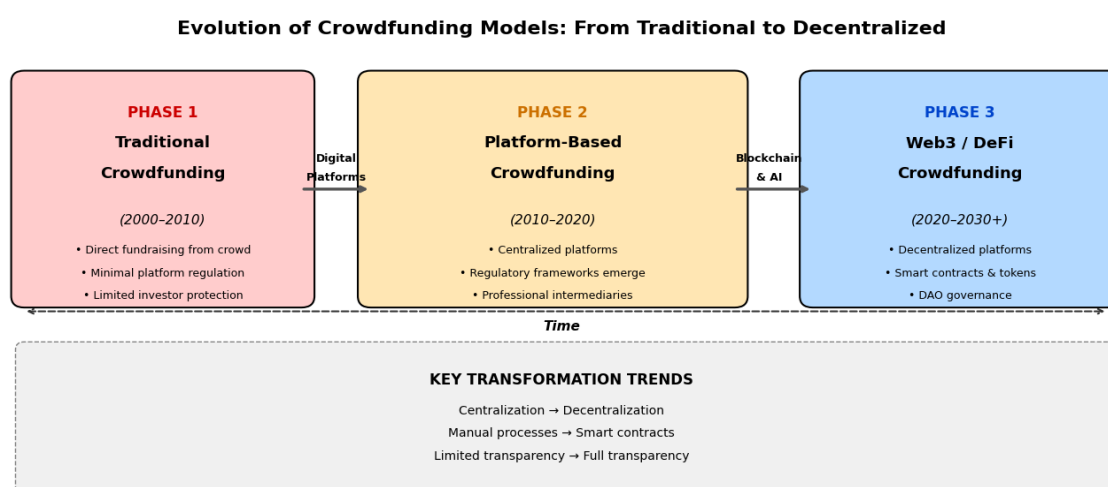


Figure 6 - Evolution of Crowdfunding Models: From Traditional to Decentralized
Source: compiled by the author based on Mollick (2014), Belleflamme et al. (2014), Schär (2021), OECD (2022).

Figure 4. Evolution of Crowdfunding Models: From Traditional to Decentralized¹¹

However, it should be acknowledged that decentralized models face their own challenges. These include the complexity of coordination in collective decision-making, the risk of token-holder apathy, and insufficient legal certainty. It appears that, in the foreseeable future, different models — ranging from fully centralized to fully decentralized — will coexist, with the choice of a particular model depending on the nature of the projects and the preferences of the participants.

4.2. DAO Mechanisms in Crowdfunding

Decentralized autonomous organizations (DAOs) deserve particular attention, as they offer a fundamentally new approach to the governance of investment processes. In the context of crowdfunding, DAOs enable investors not only to provide funds but also to participate in decision-making, ranging from project selection to determining the platform's development strategy.

Notably, the application of DAO mechanisms can substantially reduce opportunistic behavior on the part of project initiators. Since all decisions and transactions are recorded in a public ledger and voting is conducted transparently, strong incentives for responsible behavior are created. Researchers also note that DAO structures contribute to the formation of communities around projects, thereby enhancing their resilience and long-term viability.

CONCLUSION AND SUGGESTIONS

Based on the analysis presented in this article and the examination of technological innovations shaping the modern crowdfunding landscape, it can be concluded that the integration of blockchain technologies, artificial intelligence, and decentralized finance models fundamentally transforms the nature of collective financing, shifting it from a simple fundraising mechanism to a comprehensive digital ecosystem characterized by enhanced transparency, automated execution of obligations through smart contracts, and expanded investment opportunities through asset tokenization. The empirical evidence presented in this article demonstrates that blockchain-based crowdfunding platforms significantly outperform traditional models across all key performance indicators, particularly in transparency (90% vs. 20%), investor control (85% vs. 15%), and fraud protection (85% vs. 30%), while reducing transaction costs from 70% to 20%, which collectively validates the transformative potential of fintech integration. The evolution of crowdfunding toward Web3 and decentralized autonomous organizations represents a paradigm shift in how investment decisions are made and how capital is managed. However, its successful implementation depends on addressing several critical challenges, including regulatory uncertainty, technical complexity, scalability limitations, and security concerns associated with smart contract vulnerabilities.

Based on these findings, the following recommendations are proposed for different stakeholder groups. For crowdfunding platform operators, it is essential to integrate blockchain-based verification systems, implement AI-powered screening tools, develop user-friendly interfaces for token-based investments, and establish robust KYC/AML procedures while investing in educational resources to help users navigate decentralized technologies. For project initiators, it is advisable to utilize AI tools to optimize campaign presentation and targeting, consider blockchain-based platforms to attract technically sophisticated investors, ensure clear communication of project milestones and fund usage, and actively build community engagement to foster trust and long-term support. For regulators, it is important to develop clear and comprehensive regulatory frameworks for blockchain-based crowdfunding, establish standardized requirements for token issuance and investor protection, create regulatory sandboxes to test innovative models in controlled environments, harmonize international standards to facilitate cross-border crowdfunding, and support financial literacy programs that enhance public understanding of digital financing instruments.

Future research should focus on empirical analyses examining the effectiveness of AI-based project evaluation, longitudinal analyses of the impact of tokenization on investment behavior and long-term project outcomes, investigations of governance mechanisms within decentralized autonomous organizations and their effectiveness in conflict resolution and decision-making, and comparative analyses of crowdfunding integration with traditional financial systems. The sustainability and growth of crowdfunding as a legitimate and effective financing channel will ultimately depend on striking a balance between technological innovation, adaptive regulation, institutional trust-building, and the continuous development of digital infrastructure that safeguards the interests of all participants while fostering entrepreneurship and sustainable economic development.

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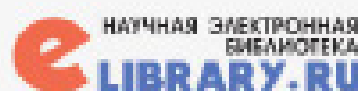
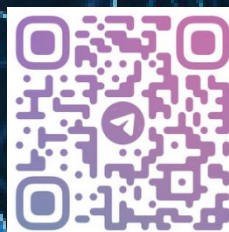
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