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Validation of Value-Driven Token Economy: Focus on Blockchain Content Platform

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Abstract: This study explores the architectural framework of a value-driven token economy on a blockchain content platform and critically evaluates the relationship between blockchain's decentralization and sustainable economic practices. The existing literature often glorifies the rapid market expansion of cryptocurrencies but overlooks how underlying blockchain technology can fundamentally enhance content platforms through a more structured user engagement and equitable reward system. This study proposes a new token economy architecture by adopting the triple-bottom -line (TBL) framework and validates its practicality and effectiveness through an analytic-hierarchy-process (AHP) survey of industry experts. The study shows that the most influential factor in a successful token economy is not profit maximization but fostering a user-centric community where engagement and empowerment are prioritized. This shift can be expected to combine blockchain technology with meaningful economic innovation by challenging traditional profit-driven business models and refocusing on sustainability and user value.

Keywords: blockchain; smart contract; content platform; token economy; triple bottom line (TBL); analytical hierarchy process (AHP)

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1. Introduction

Blockchain-based tokens are various crypto assets created and traded on the blockchain network, each making economic value [1]. Attention around cryptocurrencies, including tokens, began earnestly in 2017 with Bitcoin [2]. These cryptocurrencies are traded on a blockchain, a technology that enables transactions between individuals through a peer-to-peer (P2P) network without a third-party authorized entity, instead of storing and managing transaction information on a central server [3]. As blockchain technology is applied to various economic areas, there is growing interest in its potential to disrupt existing business models through tokens and tokenization [4]. Content platforms are no exception to this interest. A prime example is Steemit, where users are compensated for their writing [5]. But Steemit faces challenges, such as excessive rewards, falling token prices, and decreasing reward levels [6].

Although the existing research mainly explores the technical foundations of the blockchain and its role in financial innovations, such as cryptocurrencies [7], there is a significant gap in understanding value-driven token economies, especially their application on content platforms. Although the existing literature extensively describes the technical advantages of the blockchain, such as decentralization, transparency, and security [8], less attention is paid to how these features contribute to creating sustainable economic value beyond simple transactional functions. This study addresses this gap by focusing on implementing a value-driven token economy on blockchain content platforms. Through a comprehensive review of the existing research, this study identifies the lack of integration between the blockchain's capabilities and its practical application in fostering sustainable economic models that benefit all the stakeholders. By resolving this oversight,

this study aims to contribute to the academic advancement of blockchain research and propose and validate a new token economy architecture that puts sustainable value creation ahead of short-term profit maximization. On the A3I platform, the case study for this paper, every user can evaluate the value of every article, which is directly related to the author's compensation. The higher the rating, the higher the reward, which is differentiated from the reward mechanism of existing platforms, where authors are rewarded based on the number of views, regardless of the quality of the content. This study proposes a new architecture based on the sustainability-oriented triple-bottom-line (TBL) framework, and experts validate this architecture through an analytic hierarchy process (AHP).

This study has academic significance by analyzing the value of the blockchain and smart contracts as a practical model to enable user engagement and rewards in response to the problem of blockchain platforms that can be biased toward reward systems. It also has business significance by proposing a new architecture based on empirical validation by content and blockchain experts. Furthermore, it has universal social significance by providing a user-friendly platform that anyone can use. This approach highlights the unique contribution of this study and creates a solid foundation for understanding the emerging implications of a value-driven token economy.

2. Related Works

2.1. Blockchain and Smart Contracts

The blockchain provides a secure ledger stored based on a decentralized method [9]. A peer-to-peer (P2P) network blockchain is a digital ledger that stores data in blocks and allows users to access that data using a hash value [10]. Blockchain technology is organized into blocks of transactions that can verify and authenticate information without needing a centralized third-party authority [11]. The blockchain also distributes the ledger to many users. It applies a consensus mechanism to ensure that data changes require multiple consensuses, making it virtually impossible for anyone to alter or change the information stored on the blockchain [12]. The blockchain maintains data integrity, consistency, and transparency through a vast decentralized network [13]. Because of this, the blockchain provides a decentralized and secure framework for storing and transferring data [14]. The blockchain is more than just the technology for the money that powers cryptocurrencies, like Bitcoin. The blockchain has the potential to help automate, incentivize, and authenticate global trade and has a wide range of applications [15]. Therefore, blockchain technology is currently being applied across the globe to reshape industries, such as business, finance, insurance, government, and education [16].

Smart contracts are uploaded computer code that can be automatically executed on the blockchain [17]. The smart contract is an executable program that is automatically released and checked by the network nodes of a decentralized blockchain without the intervention of an authorized third party [18]. The core functionality of smart contracts can be described as consistently accepting performance data, then checking the data against the encoded contract, and executing the follow-up payment steps [19]. The smart contract architecture mainly comprises a data layer, a transport layer (the smart contract's body), a verification layer, an execution layer, and an application layer [20]. The data layer mainly stores data on the blockchain and interacts with the transport layer through APIs to deliver related data to the smart contract's body. The advantages of smart contracts include the following [21]: (1) Because of the blockchain's immutability, smart contracts cannot alter data arbitrarily once executed, thus reducing risks, such as financial fraud. (2) Smart contracts stored on the blockchain are automatically executed in a decentralized mode, which lowers management and service costs. (3) Eliminating dependence on third parties can significantly enhance the efficiency of a business in terms of time and money. Moreover, a token smart contract is critical because it stores each user's token holdings and enables payments on the blockchain [22]. Therefore, smart contracts have been gaining significant traction lately because they can automate and secure various transactions in many areas [23]. Furthermore, the blockchain and smart contracts can leverage another new technology, AI,

to optimize blockchain consensus mechanisms, make smart contract execution work more effectively, and further enhance data privacy [24].

2.2. Blockchain Value Propositions

Traditional content platforms allow anyone to create and consume content, but this also means that because the content is publicly available online, anyone can download and copy it, reducing the value of the content [25]. For this reason, content creators on traditional content platforms cannot be recognized for their rights or profits. However, blockchain technology could revolutionize digital content production, distribution, and consumption [26]. This enables the blockchain to improve the user's content experience [27] greatly. Therefore, the value proposition of the blockchain for digital content is divided into functionality and technology, as shown in Table 1 [28].

Table 1. Blockchain value proposition for digital content [28]: This table shows the value a blockchain-based content platform can provide, depending on its features.

Blockchain Features		Blockchain Value Proposition for Digital Content
Functionality	Integrity	(1) prevents content from being altered or forged by anyone; (2) verifies the authenticity of the content's ownership and license information; (3) guarantees the information or data;
	Decentralization	(4) reduces the risk of biased or centralized censorship; (5) reduces the risk in recommendation algorithms; (6) creates a more democratic content distribution environment;
	User Ownership	(7) offers direct monetary rewards to incentivize user engagement;
Technology	Smart Contracts	(8) pay rewards and incentive royalties to users (including content creators) transparently and automatically;
	Cryptographic Security	(9) ensures that transactions and content distributions are secure and protected from hacking or unauthorized access.

The functionality category has three features: integrity, decentralization, and user ownership. First, data integrity through the blockchain is characterized by the following features: (1) prevention of content from being altered or forged by anyone, thus eliminating the risks of copying, forgery, and alteration as with traditional content platforms; (2) verification of the authenticity of the content's ownership and license information; (3) guarantee of the information or data. Second, the decentralization of P2P networks has the following features: (4) reduces the risk of biased or centralized censorship; (5) reduces the risk in recommendation algorithms, and (6) creates a more democratic content distribution environment. Third, user ownership has the following features: (7) offers direct monetary rewards to incentivize user engagement. The technology category divides features into smart contracts and cryptographic security. Smart contracts are a feature of (8) paying rewards and incentive royalties to users (including content creators) transparently and automatically. Finally, cryptographic security is a feature that (9) ensures that transactions and content distributions are secure and protected from hacking or unauthorized access. Therefore, the features of the blockchain also overcome the limitations of the centralized approach of traditional solutions, which are vulnerable to attacks, lack reliability, and make it difficult to pay out rewards [29].

2.3. Framework of Token Ecosystem

A platform's ecosystem built on a blockchain can issue its token [30]. A token-based ecosystem is an alignment of multidisciplinary partners pursuing a common goal for creating common added value through a central value proposition for all the participants [31].

As shown in Figure 1, the token ecosystem comprises four fundamental principles: decentralization, law, security, and ethics, with various components operating within the

framework [32]. The components are categorized into three layers: identification, composition, and development. The identification layer includes identifying the objectives and scope of the ecosystem, finding stakeholders, identifying value actions between stakeholders, identifying token roles, and defining the business model. The composition layer includes token modeling, such as token incentives, token governance, token distribution, monetary policy, and legal compliance. The development layer includes smart contracts, simulations and testing, testnet, and security audits to code into a real system and requires third-party supervision.

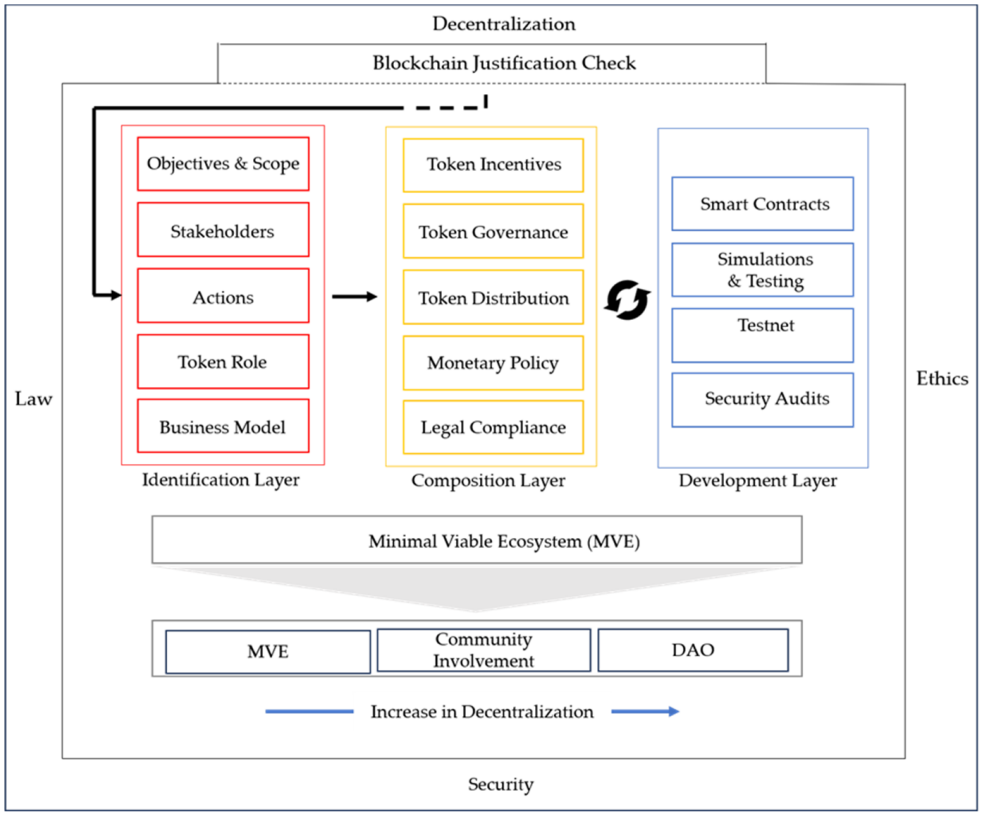


Figure 1. Framework of token ecosystem [32]: Token ecosystems operate under four fundamental principles: decentralization, legal, security, and ethics, with various detailed components related to identification, organization, and development.

2.4. Token Economy

Tokens are tradable digital assets on a distributed ledger (usually a blockchain) controlled by a private cryptographic key. They can reward social media contributions and ad engagement [33]. The main purpose of a reward system is to provide (non)monetary incentives to platform users to strengthen their loyalty and engagement with the platform [34]. Therefore, incentives and reward structures align closely with the token economy [35]. The token economy, the core blockchain model, is designed to allow users to receive rewards according to their contribution level. The token economy refers to an economy centered on tokens, such as Bitcoin and Ethereum, which is in contrast to the legacy economy, centered on traditional financial institutions [36]. The meaning of the token economy is expanding from simply compensation for computing resources to the allocation of tokens based on the decision-making of the blockchain ecosystem's participants [37].

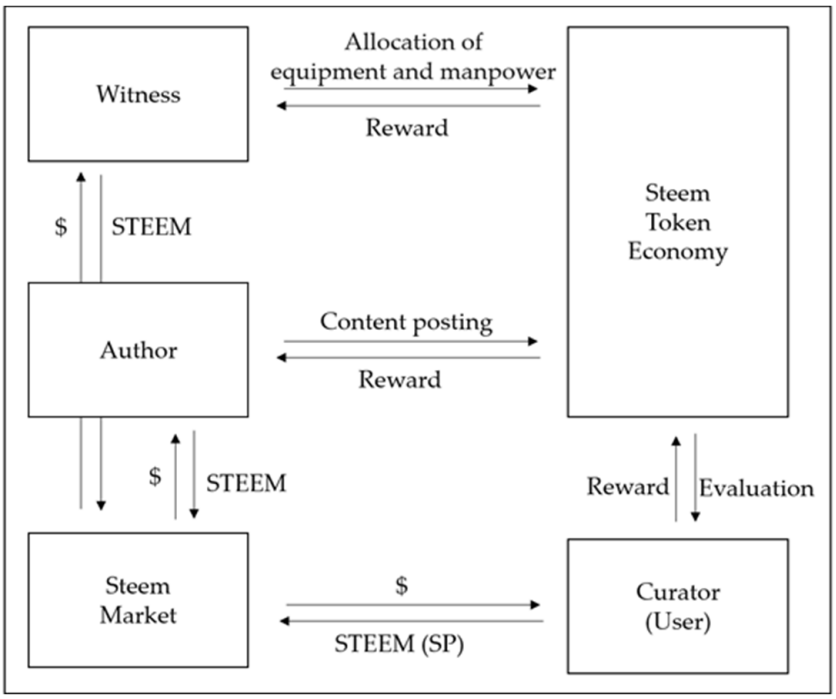
As shown in Table 2, the term "token economy" is also sometimes used interchangeably with "tokenomics" or "tokenization" in terms of the blockchain-based economy or finance, but the meaning of each is different. The token economy is designed to reward users based on their contributions [38]. And "tokenomics" combines the words "token" and "economics" and studies the supply, demand, distribution, and valuation of cryptocur-

rencies [39]. It covers the mechanisms for issuing and burning cryptocurrencies and their utility [40]. "Tokenization" is the process for converting real-world assets or rights into the form of digital tokens [41]. It can be real estate, artwork, or financial assets [42]. This study will analyze the token economy based on the blockchain, smart contracts, and platform policies rather than tokenomics and tokenization.

Table 2. Blockchain-based token models: Three models with tokens are described. The model in this study is the token economy. The token economy is a structure that offers token rewards to users based on their contribution to the platform. It also uses blockchain technology, such as smart contracts, to enhance the activation of content platforms.

Model	Definition	Features	Refs.
Token Economy	The token economy, the domain of this study, is designed to reward users based on their contributions. In addition, smart contracts on the blockchain enhance the convenience of transactions.	Tokens can promote user transactions. Tokens can reward contributors to the development of the platform.	[38,39]
Tokenomics	Tokenomics combines the words "token" and "economics". It studies the supply, demand, distribution, and valuation of cryptocurrencies. It covers the mechanisms for issuing and burning cryptocurrencies and their utility.	Tokens can be leveraged for the coordination, optimization, and governance of large networks in a decentralized method. Tokens allow users to capitalize on the platform's growth, lowering the cost of transactions for users.	[40,41]
Tokenization	Tokenization is the process for converting real-world assets or rights into the form of digital tokens. It can be real estate, artwork, or financial assets.	By transferring digital tokens, the parties aim to transfer ownership or other property rights without the involvement of traditional intermediaries, such as real estate agents. Tokenization can create a single identifier on a distributed ledger that can represent financial assets, commodities, or other resources of value as a token.	[42,43]

A prime example of this token economy is Steemit, where rewards depend on users' contributions [43]. According to the Steemit whitepaper, Steem is a database on the blockchain that supports community building and social interaction through cryptocurrency rewards, and it is the first cryptocurrency to reward users accurately and transparently [44]. Steemit shows that content creators can be rewarded for their content without advertising: When they post, they receive votes from other users, and the more votes they receive, the more they are rewarded with Steem tokens, the cryptocurrency used on Steemit [45]. Steemit designed a three-token system, including STEEM, Steem Dollar (SBD), and Steem Power (SP), to reward users for their contributions, including content creation, evaluation, and sharing, and Steem and SBD can currently be sold for real dollars on token exchanges [46]. Steemit shares 75% of the revenue generated from voting with the content producers and 25% with the users who voted. The largest share, 75%, is divided into two types of content rewards: authors who post on Steemit and curators who find and upvote quality content on Steemit [47]. To summarize, as shown in Figure 2, Steemit's token economy works by authors posting content that engages people; curators finding and rewarding good articles; investors supporting the Steem market price, which is the source of their rewards; and witnesses keeping the network running well. However, Steemit has faced a platform issue, with Steem's decline and the moral hazard for users focusing on rewards over content. A new token economy is now challenging Steemit to overcome this problem.



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2.5. Triple Bottom Line (TBL)

John Elkington showed a triple-bottom-line (TBL) framework to unify sustainability with business activity performance [48]. As shown in Figure 3, the TBL can introduce the "three Ps": people, profit, and the planet, and it aims to expand the focus of managers and investors to a more holistic perspective on organizational performance [49]. The TBL essentially means that companies create sustainable businesses by focusing on financial profitability and social and environmental impacts [50]. TBL can be further conceptualized and developed into three pillars: from people to society, from profit to the economy, and from the planet to the environment [51]. It is challenging to achieve environmental and financial performances while pursuing sustainable value, so creating social performance requires an open design that protects the interests and needs of all the stakeholders.

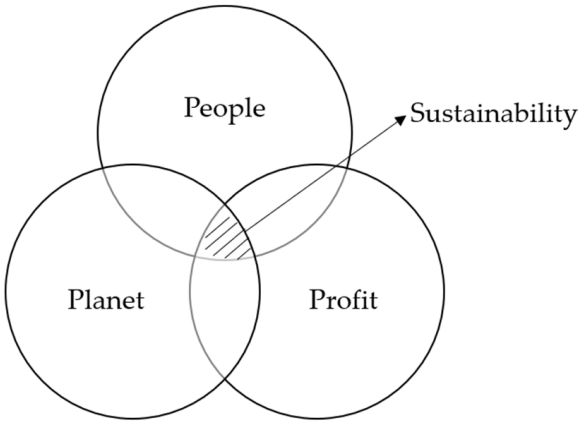

Figure 3. Triple bottom line (TBL) [49]: The TBL framework, founded by John Elkington, proposes three Ps: people, profit, and platform. Sustainable business growth is achieved when all three are in operation.

As shown in Figure 4, blockchain technology can solve these challenges with social, economic, and environmental impacts [52]. In other words, applying blockchain to supply chain operations can help businesses achieve sustainability in terms of social, economic, and environmental impacts, which are factors of TBL.

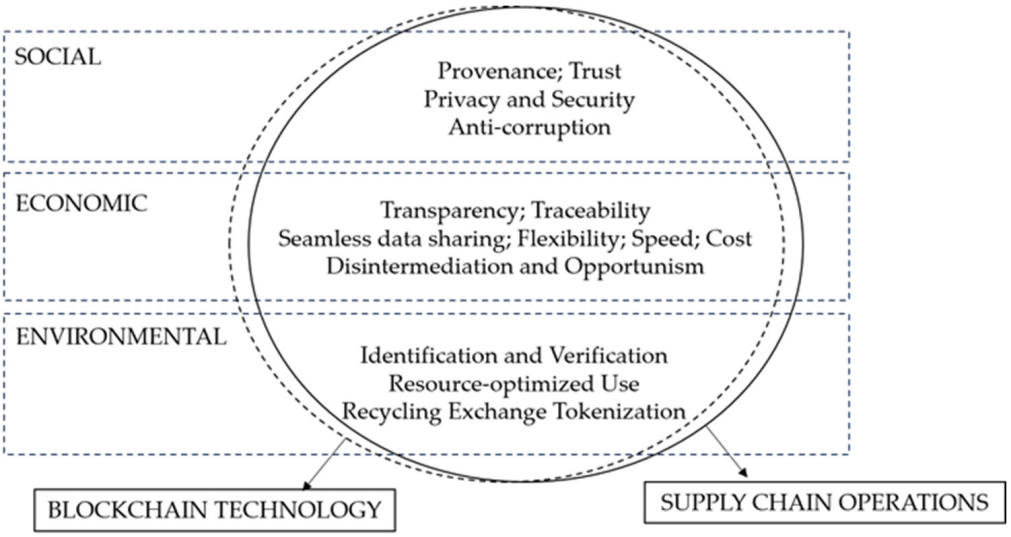

Figure 4. Conceptual framework of triple-bottom-line (TBL) blockchain in supply chains [52]: When blockchain technology is applied to supply chains, it provides provenance, trust, privacy and security, and anti-corruption on the social side. On the economic side, it offers the following values: transparency, traceability, seamless data sharing, flexibility, speed, cost, disintermediation, and opportunism. And lastly, on the environmental side, it offers identification and verification, resource-optimized use, and recycling exchange tokenization.

Blockchain technology enhances social responsibility and transparency by tracking and monitoring social aspects of supply chains. Technology helps to reduce corruption and fraud and ensures important social values, such as respect for human rights and compliance with environmental regulations. The blockchain also has the potential to improve trust relationships between businesses and society and enhance data security and privacy. Second, the economic impact is as follows: Blockchain technology has a key role in supply chain management, enabling companies to improve the transparency of logistics, transactions, and information. This improves economic performance by increasing supply chain efficiency and reducing resource waste. It also has a positive impact on the environment by promoting sustainable operations. Third, the environmental impact is the following: The blockchain can contribute for improving the environmental sustainability of supply chains, helping to trace the origin of products, calculate carbon footprints, and monitor the use of renewable resources.

2.6. Analytical Hierarchy Process (AHP)

The analytical hierarchy process (AHP) is a reliable methodology for quantifying subjective judgments in multi-criteria decision-making (MCDM) to solve complex decision-making problems [53]. AHP is a term created by Saaty (1977) [54] and a methodology for decomposing complex decision problems into multiple hierarchical levels and making pairwise comparisons with weights for each criterion and option, as shown in Figure 5 [55].

AHP assumes a subjective approach because people are not always consistent in their thoughts, and the ratio scales are obtained from the basic eigenvectors. The consistency index is the result of the basic eigenvalue [56]. According to Saaty [57], AHP consists of the following four steps in many cases: (1) actual problem modeling and (2) hierarchy structuring, as shown in Figure 5. A pairwise comparison matrix (PCM) also mathematically describes the pairwise comparisons at every level. (3) A

decision-maker or expert performs a weight evaluation to construct a PCM for each upper-level element compared to a lower-level element. (4) It takes the PCM priorities, weighs them according to each factor, and then aggregates the results to create a global prioritization. The weighting and aggregation procedure is continued until the final prioritization of the alternatives is determined. There are many strengths for applying AHP, including stability and flexibility within the structural hierarchy and for further changes; however, AHP also has a weak point: complexity, which can be uncomfortable to implement [58]. As shown in Figure 6, AHP is a 9-point pairwise comparison scale that compares A and B weights, with 1 being equally important. [59]. In AHP, the factors are divided into hierarchical criteria. These criteria are compared to each other.

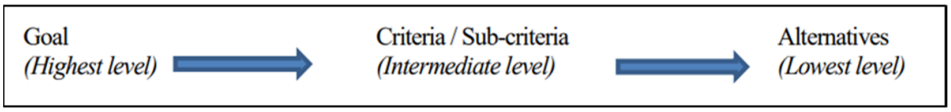

Figure 5. Hierarchy structuring [55]: The hierarchy is a pairwise comparison matrix (PCM) that mathematically describes pairwise comparisons at every level. The highest level is the study's goal; the intermediate levels are the criteria for the top factor, and the sub-criteria (factors) belong to the top factor. And the lowest level is the factors that could be proposed as alternatives.

Figure 6. Analytical hierarchy process's (AHP)'s pairwise comparisons [59]: The pairwise comparison is based on a 9-point scale that compares the weights of A and B, with 1 being equally important.

After calculating the ranking using the eigenvector method, the consistency of the results can also be checked using the consistency ratio (*CR*) and consistency index (*CI*) [60]. The consistency of the relative importance weights assigned during pairwise comparisons can be examined using the equation below.

$$Consistency\ Ratio\ (CR) = \frac{CI}{RI} \quad (1)$$

In the equation above, *CI* is the consistency index, calculated as shown, and *RI* is the randomness index, calculated as follows.

$$Consistency\ Index\ (CI) = \frac{\text{lamda max} - n}{n - 1} \quad (2)$$

3. Research Methodology

3.1. Token Economy Model of A3I®

This study analyzes the token economy model of A3I, a blockchain application platform announced by Kim, Y.S.; Hong, S.P.; Majer, M. in 2023 [61]. A3I is a blockchain-based writing content platform for equitable user interaction and evaluation. Although other existing content platforms, such as YouTube and Meta, only allow users to engage with an activity (view, comment, emoticon, and share) within a specific area of an article, A3I focuses on a feedback structure, where the author of an article and the user interact with the author's writing.

According to [61], existing platforms are designed to reward users based on the number of views rather than the quality of the content. Steemit is also designed to reward users with the most votes. The rewards are distributed to some users, but they must reach certain quantitative performance criteria set by the platform. A3I, on the other hand, has a qualitative reward structure called the article valuation evaluation mechanism (AVEM).

A3I's token economy model follows a six-step process:

[Step 1] All the users of the A3I platform can vote on the A3I index, which rates the value of every article. The A3I index comprises five indicators: new, useful, innovative, actionable, and polite. This differs from other platforms, which use quantitative measures, such as views, comments, and shares, to evaluate content;

[Step 2] The votes of all the users for each article are summed up into a final number, the A3I index. This number is then converted into rewards and paid to the article's author;

[Step 3] Opinion leaders and membership users with write permissions are rewarded with the value index voted on their posts. Subscribed users without write permissions are rewarded for the voting activity itself on each other's posts;

[Step 4] All the users can fund NFTs, DAOs, etc., and get a return on their investment;

[Step 5] All the compensation is paid in points, digital vouchers, and tokens. Mixing up the reward tools prevents moral hazard;

[Step 6] All the rewards are paid out instantly through smart contracts.

The token economy structure for the above six steps is shown in Figure 7. A3I's token economy is different from other blockchain economic structures. In most blockchain economies, money moves between users, but in A3I's token economy, money moves based on the value of posts. The value of every user's voting makes the money move.

When author A, an opinion leader, writes an article, another member of B can write an interactive article in response to A's article. They can then evaluate the value of each other's posts according to the A3I value indicator. Regular subscribers who read their posts can also evaluate their articles. And all this activity on the platform is linked to rewards. Authors A and B are rewarded based on the article value evaluation index (AVEI) they receive from users. The higher their AVEI, the more rewards they receive. Subscribed members are rewarded for the activity of the article evaluation. Therefore, A3I is a structure where all the users can evaluate the value of every article and receive rewards. In addition, although the monetary value of tokens is moved within the platform as a tool for rewards, the basis for the movement of tokens is based on evaluating the article value of each other. In addition, users can invest in high-AVEI articles and earn a return. On A3I's platform, all the rewards are paid automatically through blockchain-based smart contracts.

So, the ecosystem of A3I's token economy has the following features, as shown in Table 3: A3I's token economy is divided into user, reward, and blockchain. The user category is specialized in the following features: (1) All the users can read all the posts and vote on their value; (2) every user who writes a post receives a vote for the value of their content rather than a quantitative number of views; (3) the results of the value vote are linked to the rewards paid to users. The rewards category also has the following features: (4) Rewards are based on the A3I value index; (5) high-index articles are a chance to invest and get a return on investment; (6) all the rewards are paid not only in tokens but also in various ways, such as points, digital vouchers, and tokens. Lastly, A3I's token economy, related to the blockchain category, has the following features: (7) All the rewards are automatically paid to users by smart contracts; (8) all the data and transactions are stored on the blockchain, making it transparent and trustworthy.

Table 3. Features of A3I's token economy ecosystem: A3I's token economy ecosystem is organized into three categories: users, rewards, and blockchain, each with its own features.

Category	Features
User	(1) All the users can read all the posts and vote on their value; (2) Each post receives a value vote for its content, not a quantitative number of views; (3) The results of the value vote are linked to the rewards paid to users;
Reward	(4) Rewards are based on the A3I value index; (5) High-index articles are a chance to invest and get a return on investment; (6) All the rewards are paid not only in tokens but also in various ways: points, digital vouchers, and tokens;
Blockchain	(7) All the rewards are automatically paid to users by smart contracts; (8) All the data and transactions are stored on the blockchain, making it transparent and trustworthy.

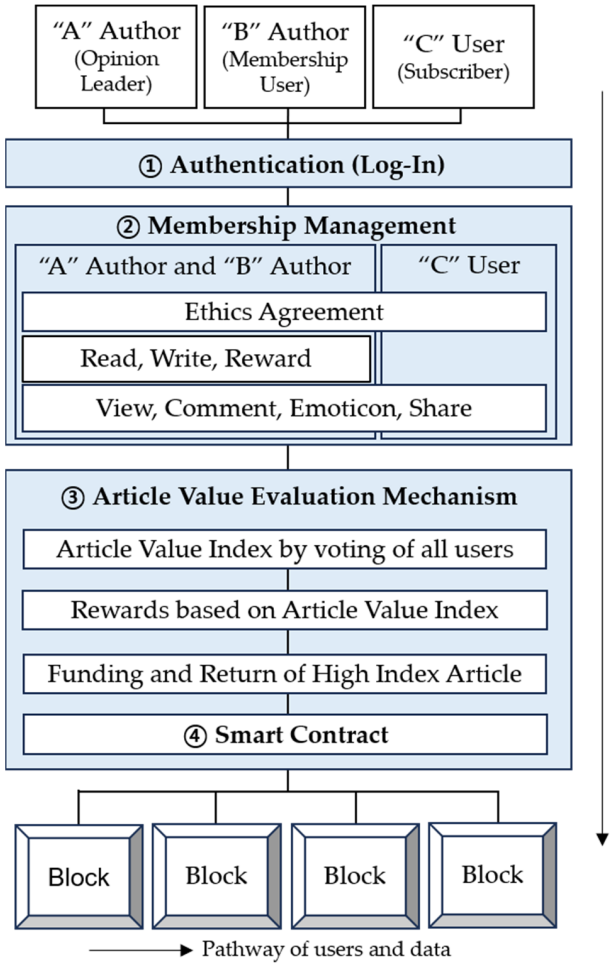

Figure 7. Token economy architecture of A3I®: Figure 7 reconfigures the original architecture [61]. When author A, an opinion leader, writes an article, another member of B can write an interactive article in response to A's article. They can then evaluate the value of each other's posts according to the A3I value indicator. Regular subscribers who read their posts can also evaluate their articles. And all this activity on the platform is linked to rewards. Authors A and B are rewarded based on the article value evaluation index (AVEI) they receive from users. The higher their AVEI, the more rewards they receive. Subscribed members are rewarded for the activity of the article evaluation.

3.2. Research Framework and Methodology

This study is organized into a conceptual framework consisting of four phases based on the study goal, as shown in Figure 8. The study goal is to validate the value-driven token economy on blockchain platforms: (1) The first phase is to identify the token economy as a whole and existing studies, followed by identifying the limitations of existing studies. Based on the limitations of existing studies, the purpose of this study is then clarified. (2) The second phase analyzes the features of the token economy of A3I; this is based on the triple-bottom-line (TBL) framework identified in a related study [48]. (3) In the third phase, the analytical-hierarchy-process (AHP) survey is conducted among experts on the elements of A3I's token economy, as analyzed using the TBL. The AHP survey ranks A3I's various token economy factors to determine their importance. The experts are divided into content experts and blockchain experts. If the results are not valid, they are not reflected in the findings, and the study's validity is increased through a re-survey. (4) In the fourth phase, the study identifies strategic factors according to the study goal and which factors are the most critical for achieving the study goal. This study will end with a conclusion that reflects the researchers' insights along with the study's results.

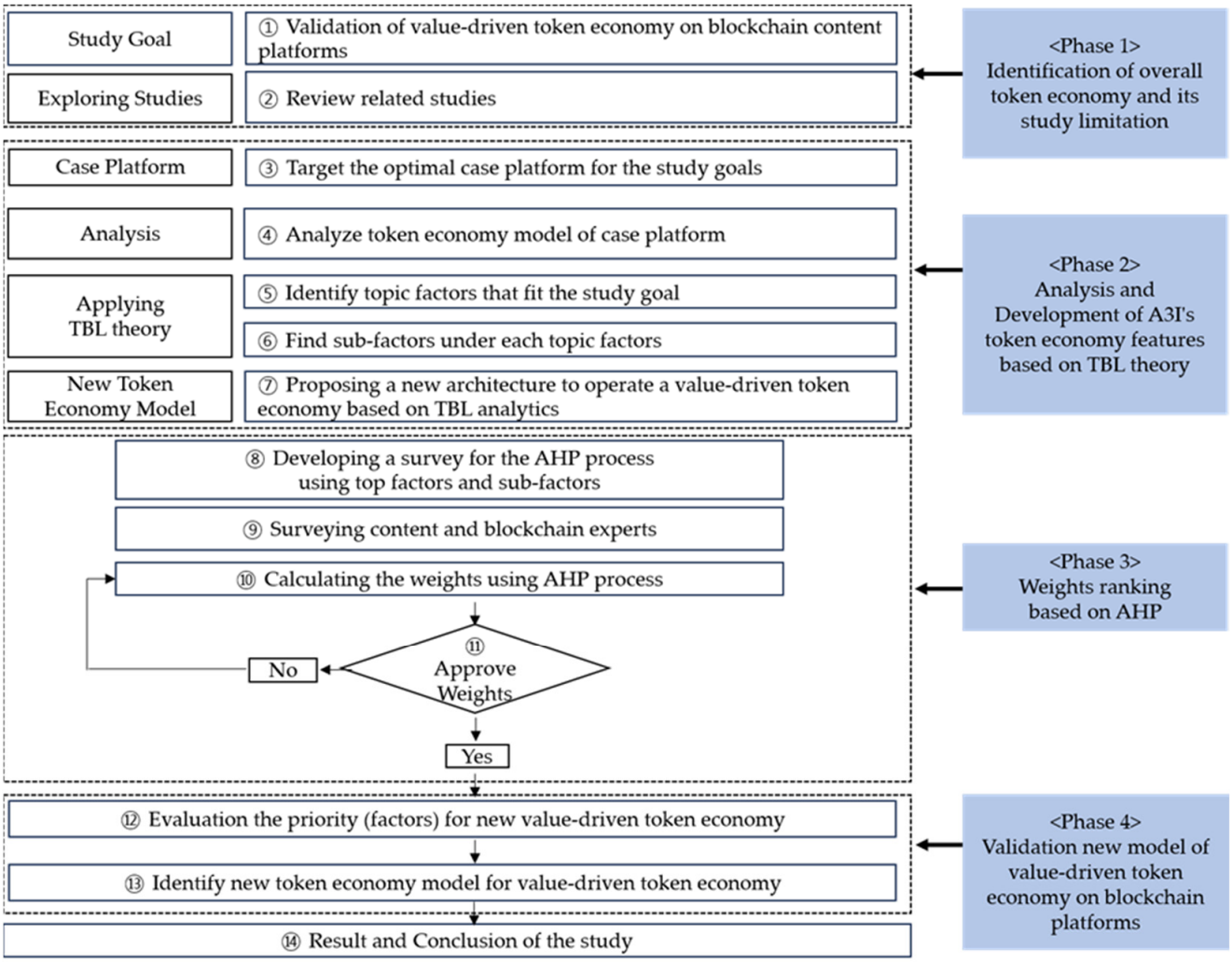

Figure 8. Study's conceptual framework: This study's conceptual framework consists of four main phases: First, it analyzes the token economy through the existing literature and identifies its limitations. Second, it analyzes the top and sub-factors of the case studies according to the triple bottom line (TBL) and develops a new token economy architecture. Third, it analyzes the experts' analytical-hierarchy-process (AHP) weights for each factor in the new architecture. Fourth, it validates the new model of the value-driven token economy.

The conceptual framework of this study was validated through two rounds of analysis and survey. Based on the TBL, the factors of the token economy in the blockchain environment were first analyzed, and experts verified the factors derived from the first analysis to enhance the validity of the overall study. Moreover, the AHP survey of the study was conducted in two parts, including content experts and blockchain experts, to prevent the tendency to be biased toward one field.

3.3. TBL of A3I®

The triple-bottom-line (TBL) framework introduces the three Ps for sustainable growth. The three Ps are people, profit, and the platform. People extend to social performance, profit extends to corporate financial or economic performance, and the platform extends to environmental performance. In between, sustainable performance is created. Platform businesses with 3P factors align with the TBL's people, profit, and platform. The sustainability that TBL pursues through these three factors is also the basic goal of most businesses, including platform businesses, like A3I. The TBL analysis of A3I's token economy is shown in Figure 9. For the goal of this study, the top factors of the

A3I token economy based on the TBL framework are as follows: users in the society (people) sector and tokens in the economy (profit) sector. In addition, the blockchain is included in the environment (platform) sector. Then, the sub-factors under each top factor were derived from the existing literature on token ecosystems and A3I's article value evaluation mechanism (AVEM) [61]. Under the top factor of people (users), there are four sub-factors: user engagement and empowerment, equitable reward distribution, personalization of platform privileges, and community-strengthening mechanisms. The following sub-factors are under the top factor of the profit (tokens): diverse reward mechanisms, value-index-based rewards, expanded investment opportunities, and monetary value of tokens. Finally, under the top factor of the platform (blockchain), there are the following sub-factors: instant reward distribution, data transparency, and data integrity. The analysis of A3I in Figure 9, based on TBL, is the same as that in Table 3, which analyzes the features of A3*I*'s architecture: user, reward, and blockchain.

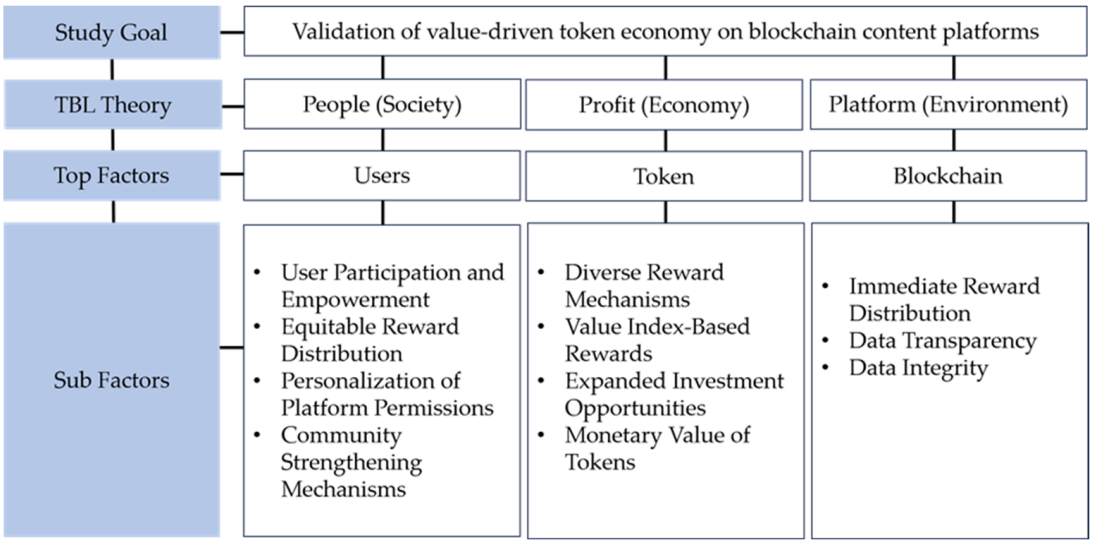

Figure 9. TBL of A3I's token economy model: This study analyzed the top factors and sub-factors for a value-driven token economy according to the TBL. The top factors are users, tokens, and blockchain, and each sub-factor was also analyzed.

Based on A3I's TBL, people are the most differentiating factor from existing platforms. The platform is the factor that all the blockchain-based platforms have. The top factor, profit, is differentiated by "diverse reward mechanisms" and "value-index-based rewards", which are unique to A3I, while the other two sub-factors, "expanded investment opportunities" and "monetary value of tokens", are also found on other platforms, such as Steemit. However, the top factor, people, has four sub-factors, all unique to A3I, including (1) "user participation and empowerment": all the users can participate in decision-making, including voting on the A3I value index; (2) "equitable reward distribution": the reward system is based on value index voting and contributions; (3) "personalization of platform permissions": users can choose platform permissions, such as read and write; (4) "community-strengthening mechanisms": the community can be strengthened with the feedback frequency that activates the user interaction.

Therefore, as shown in Figure 10, this study proposes a new architecture for a value-driven token economy centered on "people (users)" that best reflects the essence of A3I. Although the existing architecture in Figure 8 consists of the flow of users and data, the new architecture is readjusted to be user-centric again. The two architectures are not that different in terms of the user's journey. The difference between the two architectures is whether the digital content platform is designed around the user. The new architecture adds user-centered blockchain technology to a few steps. First, the ethical agreement in the existing architecture's membership management is applied to the authentication (or

login) step. Then, the ethical agreement is executed as a smart contract and delivered to all the users as NFTs. This is to strengthen user bonds to produce high-quality content. Second, the membership management is designed similarly in both architectures. Third, two new features are added to the existing method in the article-value-evaluation-mechanism (AVEM) step. Besides the existing feature that all the users vote on the article value index, proof of value (PoV), which represents the proof of the work in terms of the value, is newly applied. Smart contracts can automatically execute this proof of value. This is a new concept of the proof-of-work (PoW) system, where the higher the value indicator of an article, the higher the reward, rather than a structure where users are rewarded according to the amount of work or equity, and is a core system that operates a value-driven token economy. Reward management, which is directly linked to PoV, and funding management, which is an investment opportunity, are automatically paid to users through existing smart contracts. All these transactions are stored in blocks. All the data stored in the blocks are transparently accessible to users, preventing the forgery or alteration of the A3I value index.

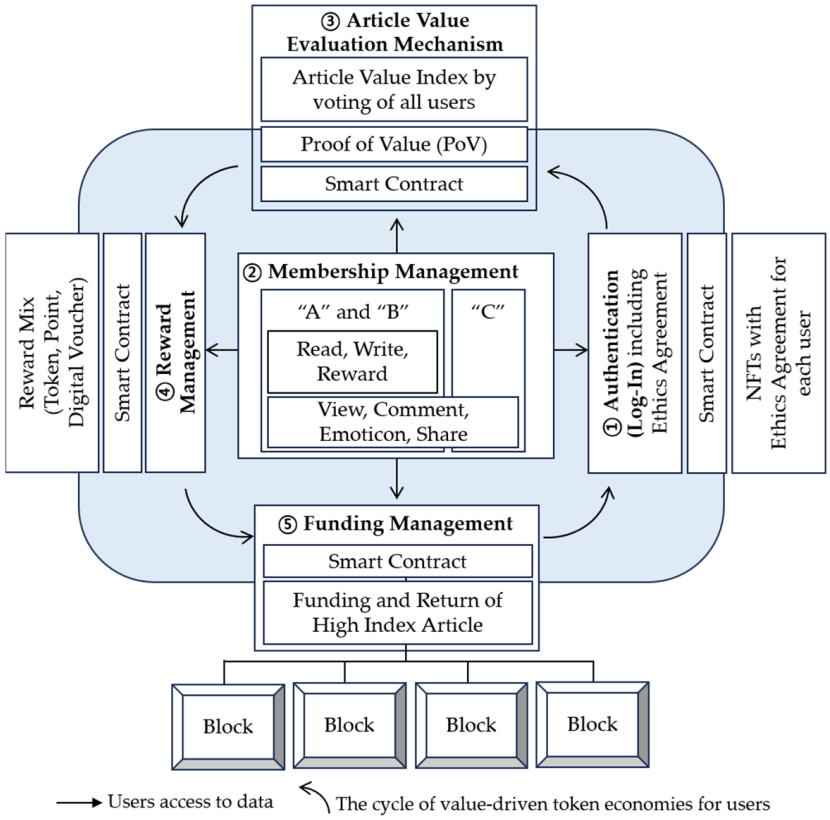

Figure 10. New architecture for the value-driven token economy based on TBL analysis: To operate a value-driven token economy, this study applied smart contracts, which were previously applied only to the reward system, to each process of authentication (or login), member management, content evaluation, reward system, and funding system to strengthen the auto-execution program based on users' consensus. In particular, the article value evaluation mechanism (AVEM), directly related to rewards, adopted a new proof-of-value (PoV) system, where all the users are rewarded according to the value they voted for. This is a new concept of the proof-of-work (PoW) system, where the higher the value indicator of an article is, the higher the reward, rather than a structure where users are rewarded according to the amount of work or equity, and is a core system that operates a value-driven token economy. The numerical numbers indicate the order of the user's journey on the platform. Solid arrows indicate that users can access each transaction history stored in a block at any time. The curved arrow indicates that each datum is circulated in a virtuous circle around the user for a value-driven token economy.

In Figure 10, the numerical numbers indicate the sequence of users' journeys on the platform, and the solid arrows indicate that users can access the history of each transaction stored in a block at any time. The curved arrow indicates that each datum is circulated in a virtuous circle around the user for a value-driven token economy. Moreover, implementing smart contracts in each process reflects the users' consensus. This means that the technical convenience of the automatic payment and execution through smart contracts has strengthened the essential foundation of the value-driven token economy, which is "user consensus".

3.4. AHP Analysis

This study applies a new, uniquely customized analytical-hierarchy-process (AHP) methodology to evaluate the key factors of a value-driven token economy by considering a blockchain platform's features and value proposition and to validate a new architecture reconfigured according to those factors. This AHP approach is highly specialized to the needs of this study. The methodology begins with data collection through a standardized questionnaire.

Based on the triple-bottom-line (TBL) framework, the AHP methodology for a value-driven token economy was applied to compare the weights for strategic multi-criteria decision-making among the top 3 factors and 11 sub-factors. The survey methodology used a 9-point scale with pairwise comparisons. As shown in Table 4, the scale ranges from 1 (equally important) to 9 (very strongly more important), allowing for a fine distinction between the importance of different factors. This approach is very effective at picking up the subjective judgment of experts and aligning it with the objective analysis.

Table 4. Scale of the analytical hierarchy process (AHP): This is the proposed 9-point scale for pairwise comparisons.

Degree of Preference	Definition	Explanation
1	Equally Important	Both factors are equally important to the purpose.
3	Slightly More Important	One factor is more effective as compared to the other factor.
5	Moderately More Important	One factor is highly affected as compared to the other factor.
7	Strongly More Important	One factor is highly dominant over the other.
9	Very Strongly More Important	One factor has the highest possibility for affecting the occurrence of landslides over other factors.
2, 4, 6, 8	Intermediate Values	Values that are located between the above key evaluations and are used to express nuances between two neighboring judgments.

After the data collection, the responses were converted into a matrix for pairwise comparisons. This matrix is crucial to this methodology because it simplifies the analysis process. Comparing two factors simultaneously makes the evaluation more manageable for the evaluator than dealing with multiple factors simultaneously. This step is crucial for ensuring a focused and efficient analysis. The in-depth analysis focuses on the relative importance of a few key factors: people (users), profit (tokens), and platform (blockchain), especially in the context of a value-driven token economy's virtuous cycle. Rather than individually examining these factors, it explores their interconnected contributions to the platform journey, exploring the individual importance of these factors, their interactions, and their holistic impact on enhancing a value-driven token economy.

To identify the relative importance of the factors analyzed in the TBL framework, this study employed a 9-point scale as outlined in Table 4. First, the survey focused on the relative weights of three top factors: people (users), profit (tokens), and platform (blockchain).

The survey asked about the importance of weights for users vs. tokens, users vs. the blockchain, and tokens vs. the blockchain. Next, the weights of the sub-factors were also surveyed in the same way as the weights of the top factors. The survey compared the importance weights of the four sub-factors under "user". "User participation and empowerment"

vs. "equitable reward distribution", "user participation and empowerment" vs. "personalization of platform permissions", "user participation and empowerment" vs. community-strengthening mechanisms", "equitable reward distribution" vs. "personalization of platform permissions", "equitable reward distribution" vs. "community-strengthening mechanisms", and "personalization of platform permissions" vs. "community-strengthening mechanisms". Similarly, the sub-factors of profit (token) and platform (blockchain) were compared in the same way as for people (users).

The response consistency is critical to the validity of the AHP analysis. The significance of each response is determined by combining the results from the individual raters and focusing on responses with a consistency ratio (derived from the pairwise comparison matrix and geometric mean calculation) of less than 0.1. Responses with consistency ratios above 0.1 are excluded to ensure the validity of the analysis. The pairwise comparison matrix (A), generated by the AHP process, reflects the relative importance of the 'n' factors being compared within each stratum. For elements (A_1, A_2, …, A_n), the results of the pairwise comparisons between a_i and a_j are labeled as a_{ij} to form the matrix $A = (a_{ij})$. If each factor is important in w_i (I = 1,2, …, n), matrix $A = (a_{ij})$ is used to calculate these weights to ensure the accuracy and validity of the derived values.

$$A = (a_{ij}) = \begin{bmatrix} w_1/w_1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \cdots & w_2/w_n \\ \vdots & \vdots & \cdots & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & w_n/w_n \end{bmatrix} = \begin{bmatrix} 1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & 1 & \cdots & w_2/w_n \\ \vdots & \vdots & \cdots & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & 1 \end{bmatrix} \quad (3)$$

In the AHP analysis, the relative importance of each factor is described by a ratio. For example, w_1/w_1 compares itself to A_1, resulting in a logical value of 1. Similarly, w_1/w_2 describes the relative importance of A_1 compared to A_2, and w_1/w_n describes the relative importance of a compared to A_1. Multiplying Equation (3) by the column vector $w = [w_1, w_2, \ldots, w_n]$, which, again, describes the approximate value of the relative importance between the evaluated factors, results in the following equation:

$$\begin{bmatrix} w_1/w_1 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \cdots & w_2/w_n \\ \vdots & \vdots & \cdots & \vdots \\ w_n/w_1 & w_n/w_2 & \cdots & w_n/w_n \end{bmatrix} \cdot \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} = \begin{bmatrix} nw_1 \\ nw_2 \\ \vdots \\ nw_n \end{bmatrix} \quad (4)$$

Using the eigenvalue calculation method, this can be shown as

$$A \cdot w = \lambda_{max} \cdot w \quad (5)$$

The maximum eigenvalue of the pairwise comparison matrix (A), labeled as λ_{max}, is important for deciding these weights. This can be shown by solving the characteristic equation for a nonzero solution in a system of n simultaneous equations to find the value of λ_{max} that satisfies the equation below:

$$|A - \lambda I| = 0 \quad (6)$$

The value of λ_{max} is always greater than or equal to n, the number of factors, and the closer the value of λ_{max} is to n, the more consistent the pairwise comparison matrix (A) is seen to be. The consistency of these comparisons is quantified using CI and CR, which are calculated as follows:

$$CI = \frac{\lambda_{max} - n}{(n-1)} \quad (7)$$

$$CR = \frac{CI}{RI} \quad (8)$$

where n stands for the matrix dimension, and *RI* stands for the Saaty random index [62], which depends on the matrix dimension. *RI* is the average consistency index obtained from randomly generated reciprocal matrices and serves as a standard benchmark for acceptable levels of consistency. *RI* values are shown in Table 5. A *CR* of 0.1 or less indicates allowable consistency in the survey returns, which validates the reliability of the AHP analysis. For each survey item, a weight (w) was decided using the eigenvalue method, and then the overall weight was calculated using the geometric mean method. The *CI*, *CR*, and λmax values were eliminated by taking the arithmetic mean of the values obtained for each survey item to yield the overall value.

Table 5. Saaty randomized-index (*RI*) values: Saaty *RI* values were used to measure the consistency of pairwise comparisons in the analytical hierarchy process (AHP). The RI value is required to calculate the *CR* value of the AHP matrix.

n	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

3.5. Data Collection

As shown in Table 6, the survey was conducted in two rounds of about a month, from 28 January 2024 to 20 February 2024. The respondents of the survey consisted of content professionals and blockchain experts, each with over five years of experience. Content experts were recruited from advertising companies, broadcast or digital media companies, and content platforms. Blockchain experts were recruited from blockchain development companies, blockchain associations, and master's students specializing in the blockchain. The survey was proposed to a total of 40 experts: 25 content experts and 15 blockchain experts. The survey was first distributed via e-mail and in person to increase the accessibility and response rates from experts in different regions and to collect comprehensive opinions.

Table 6. Overview of analytical hierarchy process (AHP) Analysis: 30 responses were analyzed: 15 from content experts and 15 from blockchain experts. Respondents were the most experienced in their 20 years (26.7%), followed by 10 years (20.0%), and 15 years (16.7%); 25 years and 5 years were equal at 13.3%; and 30 years made up 10.0%. By age, 40s were the most frequent (40.0%), followed by 30s (36.7%) and 50s (23.3%). And 70.0% were male, and 30.0% were female. The survey was conducted in two rounds: a written survey using the 9-point AHP questionnaire from 28 January 2024 to 20 February 2024.

Category	**Contents**	
Survey Goal	Validation of value-driven token economy on blockchain content platforms	
Number of Experts	30 experts (15 content experts + 15 blockchain experts)	
Year of Experience	20–25 years (26.7%)	25–30 years (13.3%)
	10–15 years (20.0%)	5–10 years (13.3%)
	15–20 years (16.7%)	over 30 years (10.0%)
Age of Experts	40s (40.0%) > 30s (36.7%) > 50s (23.3%)	
Gender of Experts	Male (70.0%) > Female (30.0%)	
Survey Method	Expert-based survey using the 9-point AHP questionnaire	
Survey Frequency	Two rounds	
Survey Period	28 January–20 February 2024	

The first round of surveys was accompanied by comprehensive guidelines that explained the purpose and key factors of the survey, based on Figure 9, to help experts understand the survey. The second round of surveys was conducted via e-mail only. The first and second surveys were used to increase the validity of the results. The AHP analysis tool used Excel.

Out of 25 content experts, 6 results were excluded because of a lack of validity and 4 because of non-response, resulting in a total of 10 results. The results received from 15 blockchain experts were all valid and responsive. Therefore, a total of 30 responses were analyzed: 15 from content experts and 15 from blockchain experts, as shown in Table 6. The respondents had 20 years of experience (26.7%), followed by 10 years (20.0%), 15 years (16.7%), 25 years and 5 years (13.3%), and 30 years (10.0%). Regarding age, the respondents were in their 40s (40.0%), followed by 30s (36.7%), and 50s (23.3%). By gender, 70.0% were male, and 30.0% were female.

4. Results and Discussion

Using the analytical hierarchy process (AHP), this study identified the relative importance of the top factors affecting the structure of the value-driven token economy. The results of this comprehensive analysis are shown in Table 7 and Figure 11. Among the three important factors, 'people (users)', 'profit (tokens)', and 'platform (blockchain)', 'people (users)' is the most important, with a relative weight of 0.487. This significant weighting of 'people (users)' shows that platforms and platform economies are more about user- and creator-centric needs, such as recognizing their creation and decision-making authority, than technology or profit. After 'people (users)', the 'platform (blockchain)' had the second highest relative importance, and the last was 'profit (tokens)'.

Table 7. The relative importance of the top factors (all 30 respondents): Among the top factors of 'people (users)', 'profit (tokens)', and 'platform (blockchain)', 'people (users)' was ranked first, with a weight of 0.487, followed by 'platform (blockchain)', with a weight of 0.271, and finally, 'profit (tokens)', with a weight of 0.242. The *CR* value of the top factors was 0.031. This value is lower than 0.1, which is considered as being valid.

Top Factor	Rank	Weight
People (Users)	1	0.487
Profit (Tokens)	3	0.242
Platform (Blockchain)	2	0.271
SUM		1.000
CI		0.016
CR		0.031
λ_{max}		3.032

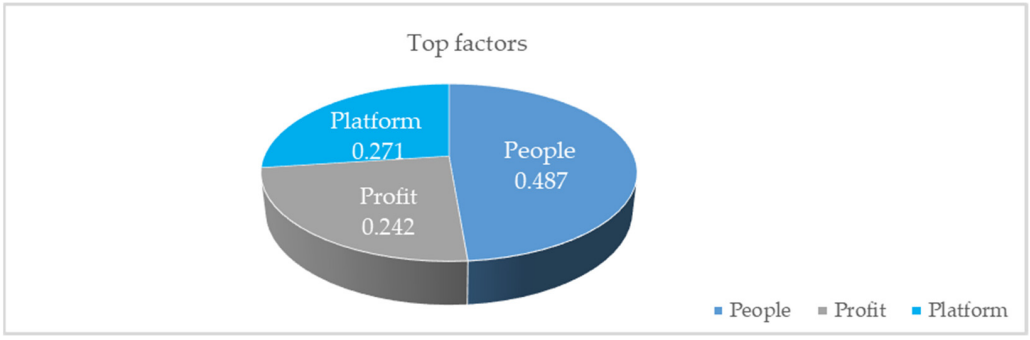

Figure 11. Weight breakdown of top factors (all 30 respondents): The weighted breakdown of the top factors was as follows: 'people', 'profit', and 'platform'.

This result's consistency index (*CI*) is 0.016, indicating consistent responses. The consistency ratio (*CR*) is 0.031, less than 0.1, and is considered as being sufficiently consistent. The maximum eigenvalue, λ_{max}, is 3.032, which is below the *CR* value of 0.1, meaning that the level of consistency is acceptable. Interestingly, the content and blockchain experts had slightly different results for the top factors.

As shown in Table 8, blockchain experts ranked 'people (users)' as the top factor, followed by 'platform (blockchain)' in second place and 'profit (tokens)' in third place. However, content experts ranked 'people (users)' the same as blockchain experts, in first place, but differed in the second- and third-place rankings. The second-place ranking was 'profit (tokens)', and the third-place ranking was 'platform (blockchain)', showing a slight difference in their views. Both groups have a *CR* of 0.1 or less, confirming the validity of these findings.

Table 8. Relative importance of the top factors as ranked by blockchain and content experts: Blockchain experts ranked "people (users)" as the most important factor, followed by "platform (blockchain)" in second and "profit (tokens)" in third. Content experts ranked "people (users)" as the same as blockchain experts, but the second and third factors were ranked differently. They ranked "profit (tokens)" in second and "platform (blockchain)" in third, showing a slight difference of opinion.

	Blockchain (15 Respondents)		**Content (15 Respondents)**	
Top Factor	**Rank**	**Weight**	**Rank**	**Weight**
People (Users)	1	0.501	1	0.469
Profit (Tokens)	3	0.205	2	0.284
Platform (Blockchain)	2	0.294	3	0.247
SUM		1.000		1.000
CI		0.017		0.016
CR		0.032		0.030
λ_{max}		3.033		3.031

Under the top factor of 'people (users)', there are four sub-factors: 'user participation and empowerment', 'equitable reward distribution', 'personalization of platform permissions', and 'community-strengthening mechanisms'. As shown in Table 9, among these four factors, 'user participation and empowerment' rank first, with a weight of 0.335, followed by 'equitable reward distribution' (second), 'community-strengthening mechanisms' (third), and 'personalization of platform permissions' (fourth). 'User participation and empowerment' and 'equitable reward distribution' are tied for first and second places, suggesting that these two sub-factors are the most important from a 'people (users)' perspective. 'Personalization of platform permissions' and 'community-strengthening mechanisms', which are twice as close as the first and second choices, are close third and fourth choices, respectively.

The *CI* value is 0.044, which indicates that the respondents have provided highly consistent responses. The *CR* value, calculated as the *CI* value divided by the *RI* value is 0.049. This is considered as being sufficiently consistent, as it is less than or equal to 0.1. Furthermore, the maximum eigenvalue, $\lambda_{\max}$, is 4.131. Given that there are four sub-factors, the $\lambda_{\max}$ value is slightly above the ideal value of 4, suggesting that the consistency, although imperfect, is still within acceptable bounds. The fact that the *CR* value is below 0.1 further supports that this level of consistency is acceptable. Furthermore, when separating blockchain experts' and content experts' weightings, both groups of experts gave the highest weight to 'user engagement and empowerment'. However, blockchain experts weighted it as 0.368, and content experts weighted it as 0.300, indicating a weight difference. These two groups also ranked their responses differently. Blockchain experts ranked 'equitable reward distribution' second after 'user participation and empowerment', 'community-strengthening mechanisms' third, and 'personalization of platform permissions' fourth. Content experts ranked 'user engagement and empowerment' first, 'equitable reward distribution' second, 'personalization of platform permissions' third, and 'community-strengthening mechanisms' fourth.

The first and second rankings were the same for both groups, but the third and fourth rankings differed.

Table 9. The relative importance of the sub-factors under 'people (users)': There are four sub-factors under the 'people (users)' top factor, with 'user participation and empowerment' ranking first, with a weight of 0.335. This is followed by 'equitable reward distribution' (second), 'community-strengthening mechanisms' (third), and 'personalization of platform permissions' (fourth). This pairwise comparison has a CR of 0.049, which is valid. Both blockchain and content experts ranked 'user engagement and empowerment' as their top choice, with 'equitable reward distribution' coming in second. However, the two groups differed in their third and fourth choices.

All the Respondents			**Blockchain**		**Content**	
Sub-Factor	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**
User Participation and Empowerment	1	0.335	1	0.368	1	0.300
Equitable Reward Distribution	2	0.326	2	0.353	2	0.296
Personalization of Platform Mechanisms	4	0.168	4	0.131	3	0.211
Community-Strengthening Mechanism	3	0.171	3	0.148	4	0.194
SUM		1.000		1.000		1.000
CI		0.044		0.033		0.054
CR		0.049		0.038		0.060
λ_{max}		4.131		4.101		4.161

Table 10 shows the four sub-factors under the top factor, 'profit (tokens)': 'diverse reward mechanisms', 'value-index-based rewards', 'expanded investment opportunities', and 'monetary value of tokens'. Among all the respondents, 'monetary value of tokens' ranked first among these four sub-factors, with a weight of 0.271, meaning that the actual monetary value of the token is most important to the bottom line. 'Value-index-based rewards' ranked second, 'diverse reward mechanisms' ranked third, and 'expanded investment opportunities' ranked fourth. The *CI* value is 0.044, indicating that the respondents' opinions are relatively consistent, and the $\lambda_{\max}$ value is 4.131, which is a bit high with four sub-factors. Still, the *CR* value is 0.049, indicating that the evaluations are consistent enough.

When the weighted responses of the blockchain and content experts are separated, the results are very different. Blockchain experts ranked 'diverse reward mechanisms' first, followed by 'value-index-based rewards', 'monetary value of tokens' third, and 'expanded investment opportunities' fourth. Content experts ranked 'monetary value of tokens' first, followed by 'value-index-based rewards', 'expanded investment opportunities' third, and 'diverse reward mechanisms' fourth. 'Value-index-based rewards' was ranked second by both groups, and this sub-factor was also ranked second by all the respondents. This shows that value-based rewards are important to both groups, despite their different fields of expertise.

Table 11 shows three sub-factors under the top factor 'platform (blockchain)'. They are 'immediate reward distribution', 'data transparency', and 'data integrity', which smart contracts enable. All 30 respondents ranked 'immediate reward distribution' and 'data integrity' as tied for first place, with a weight of 0.357. 'Data transparency' is second, with a weight of 0.286. Blockchain experts ranked 'data integrity' first, 'immediate reward distribution' second, and 'data transparency' third. Content experts ranked 'immediate reward distribution' first, the same as all the respondents, followed by 'data integrity' in second place and 'data transparency' in third place. The results for all 30 respondents were as follows: The *CI* value was 0.026, indicating a high degree of consistency, and the *CR* value was 0.030, demonstrating the validity of the consistency. The λ_{max} was 3.031, which again provides further confirmation of the consistency. The blockchain and content experts' *CI*, *CR*, and λ_{max} values were also consistent.

Table 10. The relative importance of the sub-factors for 'profit/tokens': Among these four sub-factors, 'monetary value of tokens' is ranked first, with a weight of 0.271. This means that the actual monetary value of the token is the most important factor for 'profit'. 'Value-index-based rewards' came in second, 'diverse reward mechanisms' came in third, and 'expanded investment opportunities' came in fourth. The *CI* value is 0.044, which shows that the respondents are relatively consistent, and the λ_{max} value is 4.131, which is somewhat high because there are four sub-factors. Still, the *CR* value is 0.049, which shows that the consistency of the evaluation is sufficient. Blockchain experts ranked 'diverse reward mechanisms' first, followed by 'value-index-based rewards', 'monetary value of tokens' third, and 'expanded investment opportunities' fourth. Content experts ranked 'monetary value of tokens' first, followed by 'value-index-based rewards', 'expanded investment opportunities' third, and 'diverse reward mechanisms' fourth. 'Value-index-based rewards' was ranked second by both groups, and this sub-factor was also ranked second by all the respondents.

All the Respondents			**Blockchain**		**Content**	
Sub-Factor	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**
Divers Reward Mechanism	3	0.236	1	0.310	4	0.175
Value-Index-Based Rewards	2	0.264	2	0.251	2	0.270
Expanded Investment Opportunities	4	0.229	4	0.206	3	0.247
Monetary Value of Tokens	1	0.271	3	0.233	1	0.308
SUM		1.000		1.000		1.000
CI		0.044		0.031		0.057
CR		0.049		0.035		0.064
λ_{max}		4.131		4.093		4.172

Table 11. The relative importance of the sub-factors of 'platform/blockchain': All 30 respondents ranked 'immediate reward distribution' and 'data integrity' as tied for first place, with a weight of 0.357. 'Data transparency' is second, with a weight of 0.286. Blockchain experts ranked 'data integrity' first, 'immediate reward distribution' second, and 'data transparency' third. Content experts ranked 'immediate reward distribution' first, the same as all the respondents, followed by 'data integrity' in second place and 'data transparency' in third place. The *CI*, *CR*, and λ_{max} values of the blockchain and content experts and all the respondents are fair and consistent.

All the Respondents			**Blockchain**		**Content**	
Sub-Factor (Platform/Blockchain)	**Rank**	**Weight**	**Rank**	**Weight**	**Rank**	**Weight**
Immediate Reward Distribution	1	0.357	2	0.345	1	0.368
Data Transparency	2	0.286	3	0.285	3	0.286
Data Integrity	1	0.357	1	0.369	2	0.346
SUM		1.000		1.000		1.000
CI		0.026		0.013		0.038
CR		0.030		0.026		0.034
λ_{max}		3.031		3.027		3.036

Table 12 shows the AHP analysis results that evaluate the relative importance of a top factor and its associated sub-factors in a particular decision problem. The study divides the decision criteria into three top factors: "people", "profit", and "platform", and each of the three top factors is divided into sub-factors. The importance of each sub-factor is quantified through a local weight (its importance within the top factor) and a global weight (its total importance in all the factors). The global ranking also provides the comparative importance ranking of all the sub-factors across the decision issue. Local weights represent the relative importance of sub-factors within each top factor. They emphasize how important the sub-factor is compared to the other factors within the same category. Global weights represent the overall importance of the sub-factor to the overall decision issue, considering

the weights of the top factors. They provide a holistic view of each sub-factor's contribution to the decision criteria. The global ranking gives each sub-factor a comparative ranking based on its global weight to show its overall importance in decision-making.

Table 12. Local and global weights and global ranks of all the factors: The 'people' top factor has the highest weight (0.487), indicating that it is considered as the most crucial aspect of the decision-making problem. Within 'people', 'user participation and empowerment' is the most significant sub-factor, with a global weight of 0.163, making it the highest-ranked across all the sub-factors.

Based on All the Respondents (30 People)					
Top Factor	**Weight**	**Sub-Factors**	**Local Weight**	**Global Weight**	**Global Rank**
People	0.487	User participation and Empowerment	0.335	0.163	1
		Equitable Reward Distribution	0.326	0.159	2
		Personalization of Platform Permissions	0.168	0.082	6
		Community-Strengthening Mechanisms	0.171	0.083	5
Profit	0.242	Diverse Reward Mechanisms	0.236	0.057	10
		Value-Index-based Rewards	0.264	0.064	9
		Expanded Investment Opportunities	0.229	0.055	11
		Monetary Value of Tokens	0.271	0.066	8
Platform	0.271	Immediate Reward Distribution	0.357	0.097	4
		Data Transparency	0.286	0.077	7
		Data Integrity	0.357	0.097	3

The 'people' top factor has the highest weight (0.487), indicating that it is considered as the most important aspect of the decision-making problem. Within 'people', 'user participation and empowerment' is the most significant sub-factor, with a global weight of 0.163, making it the highest ranked across all the sub-factors. The 'profit' top factor is weighted at 0.242, suggesting that profit-related aspects are important but less so than 'people' or 'platform'. Within 'profit', 'monetary value of tokens' holds this category's highest global weight (0.066), ranked eighth overall. The 'platform' top factor, with a weight of 0.271, underscores the substantial importance of 'platform (blockchain)'-related factors in the overall decision-making context. Within 'platform', 'immediate reward distribution' and 'data integrity' share the highest local weight (0.357) within this factor, with a joint global rank of 3rd, reflecting their critical importance. This table effectively communicates the hierarchical importance of various factors and sub-factors within the decision-making process, offering valuable insights for strategic decision-making and priority setting in the context of this study. It is also significant that the sub-factors of 'profit' all occupy the bottom three positions in the global ranking.

Figure 12 visually represents the global weights for the sub-factors in Table 12. Of the 11 weights for a value-driven token economy, 'user engagement and empowerment' has the highest weight, followed by 'equitable reward distribution'. These two sub-factors belong to the top factor, 'people'.

Figure 13 shows the global weights of all 11 sub-factors, divided into all the respondents and the blockchain experts and content experts among all the respondents. Among all the sub-factors, 'user participation and empowerment' and 'equitable reward distribution', which belong to the top factor, 'people', were the highest. These two sub-factors were ranked first and second among all the respondents and high among the blockchain and content experts. Among the respondents, blockchain experts had the highest weights of 0.184 for 'user participation and empowerment' and 0.177 for 'equitable reward distribution'. Therefore, blockchain experts contributed a lot to the high ranking of these two sub-factors.

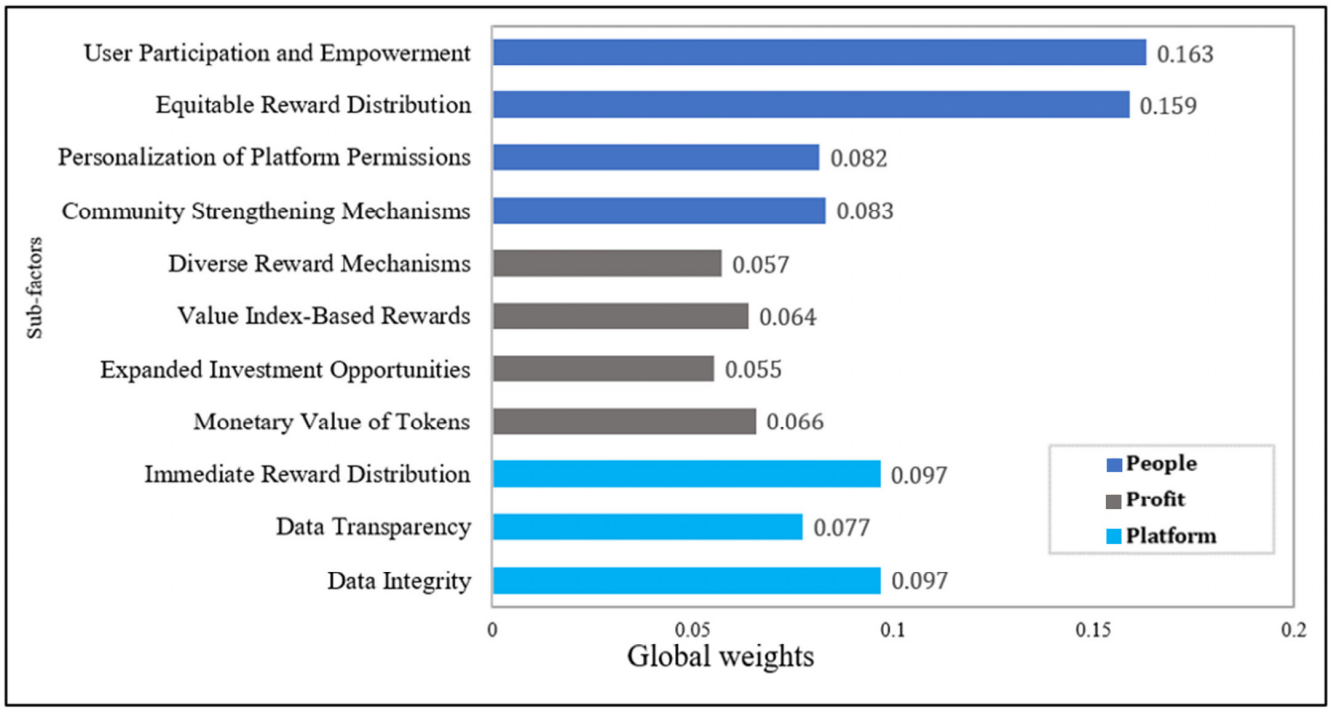

Figure 12. Global weights of the total sub-factors (based on all the respondents): 'user participation and empowerment' is the highest of the 11 weighted factors for a value-driven token economy, followed by 'equitable reward distribution'.

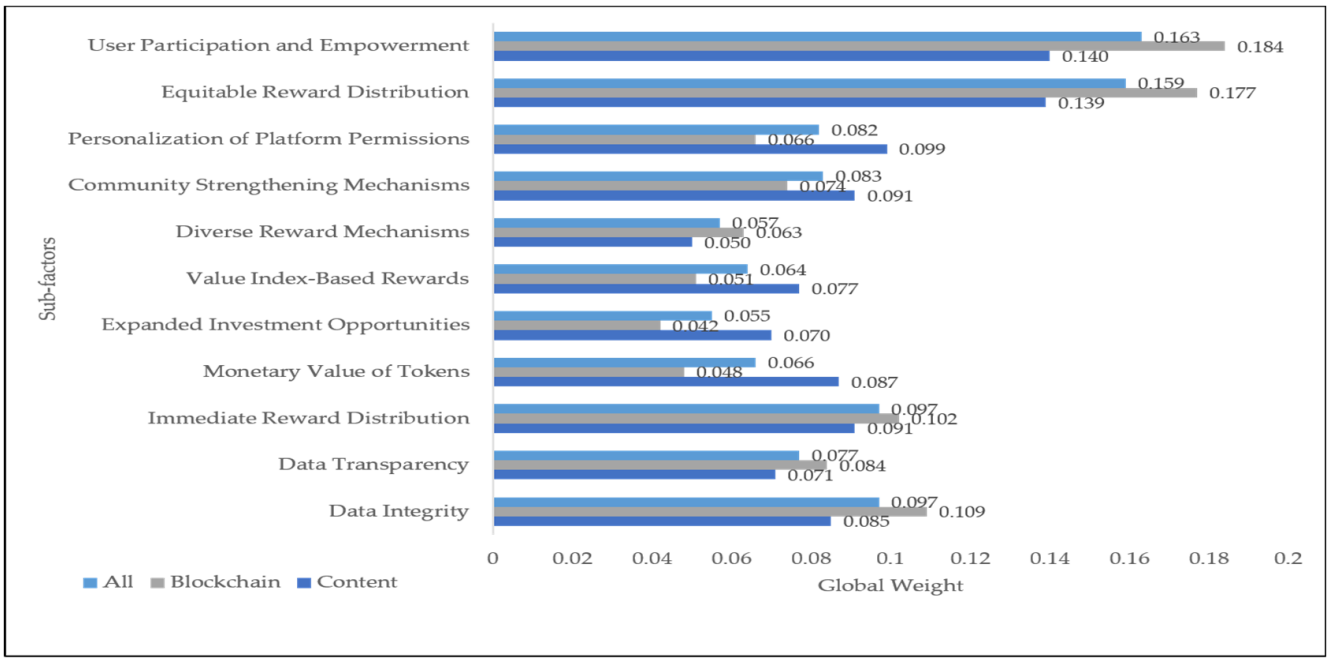

Figure 13. Global weights of the total sub-factors (based on all, blockchain, and content respondents): Among all the sub-factors, 'user participation and empowerment' and 'equitable reward distribution', which belong to the top factor, 'people', were the highest. These two sub-factors were ranked first and second among all respondents and high among the blockchain and content experts.

Next, blockchain experts gave moderate weights to 'instant reward distribution', 'data transparency', and 'data integrity', which are features of the blockchain environment, reflecting their understanding of blockchain technology. Content experts, on the other

hand, weighted "personalization of platform permissions" and "community strengthening mechanisms" behind first place "user participation and empowerment" and second place "equitable reward distribution. Content experts gave high weights to all four sub-factors that apply to users. Content experts also gave 'immediate reward distribution' the same weight as 'community-strengthening mechanisms', 0.091.

To operate a value-driven token economy, smart contracts, which were previously applied only to reward management, are applied to each process of the login, member management, content valuation, reward system, and funding system to enhance the automatic execution program based on users' consensuses. 'User engagement and empowerment', which experts ranked as the most important factor, applied the value of "consensus" as a smart contract at each step: First, users sign an ethics agreement when they join or login to the platform and agree to the signed ethics agreement being distributed as NFTs to all the users. Second, all the users read each article and vote on its value using the article valuation mechanism. This is called proof of value (PoV), which means that the higher the value of an article, the higher the reward. Third, the article's value index is converted into rewards and distributed to all the users through a smart contract. Fourth, highly indexed articles offer investment opportunities to all the users, and the smart contract pays the profits. These transactions are stored in blocks, providing transparency and trust for all the users. Storing all the transactions in blocks also ensures the equitable distribution of rewards. The value index, voted on by all the users, is transparently published, so anyone can see which articles have the highest and lowest values. The new architecture also aims to create a virtuous cycle for content quality. Every user signing an ethics agreement reads each article and votes on its value, which is linked to rewards or funding opportunities. This virtuous cycle of higher values and rewards applies across all the user experience stages. Although the old architecture focused on the user experience phase, the new architecture focused on the value-driven operation of the token economy. This is because tokens are paid out based on a value index.

5. Conclusions and Future Study

This study analyzed the factors that make a value-driven token economy work well on a blockchain content platform using the triple bottom line (TBL) and identified "people" as the most differentiating factor from existing platforms. Accordingly, this study proposed a new architecture centered on "people" by developing the existing architecture and validating the new architecture through content and blockchain expert surveys using the analytical hierarchy process (AHP).

These results are very interesting: cryptocurrencies operating on the blockchain have typically focused on the monetary value of the cryptocurrency rather than the innovative technology behind it. However, this study shows that the "people" are overwhelmingly more important than "profits" in a value-driven token economy. In other words, "user participation and empowerment" and "equitable reward distribution" on the platform are more important than the token's economic value. The new architecture in this study supports these two factors with the blockchain and smart contracts, which experts have verified using AHP. Another important finding was that after "people (users)", "platform (blockchain)" became more important than "profit (tokens)". The sub-factors of the top factor, "platform (blockchain)", include "instant reward distribution" through smart contracts, as well as "data transparency" and "data integrity". These factors can improve the user experience of the content platform. Herein, this study confirms that the weight given to the user and the weight given to the platform are deeply interrelated. It is a virtuous cycle: when the environment improves, users become more loyal to the platform; when users are empowered and entitled, the platform environment improves, and this virtuous cycle creates value for the platform's sustainability. For this reason, the new architecture utilizes the blockchain and smart contracts at each stage more extensively than the original architecture.

But there is something else to consider. The "user participation and empowerment" and "equitable reward distribution" sub-factors of the "people" top factor are deeply related to the "value-index-based rewards" sub-factor of the "profit" top factor. Allowing all the users to contribute value-based votes is a sub-factor of the top factor "user participation and empowerment", which is a sub-factor of the top factor "people", and returning those votes to users is a sub-factor of the top factor "value-index-based rewards", which is a sub-factor of the top factor "profit". The sub-factor "equitable reward distribution" of the top factor "people" is also related to the sub-factor "value-index-based rewards" of the top factor "profit". It is much like voting in an election: every user votes on the value of every article, not just a few people. There is a consensus in an election that everyone accepts the results, regardless of who each voter supports. In this way, the fact that everyone voted is excellent evidence of an equitable distribution of the second-highest weighted value. The top factor "people" is highly correlated with the top factor "profit" because everyone voted, which is linked to "empowering users" and "equitable distribution of rewards". And it has already been shown in the weighting analysis above that for "people" and "profit" to work well, the platform is no exception. So, this study suggests that it is not the size of the weights that matters but the virtuous circle of the weights. The study shows that no one factor operates independently, but, rather, they are organically connected, and this organic connection is dynamic. Because of this feature of the platform, this study finds that the connectivity of the weights is more important than the strength of the weights. This study emphasizes that this organic connection is even more important on a blockchain content platform with a value-driven token economy because the value proposition of the blockchain identified in the literature review of this study is already reflected in the sub-factors of the environment. Therefore, this study goes beyond simply identifying these factors and explores how the integration of token economy elements can impact the development of a value-driven platform economy. This study contributes to theoretical and practical knowledge, paving the way for more objective and informed decision-making in this rapidly evolving field. It also demonstrates the potential of the blockchain technology to realize its value proposition and Web3's potential to recognize and reward the rights and interests of its users. This study has presented a new architecture, where the factors of a value-driven token economy can be virtuous: proof of value, where the higher the value, the higher the reward, and the application of smart contracts. Behind the technology of this new blockchain is the user consensus and the organic relationship of each process, which makes the platform work well.

However, there are obvious limitations to this study. Although many experts have validated the operation of a value-driven token economy, operating the platform in a real business environment is still challenging. This is because there can be many design and operation variables, and experts' opinions can only cover a part of the business environment and many users. This study recognizes certain constraints that may affect the actual deployment of the proposed architecture in a real business environment. These constraints may include the operational difficulties for integrating these platforms within existing business environments, which may inhibit their broad applicability. In addition, as indicated in the literature review, Section 2.6, there are limitations to the AHP used as the validation methodology in this paper. A potential weakness of AHP is its high complexity, which can make it inconvenient to implement. In addition, the validity of the AHP analysis depends on the consistency of the responses, and responses with a consistency ratio of 0.1 or higher are excluded to ensure the validity of the analysis. These can limit the immediate applicability of this study's findings, thus requiring considered interpretations and scenarios when considering the application to an actual business. Nevertheless, this study has a few implications. First, this study is of academic significance in that it reflects the value proposition of the blockchain, is designed as a feasible business model, and is validated by industry experts. Second, this study is significant for its people-centered design to prevent blockchain platforms from running aground because of the moral hazard

of users focusing only on rewards. Third, it has business implications for the blockchain and content industries. Because the innovative value-driven token economy based on blockchain are validated by experts in the actual field. Furthermore, it has great social significance in making values and rewards accessible as a feature of the universality of content platforms that anyone can use.

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