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Towards Safer Incentive-Based Crowdfunding: A Blockchain-based Approach

Completed Research Paper

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Abstract

Crowdfunding has become an increasingly important funding mechanism, with transaction volumes growing steadily in recent years. However, significant information asymmetries between backers and project initiators challenge its sustainable development, particularly in incentive-based crowdfunding. Backers lack critical insights into initiators' motives, capabilities, and project specifics due to the anonymous nature of these interactions. Using principal-agent theory, we analyze existing problems between backers and project initiators and highlight the information asymmetries between them. These asymmetries result in backers suffering from adverse selection and moral hazard, threatening campaign success. To address these problems, we propose integrating blockchain technology into crowdfunding campaigns. Our results show that blockchain contributes to increased transparency, security, traceability, and decentralization. Based on a literature review and expert interviews, we examine the technological potential to reduce information asymmetries, strengthen trust between backers and project initiators, and contribute to improved governance mechanisms and innovative ways of implementing crowdfunding more securely.

Keywords: Incentive-based crowdfunding, information asymmetries, principal agent theory, blockchain

Introduction

In recent years, crowdfunding has gained traction as a viable method for funding ventures and projects (Shneor, 2022; Shneor et al., 2024). Crowdfunding involves raising money from a large group of people via online platforms (crowdfunding platforms), which connect project initiators and backers (Bretschneider & Leimeister, 2017; Cumming et al., 2020). It is categorized into reward-based, equity-based, lending-based, and donation-based crowdfunding (Giudici et al., 2012; Leimeister, 2012). The first three categories are considered incentive-based, as backers expect compensation (Bretschneider & Leimeister, 2017). Due to the anonymity of project initiators and backers, and their conflicting interests, incentive-based crowdfunding is susceptible to principal-agent problems (Brink et al., 2019; Guesnerie et al., 1989). Project initiators may act unethically, delivering low-quality rewards, failing to complete projects, or even committing fraud (failory.com URL). This puts backers at a disadvantage, as their financial contributions are at risk (Shneor et al., 2022). Mollick (2014), found that 9% of Kickstarter projects fail to deliver promised rewards. A notable example is the Coolest Cooler crowdfunding campaign, which raised significant funds but failed due to poor financial planning; the product was sold on Amazon before the company declared bankruptcy, leaving backers empty-handed (Schiavone, 2017). These issues stem from information asymmetries: backers lack insight into initiators' intentions (Peprah & Shneor, 2022). Current mitigation efforts of campaign videos or LinkedIn profiles aim to reduce anonymity (Blohm et al., 2024), but they are easily manipulated and considered insufficient. In response, we propose integrating blockchain-based solutions, including smart contracts, into crowdfunding campaigns. Smart contracts, self-executing protocols on the blockchain, enable secure, decentralized enforcement of predefined agreements (Albizri & Appelbaum, 2021; Eggers et al., 2021). This makes them a decentralized and secure automation technology that enables the creation of a trusted relationship between parties involved (Eggers et al., 2021; Gilcrest & Carvalho, 2018). Our research addresses the question: "*How can blockchain be used to overcome backers' problems in incentive-based crowdfunding campaigns?*"

We first identify common backer issues using principal-agent theory, drawing on a literature review and expert interviews. We then derive and validate blockchain-based solutions with further expert input. Our contribution includes a comparative analysis of principal-agent problems in incentive-based crowdfunding and a structured approach to addressing them through blockchain smart contracts. We also develop guidelines for applying blockchain to make crowdfunding safer and more effective. This work advances the steering and governance mechanism literature by showing how blockchain offers new perspectives for crowd-based mechanisms, particularly crowdfunding.

Theoretical Contextualization

Incentive-based Crowdfunding

Literature distinguishes between four types of crowdfunding: *reward-based*, *equity-based*, *lending-based*, and *donation-based* (Belleflamme et al., 2019; Giudici et al., 2012; Leimeister, 2012). In *reward-based* crowdfunding, the crowd invests in specific projects or businesses (Mollick, 2014), where backers receive rewards like products or discounts (Kraus et al., 2016). In *equity-based* crowdfunding, backers purchase shares in a company or a start-up and receive a share of the profits (Allison et al., 2015; Bruton et al., 2015). Equally to reward-based crowdfunding, equity crowdfunding campaigns have a global reach, allowing organizations to access an international crowd of micro-supporters (Mollick, 2014). *Lending-based* crowdfunding facilitates online loans from a group of private backers to businesses or individuals (Moysidou & Hausberg, 2020). Loans are managed online, and funders receive monthly interest payments that are agreed upon before the loan is made (Giudici et al., 2012). The fourth type of crowdfunding, *donation-based* crowdfunding, is not motivated by entrepreneurial purposes (Salido-Andres et al., 2021), but supports charitable causes for which donors do not receive tangible or monetary rewards (Leimeister & Zogaj, 2013). The "*reward*" for the donor is instead the satisfaction of supporting important causes (Giudici et al., 2012; Leimeister & Zogaj, 2013). Like all crowdfunding models, donation-based crowdfunding follows an "all or nothing" principle: if the fundraising goal is met within the predefined timeframe, the project proceeds; otherwise, contributors receive a refund (Cumming et al., 2020).

This study focuses on incentive-based crowdfunding, including reward-based, lending-based, and equity-based crowdfunding, where backers are motivated by the prospect of receiving a (financial) return (Bretschneider & Leimeister, 2017). The underlying process of an incentive-based crowdfunding campaign involves five steps. After developing a business idea that an organization wants to finance through a crowdfunding campaign, the first step is to select an appropriate crowdfunding platform (Belleflamme et al., 2019). Given the specialization of platforms in different industries and markets, it is crucial to find a platform that fits the business idea (Mora-Cruz & Palos-Sanchez, 2023). In the second phase, the project initiator describes the business idea (identification phase), defines the funding goal, communicates the timeframe, and outlines the rewards for backers (Paoloni et al., 2019). This step is crucial, as it is the project initiator's only opportunity to promote the initiative (Li et al., 2020). Based on this so-called "open call", backers decide whether to invest in this campaign. When backers choose to fund a project (step 3, funding), they officially become part of the campaign and their investment is transferred to the platform (Belleflamme et al., 2019). At this point, backers lose direct control over how the project initiator uses the funds and cannot reverse their funding decision. This marks a key milestone for backers, as they give up their active influence during the funding phase (Deng et al., 2022). To ensure that funds are only disbursed once the funding goal is reached, the crowdfunding platform acts as an intermediary (Mora-Cruz & Palos-Sanchez, 2023). At the end of the funding (step 4, completion phase), and if the funding goal is met, the platform releases the funds to the project initiators, allowing them to realize their project. If the funding goal is not met within the specified time, backers are refunded by the platform, and the project cannot proceed. If the funding goal is met on time, the project initiator receives the funding transferred from the platform and can begin implementing their idea, which leads to phase 5, the reward phase (Kraus et al., 2016). Depending on the type of campaign, in this phase, backers receive a product, loan interest, or a predetermined return on their investment (Bretschneider & Leimeister, 2017).

Smart Contracts and Blockchain Technology

Defined as self-executing protocols stored on a blockchain, smart contracts automate processes without intermediaries (Brandstatter et al., 2020; Gilcrest & Carvalho, 2018). Szabo (1996) conceptualized smart contracts as “a set of promises specified in digital form, including protocols by which the parties fulfill those promises”, later expanded by Tapscott and Tapscott (2016) to include the execution of the secure and transparent contracts (“securing, enforcing, and executing the settlement of recorded agreements between people and organizations”). Key characteristics of smart contracts due being stored on a blockchain – decentralization, immutability, and transparency – make them applicable for industries such as finance, logistics, and energy (Hewa et al., 2021; Negara et al., 2021). They autonomously store, verify, and execute these rules, acting as “pieces of code that codify business logic” (S. Wang et al., 2018).

During creation, the contracting parties agree on detailed terms and conditions, which are reviewed by legal experts before programming (Y. Wang et al., 2020). Once deployed, smart contracts execute pre-defined actions when certain conditions are met, enhancing security and trust through blockchain transparency (Christidis & Devetsikiotis, 2016; Kannengieser et al., 2022). Depending on access and control, blockchain systems are classified into public permissionless, public permissioned, and private permissioned blockchains (Laatikainen et al., 2023). Public permissionless systems allow open participation in reading, writing, and validation (Pedersen et al., 2019). Public permissioned blockchains permit any node to read and write transactions, though validation is restricted (Balcerzak et al., 2022). Private permissioned blockchains limit reading, writing, and validation to authorized participants (Laatikainen et al., 2023). At its core, blockchain is a decentralized digital ledger that organizes and stores data in cryptographically linked blocks (Moosavi et al., 2024). Each block stores transaction details, a timestamp, and cryptographic elements, ensuring data integrity through block hashes, Merkle trees for verification, and sequential block headers (Taherdoost, 2023). Transactions first enter an unconfirmed pool before being validated by miners and added to the blockchain through a consensus mechanism (Balcerzak et al., 2022; Tripathi et al., 2023). The Proof of Work mechanism requires miners to solve complex computational problems to validate transactions, ensuring network security but consuming significant energy (Nguyen et al., 2019; Platt et al., 2021). Proof of Stake reduces energy demands by selecting validators based on their cryptocurrency (Azbeg et al., 2021). Despite these innovations, smart contracts and blockchains face legal and technical challenges. Jurisdictional ambiguities, such as the GDPR’s “right to be forgotten”, conflict with the blockchain’s immutable nature (Drummer & Neumann, 2020).

Methodology

To answer the research question, we employed a two-step approach. First, we identified existing problems in crowdfunding processes through a literature analysis and five expert interviews (see Figure 1, no. 1-5). Second, we explored how blockchain could address these issues. Here, we first reviewed current literature before conducting expert interviews to ensure the validity of our results.

Step one: Using principal-agent theory, we developed an analytical framework to identify, analyze, and categorize backers’ problems in crowdfunding. This framework guided the expert interviews to validate the identified problems. The theoretical framework is detailed in the subchapter “*The Nature of Incentive-based Crowdfunding Campaigns from a Principal Agent Theory Perspective*”. We conducted a literature review to identify backers’ problems in incentive-based crowdfunding, following vom Brocke et al.’s approach (2015). We sourced peer-reviewed articles from databases of JSTOR, ProQuest, Emerald Journals, and EconLit, focusing on literature from information systems and business administration. Using the search string “principal-agent problems” AND “crowdfunding” AND “backers” AND “information asymmetry,” we retrieved 191 results and selected 24 papers through a systematic and iterative process of title and keyword screening, abstract review, and full-text evaluation to ensure relevance and methodological rigor. We defined the following inclusion criteria: articles in English that address backer problems in crowdfunding and fit within principal-agent theory. We excluded non-incentive-based campaigns and those without information asymmetry issues.

No.	Role	Reasons for being selected
1	Active backer	Over 15 years of experience as backer
2	Researcher in the field of crowdfunding, active backer	Over 20 years of experience as backer
3	Researcher in the field of crowdfunding, experience as backer	Over 15 years of experience as a backer and > 10 years of researcher experience in crowdfunding
4	Consultant for startups that engage equity-based crowdfunding campaigns	Over 20 years of working experience in the context of crowdfunding and experience as backer
5	Legal and smart contract expert, active backer	5 years of experience as legal advisor
6	Blockchain expert, CEO of an organization offering services based on smart contracts	Working with blockchain-based smart contracts for > 5 years
7	Blockchain expert, CTO of an organization offering services based on smart contracts	Working with smart contracts for > 5 years
8	Crowdfunding expert, consultant for backers engaged in reward-based crowdfunding campaigns	Over 15 years of working experience in the context of crowdfunding and experience as a backer
9	Smart Contract Researcher	5 years of research experience in the area of smart contracts

Table 1. Overview of Experts Involved in the Interviews

We conducted five expert interviews lasting 23 to 35 minutes to validate and expand our findings. We selected experts with at least five years of experience in crowdfunding and direct involvement, being experienced in, advising or working with companies using crowdfunding, ensuring well-founded and valuable insights. The interview structure followed our analytical framework, and interviews lasted 23 to 35 minutes. After five interviews (no. 1-5, see Table 1), we reached saturation for the identification of problems in crowdfunding. We analyzed the verbatim transcribed interviews following Mayring's qualitative content analysis (2014). To ensure methodological rigor, we drew on literature, we defined analytical criteria focused on signals addressing typical principal-agent problems. From these, we developed deductive coding categories for each crowdfunding type and principal-agent problem, which we applied during coding. We then examined the coded data to identify patterns and relationships, using them to derive and assess potential solution approaches, ensuring a grounded and meaningful analysis.

Step two: To develop and analyze solutions to the identified problems to ensure high validation, reliability, and credibility, we conducted a second literature review following to vom Brocke et al. (2015) and used the databases AIS Electronic Library (AISeL), ProQuest, Scopus, ACM Digital Library, and IEEE Xplore. The search string "blockchain" AND "smart contract" AND "crowdfunding" AND "traceability" yielded 273 papers. We systematically selected 21 papers relevant to our analysis through title, keyword, abstract review, and full-text evaluation. We included only articles written in English that propose solutions to the identified problems and can be transferred to blockchain-based implementations. Articles with approaches not applicable to crowdfunding campaigns were excluded.

Building on this literature, we developed a concept for using smart contracts to address challenges in traditional crowdfunding. We validated and extended this through nine 20–30-minute interviews with backers and blockchain experts (Table 1), analyzed via Mayring's structured content analysis (2014). To reduce bias, we presented only the problem space until the final phase. Practitioner insights added legal and regulatory perspectives absent from the literature.

Problem Specification: Trust-related Problems in Incentive-based Crowdfunding Campaigns

The Nature of Incentive-based Crowdfunding Campaigns from a Principal-agent Theory Perspective: An Analytical Framework

This section presents an analytical framework to identify and examine problems faced by backers in the crowdfunding process. It excludes the other actors, platform operators and initiators, for clarity. Grounded in principal-agent theory, the framework is well-suited for analyzing incentive-based crowdfunding, where backers (principals) fund projects in return for incentives from initiators (agents) (Akerlof, 1970; Jensen & Meckling, 1976). In incentive-based crowdfunding, anonymity between the backer and the initiator is high, as both parties are unknown to each other (Brink et al., 2019; Guesnerie et al., 1989). Unlike traditional buyer-seller relationships, the high degree of anonymity in crowdfunding limits trust and commitment, making it difficult for backers to assess initiators' intentions or qualifications. This information asymmetry leads to two key issues from a principal-agent perspective: adverse selection and moral hazard. Adverse selection arises ex ante, before funding, due to backers' limited insight into the initiator's intentions or the investment object (Oberoi et al., 2022). This lack of transparency can lead to poor decisions, as initiators may withhold key information. Moral hazard occurs ex post, when initiators alter their behavior after

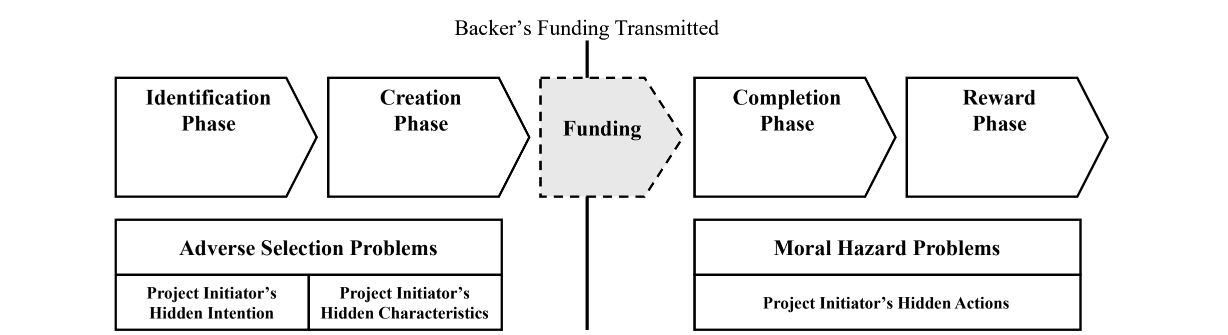

Figure 1. Categorization of Problems in Incentive-based Crowdfunding Campaigns

funding, for instance, misusing funds or failing to deliver promised incentives (Grossman & Hart, 1992; Ross, 1973). Adverse selection arises from hidden intentions (e.g., fraud) or hidden characteristics (e.g., flaws in the project or reward), both creating information asymmetry that disadvantages backers. Moral hazard results from hidden actions after funding, where initiators' behavior is unobservable, causing uncertainty about project completion or incentive delivery. Categorizing these issues enables a structured analysis of principal-agent problems in crowdfunding (see Figure 1).

Adverse Selection Problems in Incentive-based Crowdfunding Campaigns

The first insight gained from our interviews was that **reward-based crowdfunding** has to be divided into two cases. The first are reward-based crowdfunding campaigns that offer thank you cards or small gifts, as an incentive. As the monetary value of such incentives is low and have ideationally value, interviewees recommended that backers motivations in these cases are closely aligned with those of donation-based crowdfunding. As interviewee 2 said: "*Contributing to a campaign with an ideal-value reward is less about expecting a return and more akin to making a donation.*" That is why we excluded this case from small tokens of appreciation from our analysis. In the second case, the incentive of a reward-based crowdfunding campaign is of higher monetary value. In most of these cases, the investment objective constitutes the incentive in that form that backers get – in return for funding – the investment object as a reward, comparable to a purchase of a product. The already mentioned Coolest Cooler campaign is a good example of that kind of reward-based crowdfunding. Since this form of crowdfunding involves higher-value monetary incentives, reward-based crowdfunding is the primary focus of our analysis. As our empirical data revealed, in reward-based crowdfunding campaign problems of hidden intentions as well as hidden characteristics arise. As it concerns hidden intention project initiators may act with malicious intent from the outset and present faked investment objects within their campaigns with the intention of not fulfilling campaign promises and of misappropriating funds for personal use. As one interviewee mentions: "*There have been campaigns where I never heard anything about my money, the product, or the campaign after it ended.*" Or as another interviewee reflected: "*It cannot be ruled out that the project initiator ran away with the money and made a nice life for himself.*" Another issue with hidden intention is that project initiators, fully aware of potential risks, may intentionally set a low campaign budget to improve their chances of reaching the funding goal (interviewees 3, 4). In terms of hidden characteristics, the incentive, namely the product may later not perform as promised. This may be the case when – after the end of a funding phase of a campaign – the development of the product is of an immature stage or is not ready within the agreed timeframe.

To identify problems in **equity-based crowdfunding**, we again distinguish two cases. Generally, in *equity-based* crowdfunding individuals seek to increase their invested capital by acquiring equity in firms, however, in the first case, the project initiator's investment property constitutes a start-up, and in the second case an already existing company. Similar to the reward-based case, the issue of hidden intentions in *equity-based crowdfunding* for start-ups refers to the risk that in a campaign a fake start-up may be promoted (Reichenbach & Walther, 2021). This means that the project initiator may do this to launch a start-up but misappropriate funds for personal use. Alternatively, the startup may be created with the full intention of being sold right immediately after the campaign ends. Such scenarios remain high-risk in that not only their expected return of investments stay out, but also the invested equity may be misappropriated. Regarding hidden characteristics, a major problem is the market potential of the startup's underlying product or service is low because of any economic miscalculation of the project initiator. This would mean that the start-up would fail and that the investment goal could not be achieved. In *equity-based crowdfunding* for existing organizations, similar issues persist. In terms of hidden intentions, the project initiator could not be honest and present a faked investment project with the intention of misappropriating funds for personal use (Deffains-Crapsky & Sudolska, 2014). Similarly, the question of the expected economic success of the investment project could fail to materialize and therefore constitutes a hidden characteristic (Deffains-Crapsky & Sudolska, 2014). In these cases, for backers it remains uncertain and unpredictable whether their investment will yield a sufficient return or even the investment may be misappropriated ("*After you have funded, as a backer you no longer have any influence on what happens to your investment.*", interviewee 2).

The final case of incentive-based crowdfunding is **lending-based crowdfunding**, where the crowd acts as micro-financiers or micro-investors of credit for the project initiator. The primary goal of backers in this model is to grow their invested capital through repayment at a predetermined interest rate (Jiang et al., 2020). Lending-based crowdfunding also faces challenges from hidden intentions. Hidden intentions arise when project initiators use the funds for purposes other than those advertised, potentially diverting the money to projects with lower returns or entirely unrelated causes (Belleflamme et al., 2019). Or, the collected credit may be invested for questionable goals that are very different from those advertised in the campaign. These (potentially malicious) intentions are designed to maximize the initiator's benefit but are neither foreseeable nor assessable by the backers (Burtch et al., 2016). As in reward-based and equity-based crowdfunding, *lending-based* crowdfunding places the project initiator in a position of informational advantage. Initiators have more knowledge about investment risks, including hidden uncertainties, than backers (Eisenhardt, 1989; Jiang et al., 2020). This lack of transparency gives initiators considerable leeway to act unpredictably before the funding phase is finalized.

Moral Hazard Problems in Incentive-based Crowdfunding Campaigns

In case of **reward-based crowdfunding**, for the backer one problem is that he might not get the promised reward. The reason why the project initiator might not deliver the reward is that the project initiator does not have the right skills and capabilities to develop product. This includes competencies such as relevant education, experience, and the ability to effectively manage implementation (Dey et al., 2017). It includes the question, whether the project initiator has established the right partnerships to produce the product as advertised. As interviewee 1 acknowledged: "*In the videos, of course, it looks like the project initiators can implement the idea the way they want to, and how they announce it. But the reality and the implementation are very different.*" An example of this problem was the "Amabrush" campaign, an automatic toothbrush project. Here, the project initiators withheld accurate cost estimates, which led to the company's bankruptcy. Backers were left without rewards or any compensation because the reward phase was never completed (Failory.com). Furthermore, it could also be the case that the promised reward may not be delivered within the promised timeframe (interviews 1-4). As interviewee 1 remembers: "*99 percent of the rewards arrived too late*." Commonly, the reward may be delivered in low quality (failory.com URL; Hossain & Creek, 2021).

Similar to reward-based models, backers of **equity-based crowdfunding** campaigns, be it for start-ups or for already existing firms, it can be the case that the initiator's actions after the funding are not in line with their best interests (Schmitz, 2002). It is unclear until the end of an equity-based crowdfunding campaign whether the initiator has the necessary competencies and resources to successfully launch the promised startup respectively to realize the underlying investment project (interviewee 2). Another problem is that the funds are provided entirely by the backers, the project initiator does not bear any financial risk if the project fails (Cumming et al., 2020). Instead, all bankruptcy risks are borne by the funders. This dynamic incentivizes project initiators to take greater risks or act more recklessly than they would if they were using their own capital or under stricter oversight (Rogerson, 1985). As Hossain and Creek (2021) identify that self-funding plays a crucial role in the context of equity based crowdfunding. This ensures that campaigns meet their funding targets, allowing project initiators to secure external funding that would not have been available otherwise. However, funders lose control over their contribution once the funding decision is made.

A similar hidden action-situation arises in **lending-based crowdfunding**. On the one hand, the project initiator may not invest the necessary competencies and resources to realize the underlying investment objective. On the other hand, the project initiators may engage in riskier actions and therefore potentially fail to realize the investment project (Jiang et al., 2020). In both cases, it remains unclear if the initiator will not be able to generate the promised interest and pay back backers' investments. As a result, the funder may lose its entire investment.

How Blockchain can Help to Overcome the Principal-Agent Problems in Incentive-based Crowdfunding Campaigns

As indicated in the theoretical contextualization, smart contracts offer a secure and transparent way to execute predefined conditions (Shailak Jani, 2020; Szabo, 1996), with immutability and blockchain storage ensuring contract enforcement (Zheng et al., 2020). Interview findings suggest that smart contracts are particularly effective in crowdfunding, as they enhance transparency, reduce information asymmetries, and support more informed decision-making by backers (interviewees 2-9). Below, we outline how exactly they can be used to mitigate the problems identified above. We use signaling theory as theoretical foundation for classifying the approaches enabled by blockchain technology. Building on principal-agent theory, signaling theory explains how agents can actively reduce information asymmetries by sending credible signals to principals (Spence, 1973, 2002).

Blockchain-based Approach to Address Adverse Selection Problems

Currently, in a crowdfunding campaign, both project creators and backers agree to the platform provider's terms and conditions and provide the required documentation to create an account (Belleflamme et al., 2019; Kuppuswamy & Bayus, 2013). A requirement for the successful application of blockchains in crowdfunding campaigns is that project initiators grant access to the blockchain, where certificates and relevant experiences are stored ("*There must be active consent from the individual. This can be linked to the terms of use to be able to act as a backer or project initiator in the first place*", interviewee 5). These certificates are stored on a permissioned public blockchain which is accessible to the platform while the initiator's account is active (interviewee 7). If the initiators delete their account, access to their certificates would be automatically revoked through a smart contract, ensuring security and privacy ("*Data protection must be guaranteed and respected in this type of campaign.*", interviewee 5). Before agreeing to the terms and conditions, backers and project initiators can review the platform contract terms. Smart contracts take this transparency even further: all terms, execution details, and contract rules are visible to both parties from the outset (Dietrich et al., 2020). It ensures that all parties know what they are getting into and that legal claims are clarified accordingly (interviewees 4, 5). Despite the anonymity between the funder and the project initiator, smart contracts ensure the enforceability of predefined rules (Dietrich et al., 2020), thereby increasing trust and security (see Table 2).

In **rewards-based crowdfunding** and by including smart contracts into those campaigns, backers need to get access to information about previously completed projects from the project initiator (see table 2, interviewee 5). Once the projects are published, registered users will have access to the permissioned public blockchain. Through this structure, smart contracts can help mitigate the problem of "hidden intentions" (interviewee 7). Transparent, blockchain-based records of the project initiator's qualifications, experience, and past projects allow the backer to make a more informed decision (Long & Curtis, 2015), reducing information asymmetry between the backer and project initiator. The risk of hidden intentions is reduced since past projects, experiences, and evaluations are stored on the blockchain and accessible to potential backers. This transparency helps backers assess the reliability of the project initiator, thereby minimizing adverse selection risks. Providing a secure and tamper-proof record of past activities is a critical step in reducing information asymmetry between backers and project initiators in rewards-based crowdfunding. Storing certificates and credentials on a permissioned public blockchain ensures authenticity and reduces information asymmetry (Polge et al., 2021). Similarly, recording partnerships with manufacturers or suppliers on the blockchain allows backers to assess the viability of a project, reducing the risk of choosing an inappropriate project initiator ("*Even today, project initiators rely on partners to increase transparency for backers. Blockchain solutions offer a more transparent and traceable alternative.*", interviewee 5). Additionally, providing backers with blockchain-verified updates on the production of rewards builds trust and increases transparency. "*Blockchain reduces anonymity between backers and initiators by offering transparency into past projects. While it doesn't fully eliminate hidden intentions or characteristics, it decreases the likelihood of unsatisfactory behavior by permanently storing evaluations.*" (interviewee 6). To address hidden characteristics in reward-based crowdfunding related to the investment object, such as the prototype, experts recommend documenting the production process of the prototype or promised product on a private blockchain accessible exclusively to participating backers ("*Traceability provides trust to backers and makes the product tangible for them*", interviewee 6). If this is announced and communicated at the beginning of the campaign, it creates security and trust for those who want to participate (interviewees 6, 7). This transparency, along with the clear terms and conditions outlined in the smart contract, reduces the problem of hidden agendas („*It reassures backers that their money won't disappear. If the project fails, they can transparently track the process and understand what went wrong.*", interviewee 7). In addition, the problem of hidden characteristics can be reduced by linking the payout of the money collected by the smart contract to the achievement of milestones (Taherdoost, 2023). This helps to ensure that no more money is wasted if it becomes clear that the promised product target cannot be met ("*The ability of smart contracts to block payouts significantly reduces the risk that the backer will lose all the money invested without receiving any reward*", interviewee 6).

Experts agree that in **equity-based crowdfunding**, access to blockchain-stored certificates equally helps reduce the risk of hidden intentions (interviewees 5, 6, 7). As interviewee 6 points out: "*Giving potential backers access to a blockchain that stores certificates, past experiences, and recommendations serves as an important decision-making tool that helps backers assess whether to support a campaign.*" While it cannot fully disclose the initiator's intentions (interviewees 4, 5), it provides unalterable insights into previous projects, certifications, and endorsements from former project partners (Polge et al., 2021). To ensure legal security, experts propose utilizing a permissioned public blockchain, granting potential backers access for the duration of the campaign. This fosters transparency and trust between the parties, as highlighted by interviewee 9: "*As with rewards-based crowdfunding, greater transparency signals trust to backers – despite their anonymity.*" To address hidden characteristics in equity-based crowdfunding, experts recommend linking investment releases to project milestones, ensuring better alignment with backers' interests (interviewee 7, 9). If a project exceeds its planned budget for certain milestones, smart contracts can automatically halt additional funding and return the remaining funds to backers (interviewees 5, 8). By tying disbursements to predefined milestones, smart contracts enhance financial oversight. As expert 7 noted, "*This is crucial for large, high-cost projects, reducing backer risk while giving start-ups a clear, milestone-based framework.*" Blockchain-stored records of past projects and certifications further reduce the risk of fund misappropriation or fraudulent intent (Facklasur Rahaman et al., 2024). Additionally, recording reviews and evaluations on the blockchain ensures long-term accountability. Negative reviews have an impact on an initiator's reputation, allowing potential backers to make more informed decisions. As interviewee 8 states, "*Once negative evaluations are visible, backers will carefully* *reconsider funding, especially in equity-based crowdfunding*." Whether for start-ups or established companies, smart contracts provide backers with verifiable insights into an initiator's credentials and past performance. By examining blockchain-stored records of partnerships (e.g., with suppliers or backers) and assessing the team's skills, backers can evaluate the initiator's commitment and ability to deliver. Displaying these partnerships on the blockchain enhances authenticity and accountability while addressing hidden characteristics (Pu & Lam, 2023). What all experts agree on is that by increasing transparency, smart contracts and blockchain storage enable informed decision-making in equity-based crowdfunding, reduce adverse selection risks, and strengthen trust in incentive-based crowdfunding campaigns. This enhanced visibility allows backers to better assess the likelihood of achieving a return on their investment.

To address the adverse selection problem hidden intentions in **lending-based crowdfunding** and prevent initiators from misusing or absconding with the granted loan, providing access to a blockchain that stores records of past projects and ratings of previous backers is highly relevant. The interviewees agree that this significantly reduces the risk of misconduct by project initiators. The use of blockchain also helps to prevent one-off misconduct related to the investment object, the hidden characteristics, such as allocating funds to morally questionable purposes. By storing relevant information about past projects and making them available to potential backers, blockchain technology creates a sustainable accountability mechanism. This transparency ensures that potential backers make more informed decisions and reduces the likelihood of unethical behavior by enabling reputation-based and immutable ratings (interviewees 6, 7, 8).

Blockchain-based Approaches to Support Overcoming Moral Hazard Problems

With regard to the "moral hazard problems" in incentive-based crowdfunding that arise after the contract has been concluded, a significant issue is that the backer (principal) has no control over how the project initiator (agent) uses the invested funds. This lack of oversight creates uncertainty about whether the funds will be utilized effectively. As outlined, in **reward-based crowdfunding**, where backers are promised a prototype or product as a reward, two key moral hazard problems are (1) whether the project initiator possesses the competence and resources to deliver the promised product on time and (2) whether they have the competencies to do so. This issue, known as hidden action, highlights the importance of smart contract mechanisms that promote trust and accountability. Integrating smart contracts into reward-based crowdfunding campaigns enhances security and transparency by automating predefined conditions (Dietrich et al., 2020). When the funding goal is met, a smart contract automatically releases funds to the project initiator and grant backers real-time access to a blockchain that records individual project transactions (interviewee 6, 7, 9). This transparency enables backers to monitor the initiator's actions, reducing concerns about misuse of funds ("*This ex-post transparency signals safety to backers, making the post-funding process more secure.*", interviewee 5). Moreover, smart contracts can tie the release of funds to specific milestones or deliverables. These milestones might include confirmation that a prototype has entered production or evidence that a reward has been shipped (Dixit et al., 2022). By embedding such conditions into the smart contract, additional funds are disbursed only when these objectives are achieved, ensuring accountability and progress tracking. For digital rewards – such as e-gift cards, virtual badges, or online event tickets – smart contracts offer another advantage: the ability to automate reward distribution (Jayapal et al., 2023). Once funding is confirmed, these digital rewards can be delivered immediately, minimizing risks for backers (Kumar et al., 2023). Unlike physical rewards, digital rewards managed through smart contracts carry a lower risk of delays or non-delivery, providing greater reliability for backers (interviewees 6- 8).

In **lending-based crowdfunding**, smart contracts enhance trust between backers and project initiators, even in cases of anonymity or first-time collaborations. Transactions are automated through smart contracts which provide additional security for backers after they have invested. Predefined and scheduled payments can be executed automatically, ensuring that backers receive their repayments on time and according to the agreed interest rate ("*In equity-based crowdfunding, smart contracts can manage the entire process, as interest payments and if-then relationships are clear and predefined.*", interviewee 7). Smart contracts increase reliability and confidence during the repayment phase by enforcing timely fund transfers (Egelund-Müller et al., 2017). To enhance security, project initiators may be required to establish a collateral account, such as a surety bond, offering backers an added layer of protection (interviewee 5, 9). What all smart contract experts agree on is that effective governance remains crucial for the sustainable operation of blockchain networks, and that off-chain governance is best suited for the analyzed case of incentive-based crowdfunding campaigns (interviewees 5-7, 9). Generally, robust blockchain governance ensures that decentralized systems can adapt to unpredictable future changes and maintain long-term viability (Schädler et al., 2023).

Structured governance frameworks are essential to maintaining controlled operations (Vavilis et al., 2024), with off-chain governance, where decisions are made outside the blockchain through discussions, debates, and informal processes, according to the interviewees, can emerge as a practical model for crowdfunding platforms. Off-chain governance enables platform operators to retain oversight while leveraging online forums (interviewee 7, 9). This model allows key stakeholders, including developers and founders, to influence governance without directly modifying the blockchain, providing the flexibility needed to address

Type of Crowdfunding	Problem Type	"Hidden Characteristics" (Investment Property)	Solution Provided by Blockchain/ Smart Contracts
Reward-based Crowdfunding	Adverse Selection	- Product underperformance or unmet specifications - Delivery delays or failure	- Insight into previous completed projects - Evaluation of past partnerships
	Moral Hazard	- Non-delivery or late delivery of rewards - Low-quality rewards - Lack of skills/competences	- Milestone-based fund disbursement - Real-time blockchain transaction monitoring - Smart contract-triggered fund release - Automated digital reward distribution
Equity-based crowdfunding	Adverse Selection	- Low market potential or misjudged risks - Uncertainty around economic success and return on investment	- Reputation-based evaluations and reviews
	Moral Hazard	- Lack of transparency around resources and competencies - Project initiators bear no financial risk - Incentive misalignment	- Incremental funding tied to milestones - Company registration as funding trigger - Automatic share transfer via smart contracts - Automated fund halt if milestones not met
Lending-based Crowdfunding	Adverse Selection	- Difficulty assessing fund use or return generation	- Reputation-based evaluations and reviews
	Moral Hazard	- Risky behavior leading to investment loss - Lack of skills/resources to meet investment goals	- Smart contract-enforced loan repayment - Predefined payment schedules & automated transfers

Table 2. Overview of Problems in Incentive-Based Crowdfunding Campaigns and How Blockchain Applications Provide Solutions

unforeseen challenges (Howell et al., 2019). Unlike on-chain governance, which is constrained by the rigid logic of blockchain protocols, off-chain governance allows for quicker, more nuanced decision-making (Reijers et al., 2021). This adaptability is particularly valuable in addressing subjective or ethical considerations, which frequently arise in diverse crowdfunding campaigns (interviewees 5, 9). Additionally, off-chain governance fosters inclusive discussions and deliberations, ensuring that platform operators can address complex issues in real-time. Its human-centric approach makes it suited for resolving disputes and adapting to evolving stakeholder needs (Fischer & Valiente, 2021).

Discussion

Our research identifies problems in incentive-based crowdfunding that can prevent backers from receiving promised incentives or lead to a total loss of invested capital. We find that blockchain, particularly smart contracts, can help mitigate these risks by increasing transparency and traceability, keeping backers informed about potential issues with project initiators and reducing the likelihood of complete loss. However, implementing smart contracts is costly. Defining consensus for all possible conditions and ensuring legal compliance requires highly skilled programmers and legal experts (Albizri & Appelbaum, 2021). Moreover, effective blockchain solutions depend on a robust digital infrastructure, including digital wallets and cryptocurrencies (Hanneke et al., 2024). While building such infrastructure from scratch is expensive, long-term costs can be reduced through scaling (Rossi et al., 2019).

Additional practical challenges include legal issues, technical feasibility, and limited adoption due to backers' unfamiliarity with blockchain technology. Integrating on-chain data with verified off-chain data could further reduce information asymmetries. Although not covered in this study, this integration offers promising avenues for future research. Another consideration is the technological expertise required to create blockchain-based applications for incentive-based crowdfunding. This poses a significant barrier to adoption by crowdfunding platform operators. Low-code platforms for smart contract development offer a promising solution, enabling users with minimal technical expertise to create smart contracts (Curty et al., 2023; Rosa-Bilbao et al., 2023). These platforms simplify code structures, reducing vulnerabilities and improving the usability of smart contracts in crowdfunding contexts. Another challenge is the organizational complexity that backers may face when creating blockchain-based applications for incentive-based crowdfunding systems (Curty et al., 2023; Holotiuk & Moormann, 2018). This complexity stems from the decentralized, cryptographic, and algorithmic nature of blockchain technology (Antonopoulos & Wood, 2018). Blockchains like Ethereum use these properties to store transactions in a verifiable, append-only data structure, minimizing trust requirements among participants (Fill et al., 2020; Wood, 2022).

Furthermore, legal frameworks supporting blockchain and smart contracts in incentive-based crowdfunding remain underdeveloped, though such frameworks are essential for wider acceptance and implementation. In conclusion, while challenges such as high costs, legal frameworks, organizational complexity, and technical barriers remain, the benefits of blockchain applications in incentive-based crowdfunding, particularly in reducing risks, position them as a transformative tool for crowdfunding systems. If implemented effectively, smart contracts can enhance economic welfare and operational efficiency in this domain. This needs to be verified in future research and in the corresponding testing of the practical application.

Conclusion

In our research, we empirically identified backers' adverse selection and moral hazard problems prevalent in incentive-based crowdfunding campaigns. Further, we show how the application of blockchain technology can solve these problems. In the following, we elaborate on the key contributions and limitations.

Contribution to Theory and Practice

Our work provides three key contributions to research. First, our results on backers' problems in incentive-based crowdfunding contribute to the research field that aims at identifying the risks of crowdfunding. Although scholars have been researching the phenomenon of crowdfunding for more than a decade now, there is still little insight into the risk that the different forms of crowdfunding involve. Like our research, this stream of literature takes the perspective of backers, since risk in crowdfunding typically is a matter of fund givers. The thin body of work in this field neglects to provide empirically validated insights. Important work in this area, such as the work by Tenca and Franzoni (2019) or Gierczak et al. (2016), describes possible problems on a theoretical level and therefore provide unvalidated insights. Unlike prior holistic views, our findings provide focused, evidence-based insights into backers' problems, advancing the important research area of crowdfunding risks (Bargoni et al., 2024; Moritz & Block, 2016; Shneor & Maehle, 2020).

Second, our findings expand the application of smart contracts beyond typical areas such as supply chains and the Internet of Things, demonstrating their potential in incentive based crowdfunding, an area rarely explored. Third, we contribute to research on how crowdfunding platform operators govern backers and project initiators to ensure desirable behavior and campaign success. Existing governance mechanisms range from monitoring and sanctions to trust building (Bessière et al., 2020; Blohm et al., 2024).

Our work provides a novel solution to adverse selection- and moral hazard problems of backers that crowdfunding platform providers currently face. By leveraging blockchain technology, it provides a tamper-proof alternative. Automated verification of contract terms addresses long-standing inefficiencies in crowdfunding by reducing hidden intentions, hidden characteristics, and hidden actions from project initiators. This is, to our knowledge, the first study to apply smart contracts and blockchain to incentive based crowdfunding through the lens of principal agent theory, providing a transformative approach to these challenges. Practically, blockchain enhances fund security, curbs unethical behavior by initiators, reduces information asymmetry, and builds trust among backers. This attracts more risk averse investors, increases participation, and supports the growth and sustainability of crowdfunding ecosystems.

Limitations and Future Research

As in any scientific study, our work has limitations. First, our study shows how smart contracts and blockchains can be used in crowdfunding, which constitutes a completely new area of application for these technologies. A limitation of our results is the small sample size of nine interviewees. Future research should increase the number of respondents to get a bigger picture of validation. The background of the interviewed experts represents a limitation of the study. Since our aim was to understand the real-world problems experienced by backers, we focused on practitioners and academic experts. This focus enabled us to derive practice-oriented solutions, but it may limit the regulatory scope of the findings as we did not include legal and governmental experts.

Second, the contribution of this paper lies mainly in the derivation and identification of backers' adverse selection and moral hazard problems in incentive-based crowdfunding and in the development of a first concept of solutions to reduce these problems. Our study provides a foundation for future research to build on adequate research methods that allow for systematically developing and testing first prototypes in a real-world setting. In future research, the practical relevance of our results should be systematically examined in addition to further prototype development. This includes integrating empirical insights from real-world platforms such as Giveth and Gitcoin Grants to validate and contextualize our proposed solutions. By analyzing and comparing these implementations, future studies can assess the applicability, effectiveness, and distinctiveness of our proposed design features. The Design Science Research approach is particularly well suited for conducting such evaluations.

Third, the smart contract and blockchain solution proposed in our work relies on the integrity of the underlying blockchain network. Previous research has shown that the integrity of blockchain networks can be compromised by various attacks (Mueller-Bloch et al., 2024). As already outlined, the parties in a crowdfunding context are typically anonymous to each other, which would also be the case in a blockchain network that would be designed for our smart contract solutions. Although this blockchain network would be built on permission-based logic, the integrity of the blockchain network must be constantly monitored and enforced.

Finally, our research focused on the backers' perspective. Legal, technical, or governance-related aspects were not considered in this study. We therefore recommend that future research incorporates these perspectives in order to identify additional challenges and integrate them into the development of further solutions. Project initiators also face problems in this economic trade relationship and its inherent anonymity. In this anonymous environment, bakers may also behave unethically. For example, crowdfunding has seen cases of payment fraud, investment fraud, or money laundering by backers (Hossain & Creek, 2021). This brings project initiators into a disadvantaged position. Such problems certainly could also be solved with the help of smart contracts or blockchain solutions. Thus, future research should take the perspective of project initiators when researching the potential of smart contracts or blockchain solutions in incentive-based crowdfunding.

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