IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 11, Issue 10, October 2024

DOI: 10.17148/IARJSET.2024.111017

Review of Innovative Crowdfunding Mechanisms Unlocking the Potential of Blockchain Technology

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Abstract: Crowdfunding, indeed, has become the lifeline for entrepreneurs to fund their innovative ideas and projects. Despite its fantastic popularity, a traditional crowdfunding platform has been known to face plenty of challenges, including opacity, high transaction cost, and fraudulent activities. To this end, this paper reviews five innovative approaches that unlock blockchain technology for the reliability and efficiency of crowdfunding systems. Analysis of these methods would then lead to a framework of a more efficient crowdfunding model that will mitigate the existing problems while still leveraging the benefits of decentralized finance.

Keywords: Tokenised Crowdfunding, Peer –to- Peer Funding, Blockchain Crowdfunding Campaign, Transparency & Anti-Fraud, Immutable Records.

I. INTRODUCTION

Entrepreneurship is always characterized by a failure in getting the required necessary financial resources, which can be a barrier for young and emerging innovators. Traditional capital-raising approaches, such as bank loans, are very rigid and most potential entrepreneurs cannot fulfill these requirements. Crowdfunding, however, emerged as a revolutionary approach through which a large number of contributors raise capital for a project or an idea through online platforms. During the past few years, blockchain in crowdfunding emerged as a solution to all the problems by providing immutable and transparent transaction records [7].

However, crowdfunding platforms have a number of challenges related to transparency, fees, and risks of fraud, which requires more dependable solutions [2]. This article discusses several innovative methods of crowdfunding that utilize blockchain for creating a more reliable and efficient system for entrepreneurs and investors. In relation to studying how the blockchain technology creates secure, transparent, and efficient crowdfunding platforms and its impact on investor trust and adoption [8].

II. LITERATURE SURVEY

1. Dominant Crowdfunding Models:

Crowdfunding has different types, among which includes donation-based, reward-based, and equity crowdfunding [1]. Platforms like Kickstarter and GoFundMe gained much success by allowing users to present their projects and attract funds from their supporters. However, some drawbacks diminish the effectiveness of these platforms.

2. Problems with the Current Systems:

Most crowdfunding campaigns are not accountable, hence, some funds either get mismanaged or not used for the intended purpose [3].

3. Transaction Fees:

Most websites are rather expensive in terms of transaction fees which is another factor that makes many potential campaigners shy off using crowdfunding as a viable financing option [4].

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4. Complications with International Payments:
Cross-border transactions attract a lot of charges and take longer to process. This becomes complicated in transnational fundraising processes [5].

5. Phony Campaigns:
A lot of studies reveal that classic crowdfunding websites lack some level of security and trust, among other major issues. In the case of fraud, this aspect is not a stranger to typical crowdfunding sites, where an investor has very little protection [6]. Blockchain technology can solve these problems by using smart contracts and decentralized ledgers, releasing contributions only when specific predefined conditions are met [7].

6. Intermediaries Reduction:
A review of the literature shows that most blockchain-based crowdfunding platforms make use of Ethereum's smart contracts to provide security and automate that leads to removing the need for a third-party intermediary [10].

III. PROPOSED SOLUTIONS IN THE LITERATURE SURVEY

Several papers advance the idea of the use of blockchain technology to rectify the disadvantages associated with traditional crowdfunding platforms:

1. Blockchain Integration:

With smart contracts on sites like Ethereum, the money will only be released upon those certain circumstances, which helps to make funds accountable and minimize fraud activities [3]

2. Decentralized Applications (dApps):

Developing dApps makes fundraising more transparent, where funders can see the actual allocation and usage of the money [4].

3. Cross-Border Transactions:

Blockchain technology makes cross border payments faster and cheaper, thus crowdfunding campaigns more inclusive and reaching out to more people [5].

IV. PROPOSED SYSTEM

Our proposed system incorporates the insights gathered from the reviewed literature. By leveraging blockchain technology, we aim to create a trustful payment system for crowdfunding that addresses the existing drawbacks while providing a user-friendly interface.

Key Features:

1. Campaign Creation and Management:

Users can easily create campaigns with immutable records stored on the blockchain [3].

2. Smart Contract Mechanisms:

A smart contract will hold funds until the set milestones are attained. This way, the funds will be applied correctly [4]. This paper develops a blockchain-based crowdfunding system that uses smart contracts to automate and secure fundraising. The system allows project creators to establish fundraising campaigns based on predetermined terms of participation with conditions defined by smart contracts [7].

3. Decentralized Fund-approval of funds:

Those providing above the set limit can approve or deny a spending application. It promotes community involvement and helps in social accountability as well [5].

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4. Automatic Fund Transfer:

The system designed allows for an automatic fund transfer to the project owner if the campaign raises the required amount. If not, the fund is returned to the investor, completely eliminating frauding possibilities [10].

V. IMPLEMENTATION

The implementation of our proposed system involves several critical components:

1. Smart Contracts:

The heart of this system is constituted by smart contracts responsible for the management, distribution, and tracking concerning fund distribution to each campaign. The contracts will run on the Ethereum blockchain, providing a very secure and robust environment for decentralized applications. Smart contract use means automatic acceptance of donations on the platform, tracking user contributions, and disbursing funds into campaign creators' accounts. The transparency and immutability of Ethereum ensure that the rules coded within these contracts get upheld without the involvement of an intermediary, thereby reducing the risks of fraud or mismanagement of such funds. In addition to this, these contracts can also be programmed to execute certain actions upon attaining the pre-defined conditions, such as releasing funds only after attaining a certain goal of the campaign or on its deadline.

Then, smart contracts would also manage completion phases of projects, and here, contributors can track how their money is being spent by the creators of campaigns. For example, one could release money in phases with the unfolding of a project. For example, each phase would be recorded on the blockchain: This staged approach ensures even more trust in between campaign creators and donors, as contributors will get to be well aware of how the funds raised are being spent at every stage. Furthermore, all actions and transactions related to a campaign will be secure, transparent, and irreversible with Ethereum's decentralized network, which gives more strength to the integrity of the system.

2. Web Interface:

This will allow users to participate in the campaigns and have a friendly user interface in place on the web, where they can view progress. The web interface will be the bridge between the contributors and the campaign creators, providing clear views of how funds are being managed and of the projects' progression. Browsing through active campaigns, getting detailed descriptions, seeing images and funding goals, and even donating directly on the interface will be possible. Each campaign will be easily tracked, showing how much has been raised, what milestones are achieved so far, and deadlines approaching so that contributors can make adequate decisions.

The web interface will also allow for campaign creators to communicate their concerns with followers about the project and respond to their questions. There will be a dashboard where creators can manage their campaigns, keep tabs on donations, and update supporters on the various phases of projects. All the blockchain data pertaining to donations received and transactions made will be shown directly within the platform to increase transparency. Not only does this make all campaign financial activities public, but it also verifiable by contributors, thereby establishing trust in the system.

3. Blockchain Integration:

Blockchain integration will essentially allow for transparent, secure, and immutable financial transactions within the system. All contributions and transactions would be recorded on the Ethereum blockchain, and permanently viewable by anyone who chooses to check on the authenticity and movement of funds. It's this transparency that will discourage fraudulent and irresponsible use, because each and every user will have the power to audit the flow of donations and disbursements at any given time. Decentralized nature of Blockchain technology will ensure no one can alter or change those records. This situation also creates high degrees of trust in all parties who participate in the platform.

In addition to this feature of transparency, blockchain will increase the feature of security in the system. All transactions will be encrypted and verified by the consent mechanism of the Ethereum network in such a way that it becomes almost impossible for those malicious actors to interfere with or alter the real data of the transaction. With smart contracts and security held within a blockchain, these funds raised will be safely and diligently applied as per the campaign terms of agreement. Accounting procedures for the platform will also see streamlining through

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blockchain-based technology because each transaction will be automatically recorded, so there will be no scope for human error or administrative overheads.

VI. SYSTEM ARCHITECTURE

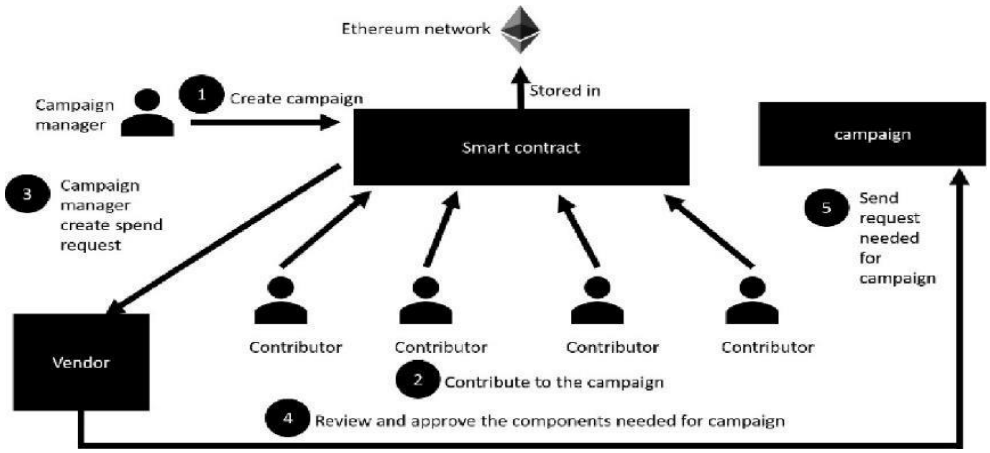

FIG. 1: SYSTEM ARCHITECTURE

The architecture in the diagram shows a blockchain-based crowdfunding system running on the Ethereum network, utilizing smart contracts to ensure transparency and automation. Below is the explanation of architecture:

1. **Campaign Creation:**
   - Once a Campaign Manager initiates creating a campaign in this platform, then that campaign is stored in a Smart Contract on the Ethereum blockchain. All the terms and conditions related to a campaign are codified in that Smart Contract, so each term, whether it is regarding the collection of funds or its dispersing, rules them and will enforce them automatically without any intermediate authority.
2. **Contribution:**
   - Contributors or contributors/investors can then contribute upon the campaign. Every contribution is recorded in a way that it will be secured on the blockchain and locked within the smart contract of the campaign before the funds from the contributors are cleared in case of actual goals being reached by the campaign or certain pre-defined milestones of the campaign. This way, handling the funds would be transparent, and contributors could trace their contributions on the blockchain.
3. **Spend Request:**
   - As the campaign is running, the Campaign Manager may create a Spend Request. The request is forwarded to the smart contract so that one can withdraw from funds needed to support a specific component of the campaign. That way, with such a process, step-by-step allocation of funds is feasible, so that resource withdrawal is undertaken only when it is necessary
4. **Approval Process:**
   - Contributors are granted permission to Review and Approve the spend requests. This is a decentralized layer that offers maximum transparency and security. Funds can only be released if a majority of the contributors vote for the approval of the request. Hence, the possibility of misuse of the fund reduces.
5. **Interaction with the vendor:**
   - Once the spend request is sanctioned, the required money is moved from the smart contract to a Vendor. This vendor can now provide the goods or services needed for the campaign. The smart contract handles the transaction by transferring funds only after the requirements are fulfilled.
6. **Campaign Completion:**
   - Now, after funding and delivery of all the necessary components for the campaign, this moves the campaign towards completion. All of these interactions and transactions are recorded immutably on the blockchain, so at each stage, the audits can be transparent and accountable.

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This ensures security, transparency, and trust through the decentralized nature of blockchain technology and the capabilities offered by smart contracts. The risk of fraud is minimized and ensures that every contributor has a say in how their funds are spent.

VII. UML DIAGRAM

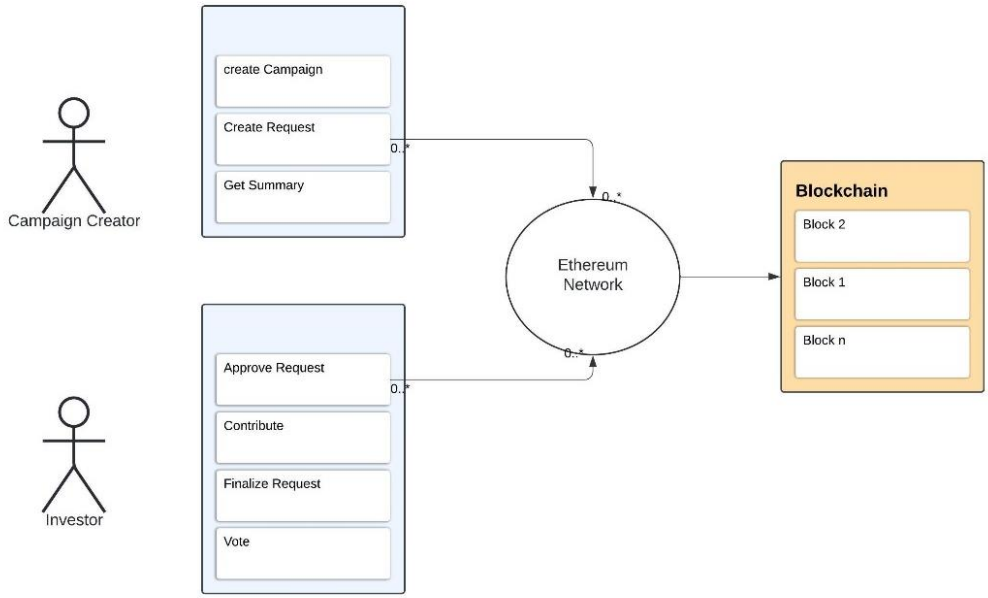

FIG. 2: UML DIAGRAM

This UML diagram illustrates the interaction between a Campaign Creator, an Investor, and the Blockchain by using the Ethereum Network for a blockchain-based crowdfunding platform. Here are all the components involved:

1. **Campaign Creator**:
   - **Create Campaign**: The creator initializes a new campaign on the platform.
   - **Create Request**: The creator initiates a request to withdraw or use the funds raised from the campaign.
   - **Get Summary**: Retrieves the summary campaign details of the amount raised, number of investors etc.
2. **Investor**:
   - **Approve Request**: Investor can accept or decline the creator's request to withdraw the funds.
   - **Contribute**: Investors contribute to the funds
   - **Finalize Request**: After approval by investor, it can finalize the request and enable transfer of funds
   - **Vote**: Investors vote on whether the request of campaign creator should be accepted or not.
3. **Ethereum Network**:
   - The Ethereum Network between the blockchain, investors, and campaign creators executes and verifies Tx.
4. **Blockchain**:
   - Transactions are recorded in blocks that keep the record open and immutable.

The diagram illustrates how both the campaign creator and the investor interact with the smart contracts on the Ethereum network as well as the logging of the results on the blockchain.

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VIII. DATA FLOW DIAGRAM

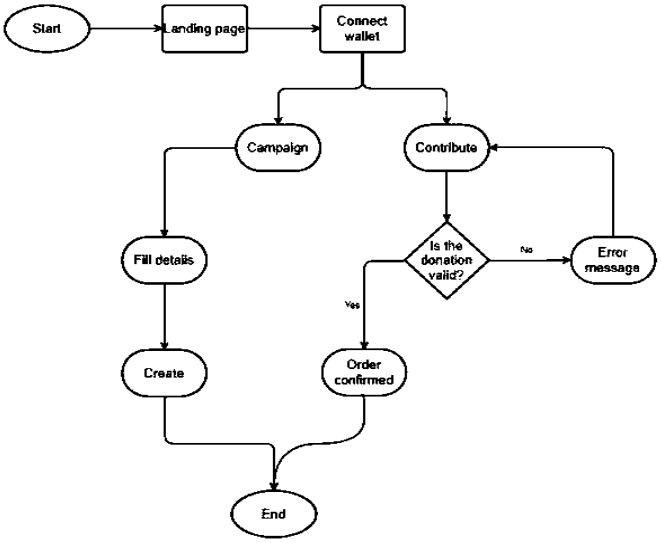

FIG. 3: DATAFLOW DIAGRAM

This supports a process flow about participating in a campaign via a blockchain crowdfunding website. The flow summary is as follows:

1. **Start**: The process begins.
2. **Landing Page**: The user is at the main page of the campaign.
3. **Connect Wallet**: The user connects their crypto wallet to the platform.
4. Then splits into two parallel flows:
   - **Campaign**: The user gives out information about the campaign and then begins creating a campaign.
   - **Donate to**: The user selects to donate to a campaign available.
5. **Is the contribution valid?**: If the contribution is valid, for example the contribution has sufficient funds, and the input is correct, then a donation is confirmed.
   - **Yes**: A message Order Confirmed comes out.
   - **No**: An error message is displayed to the user.
6. **Termination**: The activity ending in either contribution or creation of a campaign.

This was a flowchart showing the user journey from wallet connection to either contribution or creation of a campaign.

IX. CLASS DIAGRAM

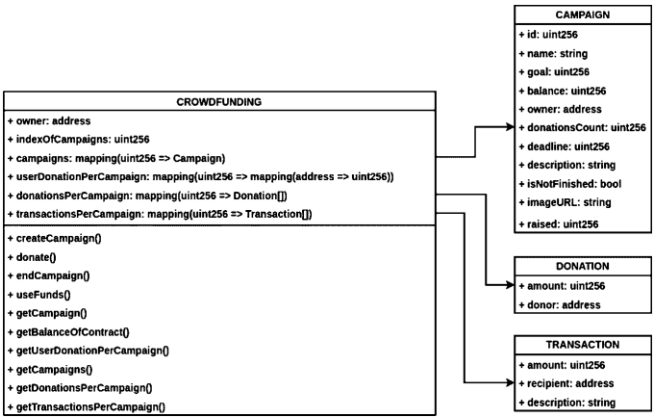

FIG. 1: CLASS DIAGRAM

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This is a blockchain-based crowdfunding system class diagram. It represents the structure of the system: it accounts for all the relationships between classes Crowdfunding, Campaign, Donation, and Transaction. So, this reads as follows:

1) CROWDFUNDING Class:

The contract will have an attribute called owner that stores the owner's address presumably the creator of the contract or platform. It will have an indexOfCampaigns and a uint256 value keeping track of the number of campaigns. The campaigns mapping links campaign IDs to specific details of each campaign. There would also be a mapping named userDonationPerCampaign that would, for example, represent how much this particular user has donated to some specific campaign; this mapping is composed of campaign IDs as keys of another mapping of the kind user address to donation amount. The contract would also hold donationsPerCampaign mapping of arrays of donations per campaign and transactionsPerCampaign mapping of arrays of transactions per campaign.

The contract will comprise several key functions managing the crowdfunding activities. The function createCampaign() will be responsible for handling the ability to create new campaigns, while the function donate() will include rules in terms of donation for a particular campaign. The function endCampaign() will include a rule to close a campaign when it is over, and the useFunds() function will allow using the funds collected for a particular campaign. To get the number of campaigns, this will obtain the details of one campaign with the method getCampaign(), and getBalanceOfContract retrieves the crowdfunding balance for the contract. Bonus points: getUserDonationPerCampaign() returns how much a user has donated toward a single campaign, getCampaigns() returns an array of all campaigns created, and getDonationsPerCampaign() and getTransactionsPerCampaign() lets you get donations and transactions associated with each campaign.

2) CAMPAIGN Class:

A campaign will have a few attributes to define and track its progress. This is an `id` as a `uint256` which uniquely identifies the campaign, and a `name` as a string is given to the campaign. The `goal` is how much the campaign goal is set to be raised, and the `balance` is a record of how much has been raised overall so far. The `owner` stores the address of the one who has created the campaign, and `donationsCount` tracks the donations received. The `deadline` is a `uint256` which shows the end date of the campaign. The `description` is information about the campaign, and `isNotFinished` is a boolean showing whether the campaign is still active. Similarly, the `imageURL` stores the link to the image of the campaign, and `raised` displays the total amount the campaign has collected.

3) DONATION Class:

Every donation will have two essential attributes. Firstly, it has an amount the size of a uint256 and makes reference to the totalling amount donated, and secondly, it has a donor, which is an address holding information about the individual or entity who made the donation.

4) TRANSACTION Class:

In each transaction, there will be three attributes; `amount` is a `uint256` representing the amount involved in the transaction. The `recipient` is an address specifying which individual or entity will receive the funds, and the `description` is a string detailing the transaction. It may specify why the funds are being used or how that sum is administered.

5) Relationships:

The Crowdfunding class is related to Campaign, Donation, and Transaction classes by mappings that show that it deals with those entities.

It represents the overall structure of a crowdfunding system, where campaigns are launched, donations are accepted, and transactions are carried out within a smart contract in blockchain.

X. CASE STUDIES

We now elaborate on the old existing platforms that have successfully integrated blockchain technology into its pipeline:

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Kickstarter vs. Blockchain-based Models:
Kickstarter has raised well over $1.5 billion since its inception. However, it charges a 5% fee on funds raised, plus payment processing fees [4]. Blockchain-based models reduce these fees drastically and make them more transparent.

Successful Blockchain Platforms:

Projects like KickICO and Giveth proved the applicability of blockchain crowdfunding, with lower commissions and higher levels of trust among participants [5].

Another example is BlockFund, which demonstrated the potential for blockchain to remove the role of intermediaries, thus saving both investors and project creators up to 30% in fees [8].

Successful Renewable Energy Projects:

A few blockchain-based crowdfunding platforms have recently been launched and were successful, for example, FundYourDream that raised more than $1 million for a renewable energy project, leveraging the security and transparency smart contracts offer [7].

Successful Real Estate Platforms:

In a real estate crowdfunding platform using Ethereum, project creators were able to raise funds securely, as the blockchain automatically allowed for the release of funds once certain milestones from projects had been achieved [9]. These case studies help to clarify the way blockchain works in crowdfunding systems, especially regarding security, efficiency, and trust [10].

XI. FUTURE WORK

Though our proposed system offers excellent benefits, further research and development are required in the following areas:

1. Study the regulatory aspects of blockchain crowdfunding.

2. Provide strategies to increase user adoption and engagement.

3. Further research will involve exploration to increase functionality on blockchain-based platforms through decentralized identity verification systems, further enhancing security and trust [6].

4. Evaluate the long-term sustainability of blockchain-based crowdfunding platforms.

5. The research into cross-chain solutions, which will allow contributions and donations from different blockchains and cryptocurrencies, is also worthy of investigation [8].

6. The scaling up of these platforms to improve their scalability has been selected as a very important focus of future research, as scalability has become a major limit in blockchain networks, as this is the case with Ethereum when handling many transactions [9]

7. The other area to be researched is the addition of AI-based fraud detection systems, which can in turn analyse campaign data in real-time and check for potentially fraudulent activities before they arise [10].

XII. CONCLUSION

The integration of blockchain into crowdfunding frameworks is an innovative chance for overcoming most of the elementary defects that are inherent in traditional systems. The most important point is one of transparency, which is straightforwardly achieved with immutable blockchain records. This way, entrepreneurs and investors can track funds flow at any given time, ensuring all transactions are both public and verifiable. By eliminating intermediaries like banks or third-party payment processors, blockchain essentially lowers costs in a transaction, making it cheaper for entrepreneurs to raise capital and cheaper for investors to contribute. Moreover, blockchain, being decentralized,

DOI: 10.17148/IARJSET.2024.111017

promotes the ease of cross-border payments. This way, entrepreneurs can, therefore, access a global pool of potential backers not restricted by geographical boundaries or fees they incur upon conversion from one currency to another.

Apart from the above-discussed direct advantages, blockchain-based crowdfunding can ensure a more sustainable environment both to the entrepreneurs and to the investors. A significant degree of trust garnered through transparency and security will attract numerous people to participate while it could reduce more opportunities for frauds and elevate the user experience in general. Entrepreneurs will have quicker access to the funds, while informed decisions by the investors are guided by comprehensive records of previous transactions that are unalterable. This decentralization model may further enhance the underrepresented or emerging markets where the traditional funding mechanisms are either limited or not accessible, thus leading to even greater chances of innovation at the global level.

However, much of this potential awaits research in the implementation of such blockchain-based systems and their long-term effects in the world of crowdfunding. The scalability and regulatory challenges also offer a need to research user adoption to see if blockchain-based solutions can actually operate efficiently at scale. More explicitly, it is advisable that future research focus on the integration of blockchain technology with the existing financial system and crowdfunding platforms in a way that will not cause any form of disruption. They will also affect legal frameworks, protections for investors and data privacy; therefore, this topic is subject to academic research in order to be sure whether the blockchain-based crowdfunding can provide a literally viable and secure alternative to traditional methods.

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