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SYSTEMS & CONTROL ENGINEERING | RESEARCH ARTICLE

A new blockchain investment and energy certificate platform

Chung Seok Han[1], Majid Lotfi Ghahroud[2], Min Jae Park[3] and Jalil Ghassemi Nejad[4]*

Abstract: This article proposes a new decentralized asset investment and energy certificate platform: BIC (Blockchain Investment Certificate) which has a Korean patent for its new solution. The platform combines features of decentralized exchanges (DEX), crowdfunding, token economies, and insurance to provide a secure and efficient marketplace for buying and selling energy assets, including renewable energy certificates such as carbon credits. Decarbonization of energy systems has been a recent trend after 2020 where large-scale renewable energy sources (RES) are integrated into the power industry. The new business model and platform in this article offer unique solutions for investors, small and medium-sized enterprises (SMEs), and the overall economy. With its decentralized structure and innovative features, the platform has the potential to accelerate the transition to a low-carbon economy and promote sustainable investment practices. In addition, this platform provides a simple way to offset carbon footprints and support clean energy initiatives, contributing to the fight against climate change. Also, this platform not only supports the renewable energy market, encouraging the generation of renewable electricity on a larger scale but enables businesses to use renewable electricity without investing in costly facilities like solar panels, making renewable energy more accessible. Furthermore, this novel energy certificate platform facilitates the choice of exactly where to buy renewable energy, whether locally or from different regions in different countries, offering flexibility and increasing renewable energy adoption

Subjects: Environmental Studies; Systems & Control Engineering; Technology

Keywords: decentralized finance; asset investment trading; energy trading

1. Introduction

Financial institutions have played significant roles in mediating for a long time, and they connect market participants to reduce transaction costs (Chen et al., 2019). When confidence in the central banks and financial institutions is being increasingly questioned after the global financial crisis of 2007–2008, decentralized systems such as blockchain, particularly Bitcoin, that decreased the necessary for such confidence were noticed (Varma, 2019). FinTech companies have reduced the need for an intermediary, and a large number of financial institutes substitute with technology companies (Philippon, 2019).

Renewable Energy Certificates (RECs) are tradable certificates that represent the environmental attributes or benefits of renewable energy generation. When renewable energy is produced, it is fed into the grid and mixed with energy from other sources, making it difficult to determine which electricity is renewable. RECs solve this problem by allowing the environmental benefits of renewable energy to be separated and traded as a separate commodity. A REC trading platform is a marketplace where buyers and sellers of RECs can come together to trade these certificates. The platform provides a transparent mechanism for tracking the ownership and transfer of RECs, which are often required by regulators or voluntary buyers to demonstrate compliance with environmental targets or sustainability goals. Currently, REC trading platforms are often centralized and can be prone to security breaches, lack transparency, and are not always scalable to handle large volumes of trading. By using blockchain technology, a decentralized and secure ledger, and tokenization, which represents the ownership of RECs as digital tokens, a more efficient and effective REC trading platform can be created. There is an article in this field: Cybersecure and scalable, token-based renewable energy certificate framework using the blockchain-enabled trading platform (Cali et al., 2022). The article proposes a framework for a cybersecurity and scalable renewable energy certificate (REC) trading platform using blockchain technology. The framework uses a token-based system to represent the ownership of RECs, which are issued when renewable energy is generated. The tokens can be traded on the blockchain-enabled platform, providing a transparent and secure mechanism for buying and selling RECs. The framework addresses several challenges faced by current REC trading platforms, including transparency, security, and scalability. By using blockchain technology and tokenization, the proposed framework enables efficient and effective trading of RECs, which can help to support the growth of renewable energy sources. The article titled "Assessing Blockchain Adoption in Supply Chain Management, Antecedent of Technology Readiness, Knowledge Sharing and Trading Need" by Ruangkanjanases et al. (2022) explores the adoption of blockchain technology in supply chain management. The study finds that factors such as technology readiness, knowledge sharing, and trading needs significantly influence the profitability of blockchain adoption in supply chain management. Additionally, blockchain adoption is shown to play a crucial role in enhancing supply network transparency, blockchain transparency, and overall supply chain performance. The research emphasizes the importance of these factors in driving the successful implementation of blockchain technology in supply chains (Ruangkanjanases et al. (2022). Moreover, the article titled "Blockchain-enabled supply chain: An experimental study" by Francesco Longo, Letizia Nicoletti, Antonio Padovano, Gianfranco d'Atri, and Marco Forte explores the application of blockchain in supply chain management. The study presents a software connector that connects an Ethereum-like blockchain with enterprises' information systems, enabling data sharing with varying levels of visibility and ensuring data authenticity and integrity over time. The research demonstrates that blockchain technology can address collaboration and trust issues within a supply chain, improve overall supply chain performance, and mitigate the negative effects of information asymmetry across supply chain echelons, thus promoting transparency and trust in the supply chain ecosystem (Longo et al., 2019). There is also an informative article regarding blockchain and energy that explores the application of blockchain technology in the context of energy banking and electricity markets. The electricity market, which involves trading electric energy in different time-domains, often requires third-party platforms and guarantees for contract and settlement, leading to overhead costs. To overcome these challenges, the article proposes the use of the Peer-to-Peer (P2P) model of blockchain technology to execute Smart Contracts agreed upon by both parties, enabling real-time energy banking transactions without the need for intermediaries, thus reducing costs and enhancing efficiency (Jain et al., 2021). The article investigates the impact of a fintech entity on sustainable bank performance through competitive advantage. In addition, tokenization is part of blockchain technology and there are many articles that explain tokenization and its applications. One of these articles is Tokenization and its application in different countries. The article discusses the significance of tokenization, which involves using blockchain technology to issue tokens representing assets, facilitating negotiation, enjoyment of asset rights, and governance. Tokenization offers various benefits, including increased liquidity, transparency, efficiency, and cost-effectiveness, but it also comes with challenges such as technology risk, cybersecurity, and regulatory principles ().

One of the main topics which is related to blockchain, sustainability and energy is Financial Technology or Fintech. It reveals that the fintech entity plays a significant role in driving sustainable bank performance directly and indirectly through competitive advantage, and collaboration with fintech is crucial for banks to maintain their performance and meet future challenges (Subanidja et al., 2022).

Since blockchain-based decentralized finance (Defi) will be new business models can emerge from blockchain technology as a next step in this progression such as new types of cryptocurrencies or decentralized finance applications or DApps (Chen & Bellavitis, 2020). Blockchains encourage and incentivize the members to stick to the rules of the network through financial rewards, and centralized networks are transformed into decentralized markets (Natora, 2021). There are many business models in decentralized finance and this article and based on the research by Chen and Bellavitis (2020), there are four major business models: Decentralized currencies called cryptocurrencies, Decentralized payment services, Decentralized contracting, and Decentralized fundraising. In this article, we try to explain briefly these models, and the desirable model of a token economy and finally we explain our unique business model as a new one.

1.1. Decentralized currencies

The national currency or fiat money has existed for hundreds of years. Until a long time ago, currencies had been supported by valuable and expensive metallic elements such as gold, and main organizations had trusted on managing the gold providing currency backing. But there has been no backing for fiat currencies like gold for many years now. Today, the worth of an order currency is solely related to people's confidence in the nation's financial system, economy, and administration. The first and the most famous decentralized cryptocurrency issued through decentralized technology is Bitcoin; however, it is not issued by any country (Nakamoto, 2008). Dissimilar conventional currencies announced by governments or central banks of counties, Bitcoin's delivery timetable is constant and should not be modified freely, thus preventing inflation. Due to its decentralization, Bitcoin has turned out to be a major valuable store in blockchain technology and is frequently mentioned to as a type of digital gold (Kramoliš & Dobeš, 2020). Similar valuable and worthy metal, Bitcoin is essentially unlimited and be able to be saved, collected, and transmitted not including the concern of any intermediaries or central Entities (Hu & Zhang, 2018). However, the proof-of-work (PoW) agreement mechanism utilized by Bitcoin requires a significant amount of energy consumption in order to solve complex mathematical problems and validate transactions on the blockchain network (Talaiekhozani et al., 2021). In addition, there are many cryptocurrencies including altcoins coins such as Litecoin, Ethereum, Dash, Monero, and Zcash with different consensus mechanisms (Tschorsch & Scheuermann, 2016). Taken together, while fiat currencies are backed by governments and central banks, decentralized cryptocurrencies such as Bitcoin are based on people's faith in the financial system and are not vulnerable to inflation. However, the energy consumption necessary for Bitcoin's PoW consensus process is a major worry, and competing cryptocurrencies with different consensus algorithms may be more energy-efficient.

1.2. Decentralized payment services

Although centralized payment and money-transferring networks like PayPal, Visa, and SWIFT enable available and offline business, generally fees are high, and commissions for services, particularly for international expenses. Even after the Internet has considerably decreased the price and cost of various services, the price and cost of payment services remained high. Some networks particularly blockchain-based networks such as Bitcoin Lightning Network enable low-cost, immediate, international payments and solve problems associated with usual payment services (Poon & Dryja, 2016). For example, a blockchain-based network such as the Bitcoin Lightning Network offers secure, fast, and stable services of payment. Based on minimal costs and transaction fees, merchants be able to considerably reduce their expenses and enhance their cost-effectiveness. As of 2023, there are several low-cost payment alternatives available to merchants who may not be fully satisfied with their current payment options. These alternatives

offer cost-effective solutions to process credit card transactions, catering to different business needs and requirements. Also, free, or nearly free payments enable different commercial models that are not feasible nowadays might emerge as achievable (such as micropayments), which can create a different movement of modernization and entrepreneurship. It is interesting that Square, which is a centralized platform set up to future payment services can be based on the Bitcoin Lightning Network. With decentralized payment services that depend on blockchain technology and cryptocurrencies which are essentially worldwide, cross-border payments can currently be faster and more economical. Ripple is presently an innovator in this zone and has united with several financial foundations (such as MoneyGram) to enhance the proficiency of cross-border cash transmission.

Decentralized payment systems have the potential to disrupt the traditional payment industry by offering low-cost, quick, and secure payment alternatives. Blockchain-based networks, such as the Bitcoin Lightning Network, provide a compelling alternative to traditional payment services, allowing merchants to save costs and increase profitability (Hu & Zhang, 2018; Poon & Dryja, 2016). The emergence of low-cost payment solutions also brings up previously unattainable opportunities for creative business models such as micropayments. Furthermore, the global nature of cryptocurrencies and blockchain technology allows for faster and more cost-effective cross-border payments (Poon & Dryja, 2016). Companies such as Ripple are already setting the standard in this field by collaborating with financial institutions to increase the efficiency of cross-border money transfers. These payment methods have the potential to grow in popularity as they mature and improve consumers and businesses alike.

1.3. Decentralized fundraising

Conventional risk financing frequently includes huge discord withinside the fundraising and crowd-funding procedure and method, as shareholders can just invest and trust in tasks with well-built system connectivity (Scott et al., 2020). Technology of Blockchain is changing the funding situation (Fisch, 2019). The Initial Coin Offering or ICO is the main form of decentralized financing. In the Initial Coin Offering, project-specific tokens will be created by the venture on the public blockchain and sell the tokens to ability shareholders or entrepreneurs to increase assets for initial-phase development (Chen & Bellavitis, 2020; Martino et al., 2019). In recent years, ICOs have appeared as a pioneering financing mechanism for initial- point projects, allowing entrepreneurs and innovators to increase a huge amount of money from investors around the world (See Martino et al., 2019). ICOs are a possibly effective approach for projects to fundraise and generate connections and networks. Also, using blockchain technology allows for transparency, open- source codes, and smart contracts, projects can be funded by investors around the world. By counting on the decentralized confidence generated by the blockchain, decentralized financing can decrease funding tension, facilitate approach to investment, and thus encourage entrepreneurship and novelty. In addition, ICO is a different path for projects to attract investors and start generating a new network. In many cases, ICOs are valuable if the token has utilities related to the project's product or platform. Such tokens frequently described to like value tokens can be exchanged for specific services or can serve as the initial medium of exchange. Direct ownership or cash flow claims may be represented by security tokens issued by some projects. Recently, a recent alternative, the Initial Exchange Offering (IEO), has appeared. Unlike ICOs, IEOs rely on cryptocurrency exchanges to guarantee the credibility of possible plans and join high-quality projects with possible shareholders. At IEOs, cryptocurrency exchanges frequently investigate potential projects, present comprehensive data about encouraging projects, and support excellent projects with their reputation.

Taken all these into consideration, decentralized funding via ICO has emerged as a promising mechanism for project finance in the early stages, allowing for transparency and open-source code. By relying on the decentralized confidence established by blockchain technology, ICOs might alleviate funding tensions, boost entrepreneurship, and facilitate access to investment.

Furthermore, the rise of IEO gives another avenue for high-quality enterprises to interact with potential investors via cryptocurrency exchanges.

1.4. Decentralized contracts

Contracts are important and crucial for markets, businesses, and people to simplify cooperation and transactions. Since the cost of bargaining, planning, implementing, and renegotiating contracts are so different, contracts can be complex and costly (Coase, 1991). Financial contracts be able to be hindered with adverse choice and moral hazards, which increases transaction expenses and limits transaction opportunities at the same time (Feltham et al., 2016).

Conventionally, dealing groups have frequently relied on financial intermediaries and institutions to build confidence and decrease transaction expenses (Benston & Smith, 1976). The rise of peer-to-peer financial contracts has been facilitated by blockchain technology in recent years. A smart contract is a program that runs routinely while certain situations (ie, regulations) of a protocol are met (Murray & Anisi, 2019). Smart contracts guarantee to decrease contract density and costs, thanks to their openness, immutability, automation, and programmability.

Once a programmable decentralized compromise is achieved, thanks to the security and automation of its temperament, makes it easier to close contingencies (Cong & He, 2019). Smart contracts develop the range of possible contracts, decrease expenses, and enable novelty and contracts. For instance, decentralized platforms like MakerDAO, Compound, and Dharma utilize different types of smart contracts to promote decentralized lending and borrowing and decrease the cost, friction, and delay of such processes based on Delphi Digital in 2019.

Overall, the emergence of P2P financial contracts, also known as smart contracts, has been facilitated by the usage of blockchain technology. Because of its openness, immutability, automation, and programmability, these contracts give advantages such as reduced contract density and expenses. Smart contracts' security and automation make it easier to fill gaps and expand the variety of viable contracts, save costs, and enable novelty and contracts (Rosado da Cruz et al., 2020; Tan et al., 2019). Smart contracts are used by decentralized platforms such as MakerDAO, Compound, and Dharma to promote decentralized lending and borrowing and reduce the cost, friction, and delay associated with such procedures. Smart contracts have the ability to transform the way contracts are implemented, and their influence is projected to rise as technology advances (Rosado da Cruz et al., 2020; Tan et al., 2019).

1.4.1. Blockchain Investment/Energy certificate (BIC) business model

There are several famous business models and platforms that incorporate decentralized exchanges (DEX), crowdfunding, token economies, and insurance such as: Binance Smart Chain (BSC)—Binance Smart Chain is a high-performance blockchain platform that enables the creation of smart contracts and decentralized applications (DApps). It incorporates a decentralized exchange (DEX) called PancakeSwap, which allows users to trade tokens without relying on a centralized exchange.

- Uniswap—Uniswap is a decentralized exchange (DEX) that operates on the Ethereum blockchain. It allows users to trade tokens without the need for an intermediary, and relies on an automated market maker (AMM) system to determine prices.
- Polkadot—Polkadot is a multi-chain platform that allows for the interoperability of different blockchain networks. It incorporates a decentralized exchange (DEX) called Polkaswap, which allows for the exchange of different tokens across different blockchains.
- MakerDAO—MakerDAO is a decentralized lending platform that operates on the Ethereum blockchain. It incorporates a token economy based on its own stablecoin, DAI, which is pegged to the US dollar.

- Aave—Aave is a decentralized lending platform that operates on the Ethereum blockchain. It allows users to lend and borrow cryptocurrency without the need for an intermediary, and incorporates a token economy based on its own token, AAVE.
- Compound—Compound is a decentralized lending platform that operates on the Ethereum blockchain. It allows users to lend and borrow cryptocurrency without the need for an intermediary, and incorporates a token economy based on its own token, COMP.
- Gnosis—Gnosis is a decentralized prediction market platform that operates on the Ethereum blockchain. It allows users to make predictions about real-world events and incorporates a token economy based on its own token, GNO.
- Augur—Augur is a decentralized prediction market platform that operates on the Ethereum blockchain. It allows users to make predictions about real-world events and incorporates a token economy based on its own token, REP.
- Nexus Mutual—Nexus Mutual is a decentralized insurance platform that operates on the Ethereum blockchain. It allows users to purchase insurance coverage for smart contract risks and incorporates a token economy based on its own token, NXM.
- Ocean Protocol—Ocean Protocol is a decentralized data exchange platform that operates on the Ethereum blockchain. It allows users to buy and sell data without the need for an intermediary and incorporates a token economy based on its own token, OCEAN.

After reviewing several business models and platforms, the first version of our business model (Blockchain Investment Certificate: BIC) has been designed based on web3.0 and it applied Several Defi features such as Decentralized exchange (DEX), Token economy, and insurance. In fact, the architecture of this platform is based on a decentralized asset investment trading service called DAITS, the name of the company.

As you can find in this model, this platform raises funds for companies based on their real project. It is a new model of crowdfunding platform based on crypto and Defi solutions. There are three pools and governance tokens which connect investors to companies. In the new version of the platform, non-fungible tokens (NFTs) are added to this platform. In addition, this platform presents enterprise service and activation of product target NFT commerce to increase the value of digital contents asset. In this part, we explain all parts of this model:

1. NFT (Non-fungible token) marketplace

2- Crowdfunding business model

3- Token economy

4- Decentralize exchange (DEX)

5- Insurance token

6- Energy certificate trading

BIC platform is a kind of Decentralized Finance Platform that presents a new solution for capital raising and asset management as well as the solution for stabilization of asset management and securitization of holding assets (Figure 1). Also, this platform can help companies to build a global network through overseas company databases.

In fact, the BIC platform is an investment platform for real assets based on blockchain. Based on this model we can issue tokens to record and check the trade investors' ownership of real assets and it is like convertible bonds, stocks issued by the company. In addition, tokens are issued by companies through the BIC platform and can be directly traded between parties without a broker in the decentralized exchange (DEX) method. In order to raise funds and investment, a company

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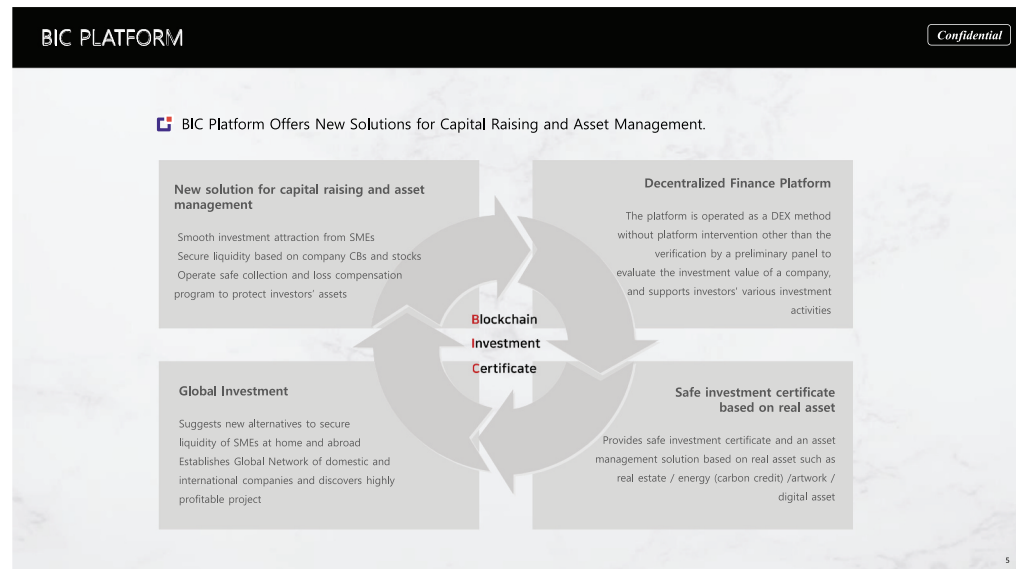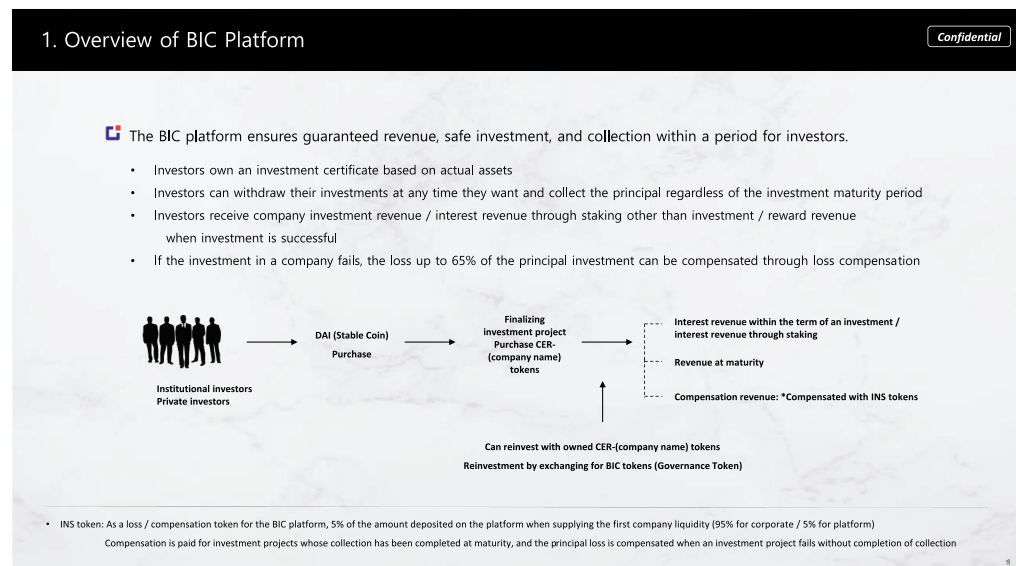
Figure 1. BIC business model.

Figure 2. Investment model in the BIC platform.

presents investment conditions based on the maturity of a convertible bond and the interest revenue rate at maturity. Fundraising and investment in a project through the preliminary profitability verification stage for real assets would be possible (Figure 2).

The wonderful point about the BIC platform is that it ensures guaranteed revenue, safe investment, and collection within a period for investors. Also, based on the model, investors own an investment certificate based on actual assets. And investors can withdraw their investments at any time they want and collect the principal regardless of the investment maturity period. In fact, investors receive company investment revenue and interest revenue through staking other than investment or reward revenue when their investment plan is successful. Also, if the investment in a company fails, the loss of up to 65% of the principal investment can be compensated through the loss compensation plan.
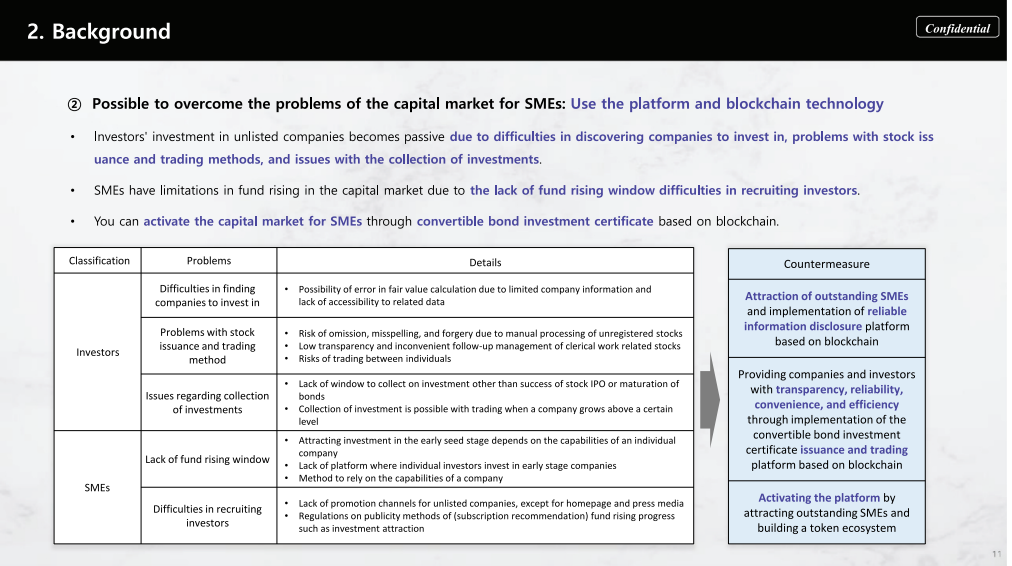
Figure 3. BIC platform and SMEs.

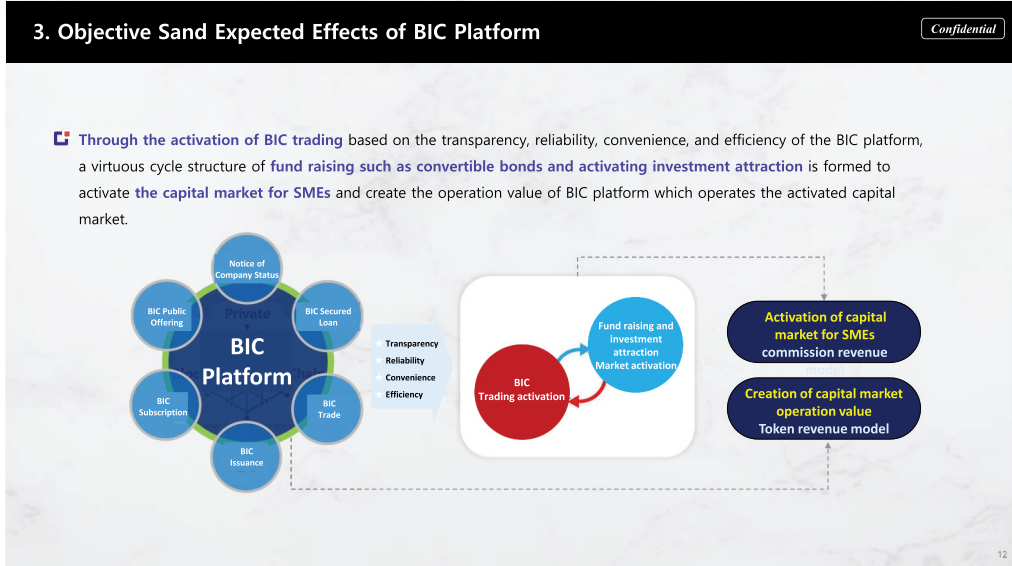**Figure 4. BIC platform model and its features.**

Figure 5. Uniswap platform.

In this model, there is also the INS token. By INS token as a loss happen and investors need compensation token for the BIC platform, 5% of the amount deposited on the platform when supplying the first company liquidity (95% for the company/5% for the platform) Compensation is paid for investment projects whose collection has been completed at maturity, and the principal loss is compensated when an investment project fails without completion of the collection.

When a company requests an investment, an expert panel of the BIC platform verifies the company (first preliminary verification). The data from a company verified by the panel is posted for all investors to check. In addition to the first verification data for the company, updates on the company's performance and changes are provided on a regular basis as well. If a Pool (size of investment request amount) is created for a company investment project after panel verification, the investment achievement amount of the BIC platform is set. The BIC platform provides the verification details of each company project and company status for all investors to check them. A panel, which consists of professional institutions/experts/BIC platform investors verifies companies, allows investors to understand the company's current status, and provides a trading chart to check the investment inflow and collection of each company's investment project at a glance.

This platform has many benefits not only for investors but for the economy. This platform can also overcome the problems of the capital market for SMEs through the platform and blockchain technology. Investors' investment in unlisted companies becomes passive due to difficulties in discovering companies to invest in, problems with stock issuance and trading methods, and issues with the collection of investments. SMEs have limitations in fundraising in the capital market due to the lack of a fundraising window and difficulties in recruiting investors. You can activate the capital market for SMEs through a convertible bond investment certificate based on blockchain.

Through the activation of BIC trading based on the transparency, reliability, convenience, and efficiency of the BIC platform, a virtuous cycle structure of fundraising such as convertible bonds and activating investment attraction is formed to activate the capital market for SMEs and create the operation value of BIC platform which operates the activated capital market (Figure 3 and 4).

1.5. Non-fungible tokens (NFT)

Various digital assets (like music, art, video, and in-game items) are represented as non-fungible tokens (NFTs) on the blockchain. NFTs based on Blockchain technology are garnering attention outside the fields of art and finance, showing prospects for approval in other environments. In simple terms, blockchain is applied to explain a kind of common add-only archive that store and keeps data digitally, where blocks of information are periodically accumulated as units, chained, and encrypted. Blockchain is unique because of its immutability, decentralization, and transparency. When assessing NFTs, irreplaceable is an economic word for assets that cannot be exchanged. For instance, $1 can be replaced with another fungible $1, but the artwork is not fungible because it cannot be replaced due to its inherent characteristics. Tokens represent the functionality of NFTs that represent physical/ digital items upon the blockchain. An NFT is therefore basically a blockchain illustration of the presence of a tangible or intangible asset: a unique digital record of the asset's proof of authenticity and ownership (Batchu et al., 2022). The high instability and risk of the blockchain market have attracted the interest of investors and market members, who are looking to diversify NFTs, DeFi tokens, and cryptocurrencies. In an article, extreme risk transfer in blockchain markets utilizing quantile connectivity techniques under medium, ultra-low, and ultra-high volatility conditions is examined. The authors in this article considered important risk spillovers between blockchain markets with powerful decoupling from NFTs. On the other hand, time-varying characteristics characterized different rough economic conditions. Overall, NFTs suggest more expansion opportunities with greater risk-taking ability than other blockchain markets to protect funds and minimize extreme risk (Karim et al., 2022). In another research, NFT and other resources such as oil, gold, Bitcoin, and the stock market index (S&P500) are examined. The paper examines the volatility transmission and returns among NFTs, Defi properties, and other assets (oil, gold, Bitcoin, and S&P 500) using the TVP-VAR structure. The findings show that new digital resources are uncoupled from conventional asset

classes. Bitcoin, oil, and half of the NFTs and Defi assets are internet transmitters of volatility spillovers and return, while others are internet recipients of spillovers. Return and volatility connectedness come to be better for the duration of the preliminary segment of the coronavirus pandemic and the cryptocurrency bubble of 2021. Authors in this article additionally compute the dynamic and static most fulfilling NFT/other asset and Defi Asset/other asset portfolio weights, hedge ratios, and hedging effectiveness and display that buyers and portfolio managers must not forget including NFTs and Defi properties of their portfolios of gold, oil, and stock markets to acquire diversification benefits (Yousaf & Yarovaya, 2022). Also, during the Coronavirus pandemic, a bubble in the digital financial market happened. A paper by Maouchi et al. (2022) examines the digital financial bubble during the pandemic of COVID-19. Utilizing our model of nine DeFi tokens, three NFTs, Bitcoin, and Ethereum, we can see multiple covering bubbles in the crypto assets under investigation. This paper argues that DeFi and NFT bubbles occur less frequently but are larger than cryptocurrency bubbles. Likewise note that Total Value Locked (TVL) is negatively correlated with cryptocurrency bubbles, while COVID-19 and trading volume have exacerbated the occurrence of bubbles. The finding indicates that TVL can be applied as a market investigation tool. In another article, the mixture of blockchain technology and the backing business has created a unique economy, commerce, and currency—the Metaverse and the play-to-earn game that contains the Metaverse and the play-to-earn tokens. The work analyzed the presentation and dynamics of 174 tokens and found that this emerging cryptocurrency niche was characterized by (1) positive long-term performance, (2) lack of high parallelism with the cryptocurrency market, and (3) bubbles (4) Lack of high correlation with NFT characteristics like the number of transactions, revenue, and Google searches (Vidal-Tomás, 2022).

2. Decentralized crowdfunding

The goal of crowdfunding is to get the support of the public for projects, not just a few investors or venture investors. Projects of all kinds, from start-ups and artistic ventures such as movies and music albums to political campaigns, and even funding systematic study projects can be funded by Using this strategy. Crowdfunding allows you to receive funding from many people who don't claim a stake in your business. Even so, you will still be a majority shareholder and continue to call shots, as the ownership of third parties has been diluted for many investors.

Many organizations are raising funds to help people during the most critical times of COVID-19, the war in Ukraine, and other natural disasters, and governments are distributing funds to those in need. It also raises funds for new business projects. An important factor for those involved in fundraising is trust and security. Traditional fundraising methods can face many trust and transaction transparency issues. In response to this issue, increasing contributor trust by providing more transparency and security must be considered. Each transaction has to be recorded on the blockchain network, ensuring that valid organizers receive the amount. Blockchain-based smart contracts can be applied to key areas of the fundraising process (Mukesh & Shivaram, 2022).

Traditional crowdfunding also has its difficulties. Funding a project is not always easy. You need to persuade a lot of people about the value of your startup, which requires you to create good sales and campaigns. Still, there is no assurance that individuals will be involved in your actions. Moreover, even if you can get the money, most platforms will reduce the money you raise. For example, Kickstarter gives you 5% off each project, so you must worry about costs such as payments and referral fees. In addition, it can be a serious problem when it comes to intellectual property rights. Early protection of your idea is crucial, someone might steal it before you start your business. Some of these disadvantages can be neutralized by a new trend in crowdfunding: Crowdfunding is based on blockchain or decentralized systems.

Crowdfunding has changed the way people get funding, allowing startups to increase money without much bureaucracy. According to existing models, individuals donate tiny amounts of money to projects in hopes of financial or non-financial earnings. Crowdfunding platforms receive commissions and meet the requirements and opportunities of funders and fundraisers. Blockchain knowledge is a decentralized, more effective, secure, and tamper-proof system of connected

nodes. Adopting blockchain for crowdfunding will improve reliability, transparency, reliability, decentralization, cost-effectiveness, and convenience. Crowdfunding platforms that previously acted as intermediaries offer only technology and name, offering their own cryptocurrencies that act as a medium of transaction and trade. The fundraiser generates its own currency and each person on the system is informed of the project. A funder can withdraw at any time by buying this cryptocurrency and claiming his stake in a project, selling the currency and he loses his stake in one plan or transmitting it to another plan. Blockchain can further enhance this single and modern approach of increasing funds by increasing trust and transparency (Baber, 2020).

Decentralized crowdfunding is a different path to raise money based on blockchain technology. Blockchain is the similar knowledge that underlies cryptocurrencies such as Ethereum and Bitcoin. In short, it's a secure, tamper-proof distributed database that doesn't require a trusted third party to validate the transactions.

In the new globe, online crowdfunding plays a significant role. This allows several shareholders to fund projects offered by numerous creators. Madaan et al. (2022) compared the pros and cons of traditional crowdfunding and blockchain crowdfunding. Traditional crowdfunding faces several challenges, like transparency problems, fraud problems, and investor abuse. But to overcome these problems, blockchain crowdfunding emerged. Blockchain crowdfunding aids overwhelmed the problems of traditional crowdfunding (Madaan et al., 2022).

Traditional crowdfunding platforms charge a processing fee on every transaction because of intermediaries. This creates additional equity for the beneficiary. Applying a blockchain-based method excludes the need for intermediaries and decreases handling fees incurred. Blockchain is essentially safe, decentralized, verifiable, and transparent. This creates an environment of trust where investors and recipients can work simultaneously in a realistic and regulated manner. In some cases, the project was illegal. Such inconsistencies intimidate potential investors. Blockchain-based crowdfunding can alleviate such cases with the help of smart contracts. It can be concluded that a blockchain-based method to crowdfunding is beneficial (Mutharasu et al., 2022).

Startups receive funds through decentralized crowdfunding by selling tokens and currencies to investors. They are known as blockchain-based offers, or BBOs. When the project begins, investors may use these tokens or coins to gain access to startup products or services. Alternatively, tokens can stand in for debt instruments, securities, or other types of investments. In addition, a successful launch of a startup can significantly increase the value of the token itself. This lets shareholders to leverage their asset only by trading tokens in a profitable way using a variety of online brokers and crypto exchanges.

Smart contracts are one of the main factors that blockchain technology applies to crowdfunding. Smart contracts are digital programs that run automatically when specific situations happen at the same time. This vital component enables the progression of programs that work without human concern, making all transactions safe and rapid. This not only eliminates mediators but also eliminates most fees that may be important to many funders. Decentralized crowdfunding is the future of fundraising for startups. Decentralized crowdfunding has several advantages, the most important of which are:

- Eliminate mediators and reduce funding costs.
- Ability to sell tokens globally.
- Increased security by utilizing smart contracts.
- You will still be a majority shareholder.

On the other hand, decentralized crowdfunding is yet a different view, and there are not several programs that recommend this assistance. The crypto ICO thriving has had a lot of distrust of

funding platforms that use blockchain technology since several of them pointed out to be complete tricks to steal from the community. It's no wonder why various risk-averse investors follow the guidance of credible investment bulletins, numerous of which point to the common risks of crypto investment and ICOs.

Finally, due to the significant energy consumption necessary to maintain a blockchain platform, many are generally concerned about the environmental impact of blockchain technology. Decentralized crowdfunding works with the aid of offering varieties of tokens through blockchain-based contributions. Choosing the type of BBO to offer to investors is the first step toward decentralized crowdfunding. While seeking funding, BBO entrepreneurs can select one of three basic forms.

(I) Initial coin offerings or ICOs

(II) Security token offerings or STOs

(III) Initial exchange offerings or IEOs

2.1. Initial coin offerings or ICOs

At ICO, startups provide investors with utility tokens. They are digital resources that are not linked to the firm's stock and investors can use them to pay for startup products and services on their online platforms. These tokens work through smart contracts running on the blockchain. Investors who purchase ICO payments using cryptocurrencies such as Bitcoin and Ether will automatically transfer ownership of the token to the investor and register that ownership in the blockchain when the smart contract confirms the payment.

2.2. Security token offerings or STOs

Security Token Offerings are like ICOs in that they offer digital resources as an investment opportunity. But, different value tokens and security tokens show the real capital of the firm and are therefore a matter of government rules.

2.3. Initial exchange offerings or IEOs

Initial Exchange Offering (IEO) is a kind of BBO that is developing more common. At IEO, startups get funding by selling tokens to shareholders through cryptocurrency exchanges. These connections act as an intermediary among startups and investors and assist encourage IEO as well as their client base. With millions of users in crypto exchanges like Binance, projects reach a potentially huge audience.

3. Token economy

As a formal description, a token economy is a type of behavioral change. It uses tokens to encourage good behavior and decrease unwanted behaviour. People obtain tokens when showing attractive behavior. The tokens are stored and after can exchange for a significant purpose, gift, or opportunity.
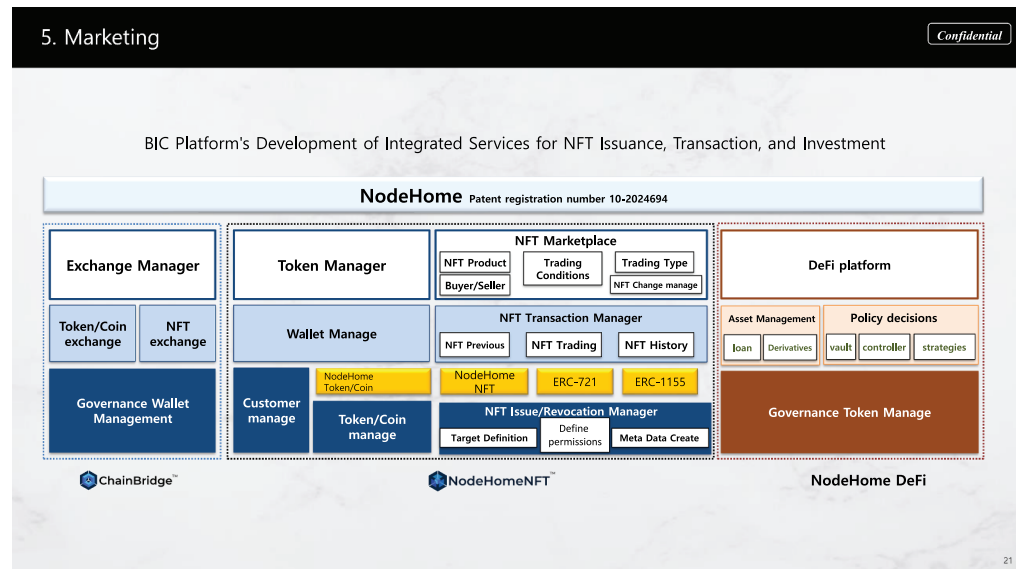
Elements in the token economy:

3.1. Tokens

Anything that is visible and countable

3.2. Target behavior

people who participate in a token economy should know what they should do to obtain tokens.

Figure 6. The new version of the model.

3.3. Back-up reinforcers

Back-up reinforcers are the significant gifts, items, privileges, activities, or even money that people receive in trade for their tokens. In fact, they can give the collected tokens and use these benefits.

3.4. Exchanging tokens system

A system for purchasing backup reinforcers is necessary.

3.5. Recording data system

A system must be designed to record behaviors before and after receiving tokens and collect each individual's behavior.

In other words, token economies refer to the economics of services, goods, and all things that have been tokenized. Blockchain technology can help token economies since it can remove intermediaries and third parties. Four elements of the token economy for digital assets are Documentation, Tokenization, Governance, and Trading. Documentation allows people to record all information about assets and anchors on the blockchain. Tokenization can add a quantifiable and countable substance to a digital asset. Governance is what connects actions to conditions that cannot be broken. It is usually applied in the form of smart contracts on the blockchain. It can add regulations and restrictions to the use of tokens. The fourth element is trading and exchange values.

4. Decentralized exchange (DEX)

A decentralized exchange (DEX) is a cryptocurrency exchange that operates in a decentralized manner, without the need of a central authority or intermediaries. In other words, decentralized exchanges, or DEXs, are peer-to-peer markets where bitcoin dealers conduct direct transactions. So, avoid entrusting the administration of their finances to a third party middleman or custodian. These interactions are enabled by the use of smart contracts, which are self-executing agreements written in code. There are many DEX platforms such as Uniswap, Sushiswap, and Pancackeswap. Since Uniswap is one of the most popular platforms, we will explain this platform in this section of this article (Figure 5).

Uniswap is a cryptocurrency exchange that operates on a decentralized network. Moreover, Uniswap is the name of the firm that created the Uniswap protocol. By the use of smart contracts, the protocol enables automatic transactions between cryptocurrency tokens on the Ethereum blockchain.

5. Insurance token and decentralized insurance

Because of the enormous potential payoff, any tokens linked within smart contracts are potentially subject to smart contract exploitation. Nobody knows if the smart contracts in most of the projects that have had their codebases audited are genuinely safe, and there is always the risk of a hack that may result in a loss. The hazards underline and reaffirm the importance of acquiring insurance, especially when dealing with big sums of money on DeFi. An example of a decentralized alternative to insurance is the protocol Nexus Mutual. Based on the new version of the model, an NFT marketplace was added to this platform (Figure 6).

6. Energy certificate trading

6.1. The role of energy certificates in promoting renewable energy

Energy certificates are an important instrument for encouraging renewable energy and lowering greenhouse gas (GHG) emissions. They provide a market-based mechanism for promoting the use of renewable energy and easing the transition to a low-carbon economy (Woo et al., 2021; Zhao et al., 2022). The market supports investment in renewable energy projects by creating demand for renewable energy certificates (RECs) and other types of energy certificates, thereby increasing the share of renewable energy in the energy mix. Energy certificates also serve to build a transparent and trustworthy marketplace for sustainable energy by certifying and documenting the environmental benefits connected with renewable energy generation.

6.2. The various types of energy certificates

There are several types of energy certificates, including RECs, carbon credits, and energy efficiency certificates (Cali et al., 2022; Hosseini & Kamyab, 2022). RECs are tradable certificates that represent the environmental benefits associated with the generation of one megawatt-hour of renewable energy. Carbon credits, on the other hand, represent a reduction in GHG emissions and are generated through projects that reduce or avoid emissions (Woo et al., 2021). Energy efficiency certificates, also known as white certificates, are issued for energy savings achieved through energy efficiency measures.

6.3. The trading and pricing mechanisms of energy certificates

Typically, energy certificates are exchanged on exchanges or in over-the-counter (OTC) markets. Supply and demand issues, as well as regulatory and policy considerations, all influence energy certificate pricing. The cost of renewable energy generation, the cost of complying with renewable energy laws, and the level of demand from buyers wanting to satisfy sustainability targets, for example, all influence the price of RECs.

6.4. The regulatory frameworks that govern energy certificate markets

At the national, regional, and international levels, energy certificate markets are governed by a variety of regulatory regimes. These frameworks provide the procedures for creating, certifying, trading, and retiring energy certificates. They also include recommendations for monitoring and reporting on energy generation, emissions reductions, and energy efficiency initiatives. Regulatory frameworks are frequently designed to aid the transition to a low-carbon economy by rewarding the use of renewable energy and boosting energy efficiency.

As mentioned before, this platform provides a decentralized marketplace for buying and selling energy assets, such as renewable energy certificates (RECs) or carbon credits. In fact, the energy sector and decentralized asset investment trading can be connected through a number of business models that leverage blockchain technology. One such model is the creation of a decentralized

marketplace for buying and selling energy assets, such as renewable RECs or carbon credits. This marketplace could allow consumers and producers of energy to trade these assets directly, without the need for intermediaries, and could provide greater transparency and accountability in the trading process.

Another way that decentralized asset investment trading can connect to the energy sector is through the creation of tokenized energy assets. Energy producers could use blockchain technology to tokenize their energy generation capacity and offer these tokens for investment. Investors could then purchase these tokens as a way to invest in the energy sector and earn a return on their investment as the energy is generated and sold. Moreover, decentralized finance (DeFi) protocols could also be used to finance energy projects and provide new sources of capital for the energy sector. For example, DeFi protocols could be used to issue loans for energy projects, which could then be paid back with interest using the revenue generated by the energy generated by the projects.

The blockchain-based platforms for trading energy certificates like carbon credits typically use a decentralized approach, allowing individuals and organizations to buy and sell these certificates directly without the need for intermediaries.

There are a lot of business models for energy certificate platforms, and you can find famous platforms here:

1-Energy Web Foundation (EWF)—EWF provides a blockchain-based platform for energy certificate trading, including carbon credits. Their platform enables users to create and manage digital certificates, which can be traded directly on the Energy Web Chain. EWF earns revenue through various sources, including transaction fees, consulting services, and grants.

2-Power Ledger—Power Ledger's platform allows individuals and organizations to trade renewable energy certificates (RECs), carbon credits, and other energy assets on a peer-to-peer basis. Clients can buy and sell these assets using Power Ledger's cryptocurrency, POWR. Power Ledger earns revenue by taking a small commission on each transaction.

3-Prosume—Prosume's platform uses blockchain technology to create a transparent and secure marketplace for trading energy certificates, including renewable energy certificates and carbon credits. Users can trade these assets directly on the Prosume platform, and Prosume earns revenue by charging transaction fees.

4-Veridium—Veridium's platform provides a marketplace for trading carbon credits and other environmental assets using blockchain technology. Their platform enables users to buy and sell these assets directly, and Veridium earns revenue by charging a commission on each transaction.

So, the business model of these platforms is based on providing a secure and efficient marketplace for energy certificate trading while earning revenue through transaction fees and commissions. The decentralized nature of blockchain technology enables greater transparency and efficiency in the trading of these assets and can help to accelerate the transition to a low-carbon economy. Moreover, energy certificates, such as renewable energy certificates (RECs) and carbon credits, are a type of sustainable energy asset that can be traded on digital currency platforms. The challenges and prospects of digital currencies in the energy sector are important considerations for the development and adoption of energy certificate trading platforms (Hosseini & Kamyab, 2022).

In addition, it is possible to add exchange energy tokens to an energy certificate platform. Energy tokens can be used to represent energy assets or commodities and can be traded on a blockchain-based platform along with energy certificates such as carbon credits. This can help to

create a more efficient and transparent marketplace for energy trading while also promoting the adoption of renewable energy sources.

Given the aforementioned review, the proposed decentralized asset investment and trading platform for energy certificates has the potential to stimulate the adoption of renewable energy sources by facilitating the trading of energy certificates and by providing a safe and secure marketplace for buyers and sellers. The platform can assist in lowering entry barriers for small and medium-sized firms (SMEs) and individual investors by adding features like token economies, crowdfunding, and insurance. By stimulating investment in renewable energy projects and facilitating the trade of carbon credits and other types of energy certificates, the platform's decentralized structure can also aid in the promotion of sustainability and the reduction of the carbon footprint of energy systems. Overall, the platform may help to advance sustainable investment methods and quicken the transition to a low-carbon economy.

There are several well-known energy certificate platforms such as:

(1) International Renewable Energy Certificates (I-REC)—I-REC is a platform that allows for the tracking and trading of renewable energy certificates (RECs) across international borders. It operates in several countries, including Brazil, Turkey, and South Africa.

(2) Renewable Energy and Energy Efficiency Partnership (REEEP)—REEEP is a platform that supports the development and deployment of renewable energy and energy efficiency technologies. It operates in several countries, including India, South Africa, and Vietnam.

(3) Green-e—Green-e is a certification program that provides assurance to buyers that the energy they purchase is produced from renewable sources. It operates in the United States and Canada.

(4) Tradable Instrument for Global Renewables (TIGR)—TIGR is a platform that allows for the trading of renewable energy certificates (RECs) and guarantees of origin (GOs) across international borders. It operates in several European countries.

(5) The Gold Standard—The Gold Standard is a certification program that provides assurance to buyers that the energy they purchase is produced from renewable sources and meets certain sustainability criteria. It operates globally.

Figure 7. Model for creating energy certificates based on energy and carbon emissions in the agriculture sector.
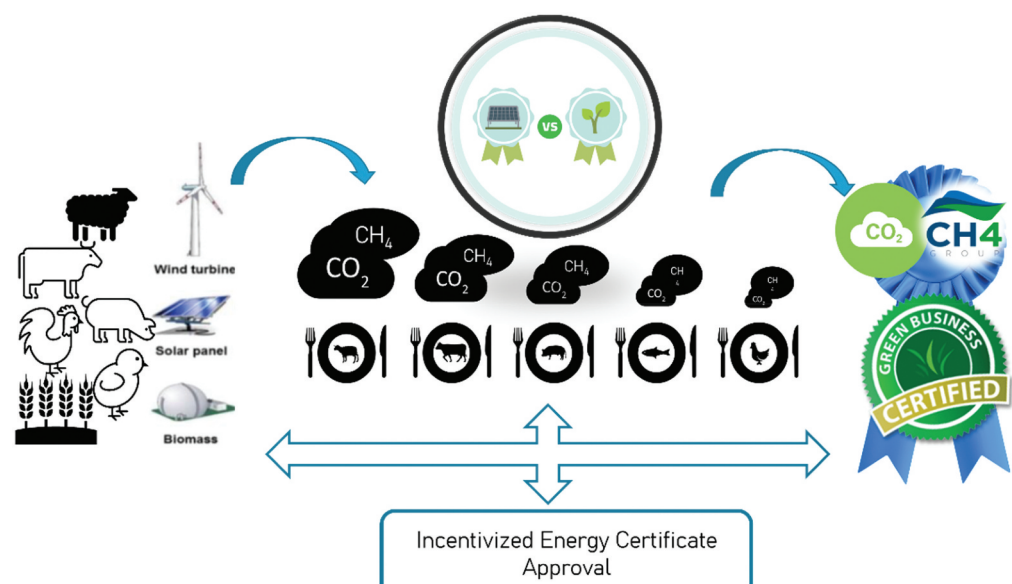
(6) Climate, Community & Biodiversity Standards (CCBS)—CCBS is a certification program that provides assurance to buyers that the energy they purchase is produced from renewable sources and supports sustainable development. It operates globally.

(7) Application of energy certificate for agriculture

After reviewing several models, a section was added to BIC platform which is related to energy certificate.

Figure 7 illustrates a potential model for the application of energy certificates in green farming activities. It demonstrates how farms could receive incentives if they meet the criteria for energy certificates and have lower carbon emissions (CO_2 and CH_4).

If farmers meet the criteria for Incentivized Energy Certificate Approval (IECA), they will not only receive incentives in the form of agricultural-based tokens (ABT) but also be exempted from carbon taxation. Failure to meet the criteria will result in higher taxation based on the amount of carbon emissions. The model below shows how farm activities and production contribute to carbon emissions, as well as how policymakers might incentivize farmers who contribute less carbon emissions using IECA.

6.5. The role of energy certificates in promoting renewable energy
Energy certificates are a key policy tool for promoting renewable energy production. They enable the decoupling of physical energy from the environmental attributes, such as the reduction of greenhouse gas emissions. This is done by certifying that a certain amount of renewable energy was produced and delivered to the grid. The certificates provide financial incentives to renewable energy producers by giving them an additional revenue stream from the sale of the certificates.

6.6. Various types of energy certificates (RECs, carbon credits, energy efficiency certificates)
There are several types of energy certificates, including renewable energy certificates (RECs), carbon credits, and energy efficiency certificates. RECs are certificates that verify the production of a certain amount of renewable energy, and they can be traded on a market. Carbon credits are certificates that represent a reduction in greenhouse gas emissions and can also be traded. Energy efficiency certificates are used to certify the energy savings achieved through efficiency measures and can also be traded.

6.7. Trading and pricing mechanisms for energy certificates
Energy certificates are traded on a variety of markets, including voluntary and compliance markets. Compliance markets are typically created by government regulations and require certain entities, such as power companies or industrial facilities, to meet a certain quota of renewable energy or emissions reductions. Voluntary markets, on the other hand, allow individuals and companies to purchase energy certificates voluntarily to offset their own carbon emissions or to support renewable energy production. Pricing mechanisms for energy certificates are typically based on supply and demand, with prices fluctuating based on market conditions.

6.8. Regulatory frameworks governing energy certificate markets
Regulatory frameworks governing energy certificate markets vary by region and are typically designed to ensure transparency, integrity, and accountability in the trading process. Regulations can include requirements for certification, verification, and reporting, as well as penalties for non-compliance. In some cases, regulatory frameworks may also include mechanisms to support the development of renewable energy technologies or to encourage the adoption of energy efficiency measures.

6.9. Equations for calculating GHG emissions, renewable energy generation, and energy savings achieved through efficiency measures

Calculating greenhouse gas emissions, renewable energy generation, and energy savings achieved through efficiency measures requires the use of complex equations and data analysis. The equations used can vary depending on the type of energy source or efficiency measure being evaluated. However, common factors that are typically considered include the energy source or efficiency measure itself, the amount of energy produced or saved, and the environmental impact of the energy source or efficiency measure.

6.10. Applications of energy certificates in agriculture and animal industry

Energy certificates have several potential applications in the agriculture and animal industry, including incentivizing the adoption of renewable energy technologies and supporting the implementation of energy efficiency measures. For example, energy certificates could be used to incentivize farmers to implement solar or wind energy systems on their farms or to upgrade their equipment to more energy-efficient models. Additionally, energy certificates could be used to incentivize the adoption of sustainable agricultural practices, such as reducing greenhouse gas emissions from livestock or improving soil health.

7. Conclusion

There are many decentralized asset investment trading platforms such as Aave, and Curve. These platforms are decentralized, meaning they operate on a peer-to-peer network and do not rely on a central authority. This makes them more secure and transparent compared to centralized exchanges. In this research, a new business model for a decentralized investment platform is presented. This business model allows firms to use a variety of services to invest in and exchange cryptocurrencies as well as solutions for the energy sector such as carbon credit certificates and token economy. In addition, since there is a unique insurance service on this platform, the risk of investment will be decreased. In a token economy, blockchain technology is applied to cover physical assets and digitize them. Also, it can prove their ownership, and potentially trade them via the token economy platform and it would be a good solution to finance the energy sector. Moreover, decentralized asset investment trading be able to play a significant part in the energy sector by delivering new sources of capital, creating new marketplaces for buying and selling energy assets, and promoting transparency and accountability in the energy sector.

7.1. Main findings of the present study

The present study explores the potential of decentralized asset investment trading platforms, such as Aave and Curve, which operate on peer-to-peer networks and do not rely on central authorities. It introduces a novel and unique business model for a decentralized investment platform that allows firms to invest in and exchange cryptocurrencies, as well as solutions for the energy sector like carbon credit certificates and token economy. The inclusion of a unique insurance service on this platform reduces investment risks, while the application of blockchain technology in a token economy facilitates the digitization and ownership verification of physical assets, promoting transparency and accountability in the energy sector. Decentralized asset investment trading platforms can play a significant role in the energy sector by providing new sources of capital, creating marketplaces for energy assets, and promoting transparency and accountability.

7.2. Comparison with other studies

The comparison with other studies indicates that decentralized asset investment trading platforms offer distinct advantages over traditional centralized exchanges. Unlike centralized platforms that rely on a central authority, decentralized platforms operate on peer-to-peer networks, making them more secure and transparent. Additionally, the integration of blockchain technology in the token economy enables the digitization and ownership verification of physical assets, which can

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contribute to financing the energy sector. Also, based on energy certificate platforms and supply chain models based on blockchain technology, there is no model like this new model which combines DeFi solutions like DEX and Energy Certificate platforms together.

7.3. Implication and explanation of findings
The findings have significant implications for the financial and energy sectors. Decentralized asset investment trading platforms offer a more secure and transparent alternative to traditional centralized exchanges. By leveraging blockchain technology, these platforms can enable the tokenization of physical assets, providing new avenues for financing the energy sector. The inclusion of an insurance service reduces investment risks, further promoting participation in decentralized asset investment trading platforms.

7.4. Strengths and limitations
The strength of this research lies in its exploration of decentralized asset investment trading platforms and the introduction of a novel business model for such platforms. The use of blockchain technology to digitize physical assets and enhance transparency in the energy sector is a notable contribution. However, the study's main limitation is its general focus without specific geographic domain restrictions, which might affect the applicability of the results to certain countries or regions.

7.5. Recommendation, and future direction
In conclusion, the research establishes the potential benefits of decentralized asset investment trading platforms for both financial and energy sectors. It recommends further research and development in the digitalization and platformization of the energy sector to maximize the advantages of decentralized systems. Future directions should involve studying specific geographic domains and regulatory contexts to tailor the platform's implementation to the unique requirements of each region. Additionally, exploring additional features and functionalities to enhance platform usability and appeal to a broader range of stakeholders could lead to further advancements in this domain.

Data availability statement
Data are available upon a reasonable request from the first author(s).

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Disclosure statement
No potential conflict of interest was reported by the authors.

Patents
A patents resulting from the work reported in this manuscript. The patent titled: Capital Raising and Asset Management System Using A Blockchain Investment Certificate Platform (patent registration ID: 4–2018–038128–6; patent no.: 4–2023–012434–9).

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