2022 EC³
2022 European Conference on Computing in Construction
Ixia, Rhodes, Greece
July 24-26, 2022

THE BLOCKCHAIN'S TRANSFORMATION IN NEW FINANCING AND MANAGEMENT PROGRESS WITH THE APPLICATION OF SMART CONTRACTS AND METAVERSE

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Abstract

Today the emergence of many technologies has transformed the financial and commercial sectors. Blockchain is considered one of the emerging technologies in various industries. Blockchain financing allows investors to choose projects they trust and participate in without the need for third-party intermediaries. The main features of blockchain are security, transparency, and immutability; hence, using blockchain in crowdfunding makes this process more reliable. The current study presents a model based on a smart contract on the Ethereum blockchain network and integrates the (ICO) and (IPO) models. This study proposes an integrated ecosystem for attracting and monitoring project progress by stakeholders based on a smart contract, where the smart contract's data are connected via Oracle to an external database. As a result, the shareholders can track the project's progress via its corresponding Digital Twins in its respective Metaverse.

Introduction and Literature Review

Nowadays, we have witnessed the emergence of many technologies that have transformed the financial and commercial sectors particularly. Blockchain technology can be mentioned as one of the emerging technologies combined with innovations in many industries like banking and finance, supply chain, healthcare, insurance companies, et cetera. The construction industry is also considered one of the industries with many potentials to use blockchain technology due to its high volume of transactions (Kim et al. 2020). Perhaps one of the reasons why bitcoin is often equated with blockchain is that blockchain technology was first introduced in 2009 in the bitcoin programming code. Later, with more and better knowledge of this technology, experts realized that the use and application of blockchain is not only related to cryptocurrencies, but this technology also has a wide range of other applications (Underwood 2016). Security, transparency, and immutability are among the features of blockchain. The information in the blockchain is encrypted before being stored, which increases the security of the information. One of the significant points is that the information in the blockchain is visible to all its mem bers, demonstrating maximum transparency at its highest. Another advantage is that the data in the blockchain cannot be changed or deleted (Perera et al. 2020).

On a global scale, the interest in blockchain technology is proliferating. The benefits of this technology can be realized by accepting it as much as possible. Crowdfunding is a revolutionary concept that has disrupted the current financing model and provides a platform for connecting emerging businesses and securing investment. The concept of blockchain crowdfunding has the potential to transform many businesses.

Today, the Internet has completely altered our lifestyles and communications, and more importantly, it has affected our finances. On the other hand, nowadays, it could be realized that crowdfunding allows startups to fund themselves without much red tape. This method of financing is based on raising money from groups and individuals who have common interests and want to make small contributions to the projects. Risky and professional investors, besides being profit-oriented, choose only projects with high potential (Baber 2020).

The 2008 financial crisis had a profound impact, and many people lost their faith in the banking system. Today, people are tired of corruption and insecurity; hence, they have turned to highly transparent decentralized systems, which these systems will eventually alter the way goods and services are traded worldwide. For instance, interim payment provisions in construction projects are sometimes accompanied by unfair payment methods (Ramachandra & Rotimi 2015). Countermeasures, such as project laws, legal statements, and Project Banking Accounts (PBA), are available to reduce dishonest behaviors. Despite the fact that small subcontractors are protected by law, regretfully, contractors frequently fail to pay their earned funds from high-level sources to downstream subcontractors (Schleifer 2017) due to the unequal bargaining power of construction project participants. This issue creates a domino effect on their failure to pay (Miller & Wongsaroj 2017).

In the past, financing platforms had to collaborate with banks and payment service providers to facilitate financial transactions. Aside from existing approaches such as the Project Bank Account (PBA), due to the system's centralized structure, stakeholders such as subcontractors may lack complete faith in its integrity. Therefore, a dispersed and unreliable infrastructure that can work and integrate with existing payment systems for construction projects to facilitate payment transparency, using blockchain financing, investors can choose projects they trust and participate in without the need for third-party intermediaries. Meanwhile, block-based platforms are ideal for process automation in distributed environments such as construction projects where participants typically do not trust each other based on the inherent nature of the project's organizational

structure (Das et al. 2020), but the use of blockchain in crowdfunding makes this process more reliable, transparent, decentralized, and accessible. Businesses can start selling their TOKENs without convincing the investors or incurring IPO costs to raise funds for growth, a process known as an "initial coin offering." Investors can claim their share of a project by buying the digital currency and can withdraw their share of that project whenever they want by selling their currency (Conley et al. 2017). While ICOs and IPOs share some similarities, their structures and processes differ in many ways, including underwriting, distribution, and regulation (Chuen et al. 2017) . Token selling is a method of selling a partnership or franchise in an economy or project that starts at a later date, whereas an IPO sells a stake in the company. An ICO introduces a new form of crowdfunding in which each participant can participate in financing and monetization through the use of tokens. ICOs are relatively decentralized, relying solely on blockchains' P2P (peer-to-peer) mechanisms (Robinson 2017).

Investors now have access to emerging businesses and emerging global markets, which such a connection was not previously possible. Previously, traditional financing systems limited the growth of many businesses, and naturally, a lack of money and budget for these businesses meant that the ideas they had in mind did not materialize. Blockchain technology and Initial Coin Offerings (ICOs) significantly impacted early-stage financing in 2017, transforming the entire crowdfunding sector in methods that just a few could have predicted. Blockchain can improve transparency and confidence in this unique and modern way of raising capital (Arnold et al. 2019).

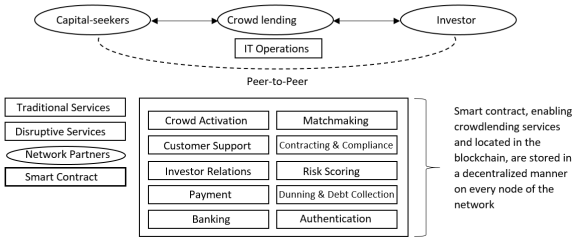

Figure 1: Blockchain-based crowdfunding service ecosystem (Schweizer et al. 2017).

Metaverse

The term "Metaverse" first appeared in Neal Stephenson's 1992 science fiction novel "Snow Crash." Metaverse is no longer limited to a science fiction term. Such a world should not be far from what is expected of us, thanks to technology that has completely changed our way of life. The metaverse is rapidly emerging in the current context of declining human exposure to COVID-19 (Sparkes 2021).

Indeed Metaverse is a three-dimensional design of a digital world. This digital world comprises virtual spaces that you can explore using virtual images. For instance, in Metaverse, you can go shopping, work with your colleagues in a virtual office, study at a university in another country, and do a variety of other things.Currently, several projects, including Decentraland and Sandbox, have their own virtual worlds that are running and managing this space. However, the Metaverse concept as a whole is still in its infancy. Nobody knows what the Metaverse's future will be like, whether it will be a single massive, all-encompassing Metaverse or a collection of digital worlds.The corona epidemic has also accelerated the process of attracting interest and attention to the development of Metaverse. We are witnessing an increase in demand for more interactive communication with other people due to the prevalence of telecommuting culture caused by the spread of this virus. 3D virtual spaces that allow a company's employees to gather and interact in a meeting are becoming more popular. It should be noted that Metaverse is still in the early stages of development. Some of the challenges in this area include authentication and privacy control. Unlike the virtual world, identifying a person is not difficult in the real world. When people around the world use avatars to explore the digital world, it is difficult to identify individuals. With the increasing development of technologies such as augmented reality (AR), virtual reality (VR), artificial intelligence (AI), etc., it seems that we are witnessing the emergence of new features and attractions in this virtual and borderless world (Academy 2022).

Main Body

Based on a smart contract, this study proposes an integrated ecosystem for attracting and monitoring project progress by stakeholders. Following their participation in the project via an smart contract, the shareholders can track the project's progress via its corresponding Digital Twin in its respective Metaverse.

The Application of Blockchain Technology to Raise Capital and Manage Projects

The fundraising model is one of the most important aspects of a megaproject's planning, management, and execution. More capital can be raised for the project if more public participation is created. In other words, besides the macro-investors that exist in the project's geographical area, we can consider micro-investors and other macro-investors from other regions. These small investors worldwide can also play essential roles in project branding in addition to the financial aspect. In the first place, a platform for customer identification (Know Your Customer) or KYC for investors is established. This is to prevent money laundering and or criminal activities from the participants. In this regard, the current study presents a model based on a smart contract on the Ethereum blockchain network and a solution to integrate the Initial Coin Offering (ICO) and Initial Public Offering (IPO) models. Initially, like the traditional IPO stocks, a committee of financial and regulatory experts is formed to determine the correct pricing of the project's stock based on the original project owner's records and assets. Investors' participation is structured in such a way that each project tokenizes its shares based on a

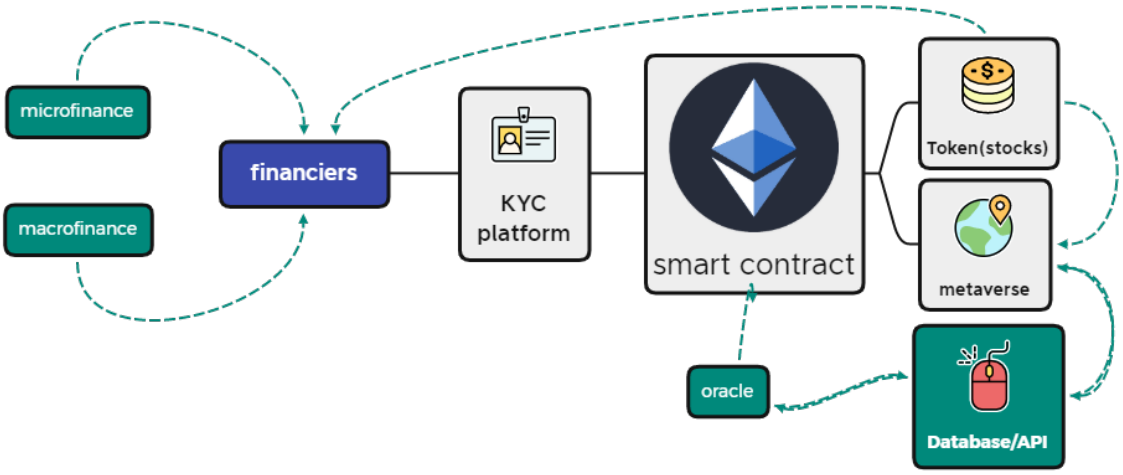

Figure 2: Proposed structure of investment ecosystem

smart contract that is coded specifically for it. Each smart contract token can be a stock of the whole project:
spp = % of shares per person
atp = amount of tokens purchased
tto = total tokens offered
sos = % of shares offered in the smart contract

$$spp = \frac{atp}{tto} * sos \tag{1}$$

For example, a project offers 50% of its shares under a smart contract. The total number of tokens available is 10,000 at a price of 0.1 Atrium. If someone purchases 1 token, he now owns 0.00005 of the project's shares.
(1/10000)*50% = 0.00005

Oracle

This information can also be transferred outside of the blockchain network. Thus, ORACLE is used for this purpose. Oracles are external data sources that bring critical information into or out of blockchains. Indeed, it can be thought that oracles are the decentralized information networks in which blockchains need to interact between on-chain and off-chain transactions. Then, we use Outbound Oracles in this step, which allows smart contracts to send data to sources outside the blockchain network in which they are located (Curran 2018). This information, which includes the details and percentage of ownership of the shareholders in the project and the company's own database, is also sent directly and transparently to the company's official portal to be available to everyone.

Metaverse - Participants' Direct Monitoring in the Projects

This smart contract is linked to a designed metaverse. Any project participant who has prepared the token can enter this metaverse. This access can be achieved by using technologies such as augmented reality (AR), virtual reality (VR), or 3D graphics space such as computer games. Here is a digital model of the actual project based on the project's progress and the number of human resources involved in the project so that investors can monitor the project in real-time. To accomplish this, we used Digital Twins. Project progress information is collected concurrently through the sensors of IoT-based devices, BIM, and artificial intelligence networks that are integrated through a software interface and finally modeled. The final model is now available in the project metaverse.

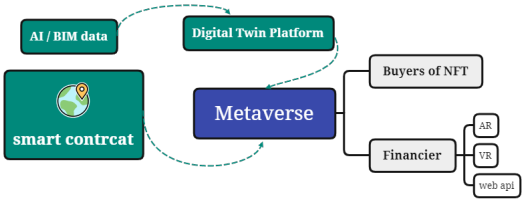

Figure 3: Project Metaverse Network .

The project itself can generate revenues for shareholders and add value to the project. To accomplish this goal, digital assets, products, and properties are offered, and those who are not even project investors can purchase these items as a Non-Fungible Token (NFT). The proceeds are considered as shareholders' equity.

Conclusions

It is possible to attract various capital for construction megaprojects in today's world by utilizing new technologies. One of the most recent methods for raising collective capital is to use blockchain. As a result, in addition to macro-investors, micro-investors can be included in projects to achieve financial goals as well as branding benefits. Investors become project shareholders by pur-

chasing the relevant tokens via a smart contract explicitly created for the project. Shareholders can enter the project metaverse and watch all of the project's progress in real-time to ensure that it is being implemented flawlessly. The following research can make better use of the Hyperledger to personalize the smart project contract. It is also possible to create an integrated programming platform that can use artificial intelligence to receive, model, and transmit project progress information to the metaverse without any human intervention.

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