

Blockchain-Driven Music Copyright Distribution: An Agent-Based Modeling Perspective

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ABSTRACT

Purpose-The purpose of this paper is to investigate the transformative potential of blockchain technology in the realm of music copyright distribution, focusing on how it addresses the inefficiencies and challenges of traditional systems. The aim is to enhance transparency, ensure fair revenue distribution, and streamline copyright management processes. **Design / Methodology / Approach**-To achieve these objectives, we employ an Agent-Based Model (ABM) to simulate the operations of a blockchain-enabled music copyright distribution system. This model captures the dynamics and interactions among key stakeholders—music creators, copyright organizations, and listeners—in a blockchain environment. By modeling scenarios and behaviors within this framework, we can evaluate the impact of blockchain on the music industry's ecosystem. **Findings**-Our findings reveal that blockchain technology significantly improves the efficiency and fairness of music copyright distribution. With blockchain, every transaction involving music works is accurately recorded, providing an immutable ledger that enhances transparency and traceability. Smart contracts automate the execution of copyright agreements, reducing the need for human intervention, minimizing errors, and lowering administrative costs. Stakeholders benefit from more equitable revenue sharing and reduced disputes over ownership rights. **Practical Implications**-The practical implications of our research highlight the opportunities for the music industry to leverage blockchain technology for more effective copyright management. By implementing blockchain-based solutions, music creators can gain greater control over their intellectual property, while listeners can access music content with confidence in its authenticity and legal status. Copyright organizations stand to benefit from reduced operational costs and enhanced reputation for fairness. **Originality/Value**-This study contributes to the literature by offering a comprehensive analysis of blockchain's role in music copyright distribution through the lens of an ABM simulation. It provides empirical evidence of the technology's potential to revolutionize the industry, addressing longstanding issues related to copyright management. The findings offer actionable insights for policymakers, industry professionals, and technology developers looking to harness the benefits of blockchain for music copyright distribution.

KEYWORDS

Blockchain; Smart Contracts; Agent-Based Modeling (ABM); Music Industry; Music Copyright Distribution

1. RESEARCH BACKGROUND

In the era of digitalization and networking, the music industry has undergone unprecedented transformations, one of which is the transition in music copyright distribution models. Traditionally, the management and distribution of music copyrights rely on complex intermediary structures

involving musicians, record companies, copyright agents, distributors, and retailers. This traditional model is inefficient and often results in unclear copyright ownership and unfair revenue distribution. For example, musicians often receive only a small portion of the revenue from their works, while copyright agencies and music platforms suffer from a lack of transparency in copyright management.

Recent advancements in blockchain technology offer a revolutionary solution for music copyright distribution. As a distributed ledger technology, blockchain's decentralized, immutable, and smart contract features have the potential to significantly improve the management and distribution of music copyrights. Through blockchain, every transaction and use of a music work can be accurately recorded, ensuring transparency and traceability. Smart contracts can automate the execution of copyright agreements, reducing human intervention and increasing efficiency while lowering transaction costs.

For various stakeholders in the music industry, the changes brought about by blockchain technology are profound. Musicians can directly upload their works to a blockchain platform and use smart contracts to automate revenue distribution, which not only increases their income but also stimulates their creativity. Copyright organizations and music platforms face redefinition, potentially transforming into providers of value-added services. For listeners, the introduction of blockchain technology means access to a richer variety of music resources, a fairer pricing system, and more direct support for artists.

Although blockchain technology theoretically provides an optimized solution for music copyright distribution, its implementation and effects remain uncertain. Factors such as adoption rates, user acceptance, legal regulatory frameworks, and industry standards need to be considered. Therefore, using agent-based modeling (ABM) to simulate the dynamic processes of music copyright distribution under a blockchain environment will help us understand how this emerging technology impacts the relationships between stakeholders in the music industry and how it changes the distribution of copyright revenues and value transmission pathways.

This study aims to construct a blockchain-based music copyright distribution system model that simulates the behavior and interactions of different stakeholders (music creators, copyright organizations, music platforms, listeners) in a blockchain environment. It assesses the actual impact of blockchain technology on music copyright distribution, including real-time distribution of copyright revenues, transparency of copyright transactions, accessibility of music works, changes in user payment behavior, and total transaction volume. In addition to these key indicators, we introduce total market revenue as a critical parameter to measure the overall economic effectiveness of the music copyright distribution system. The findings will provide valuable insights for participants in the music industry to better address the opportunities and challenges posed by blockchain technology.

2. LITERATURE REVIEW

2.1. Music Copyright Management and Distribution

Music copyright management and distribution is a complex and significant issue within the music industry, involving multiple aspects such as copyright law, digital rights management, collective copyright management, and copyright revenue distribution. With the rise of the internet and digital music platforms, copyright management and distribution have faced new challenges and opportunities. Previous research on music copyright management has largely focused on the macro-level design of copyright laws. For instance, Zhu Xin (2009), through an analysis of the market demand for digital music in China, proposed the concept of a "trinity" digital music copyright management system from three dimensions: digital music copyright law, collective management organizations, and technical protection, aiming to balance the interests of all stakeholders in digital music copyright activities. This highlights the importance of studying the relationships and roles of stakeholders in music copyright distribution.

In the study of music copyright distribution, some scholars have explored from the perspective of the music industry value chain. The information intermediary theory proposed by Hagel and Rayport (1997) has significant enlightening significance for the study of the music industry value chain. Copyright management is one of the core issues of the music industry value chain. Copyright, as a certificate of value ownership, is more often studied from a legal perspective, while version management studies the process of copyright transfer and value transmission from an industrial and marketing perspective, especially the research on copyright distribution in the digital economy era has more practical significance. In the research on copyright management and distribution, many scholars have studied the operation of digital music copyright and the operation model of distribution platforms. Meng Na (2018) believes that the distribution of interests among various entities in the music industry chain lacks rationality, and the existing development model cannot adapt to the difficulties brought about by technological changes and industrial transformation. It is necessary to innovate the business model to solve the dilemma faced by the digital music industry. Today, the digital music industry, which uses new media as a carrier, has become a core feature of the music industry. Research on digital music copyright distribution in the new media environment has become a major research field of concern to many researchers. In the new media environment, the previous exclusivemusic copyright model is gradually declining. A symbolic event in China was on July 24, 2021, when the State Administration for Market Regulation issued the "Administrative Penalty Decision on the Illegal Implementation of the Case of Tencent Holdings Limited Acquiring the Equity of China Music Group." It required Tencent Holdings Limited to dissolve the exclusive agreements reached with upstream copyright parties within 30 days from the date of the decision. On August 31, Tencent issued a statement saying that it would give up the exclusive authorization rights of music copyright. The stakeholders involved in the distribution of digital music copyright in China's new media are concentrated in the midstream and upstream of its industry chain, including music creators, record companies, digital music platforms, and the Music Copyright Society, etc. The downstream entities are responsible for the distribution of the copyright of digital music works, and the downstream entities include copyright distribution platforms and downstream users. The downstream users can be divided into ToB (Business to Business, the business model between enterprises) and ToC (Business to Customer, the business model between enterprises and consumers). The copyright distribution platform, as a key entity linking the upper and lower reaches of the digital music industry chain, connects digital music users and also directly controls the content distribution channels for the dissemination and sales of digital music works. Therefore, the stakeholders in the current music copyright distribution include musicians, copyright agencies, music platforms, and listeners. The model composed of their interactions and behaviors directly determines the efficiency and value of music copyright distribution, and also determines the level of development of the music industry.

2.2. Research on Stakeholders

There is no unified definition of stakeholders. According to the concept proposed by Freeman (1984), stakeholders are any groups or individuals affected by or affecting the organizational goals, including shareholders, manufacturers, governments, communities, employees, etc. Chakham J P (1992) defines corporate stakeholders based on the existence of contractual relationships with the enterprise, dividing corporate stakeholders into contractual and public stakeholders. Clark (1998) believes that the stakeholder group is a group vital to the survival of the enterprise. However, these definitions have operational issues in distinguishing stakeholders. Therefore, Mitchell A W (1997) proposed a classification method for stakeholders based on attribute scoring, which redefines stakeholders into definitive, expected, and potential stakeholders from three aspects: legitimacy, power, and urgency. Swarbrooke J (1999) classifies stakeholders based on the degree of connection between stakeholders, dividing them into loose, close, and core stakeholders. Wu Ling et al. (2003) classified corporate stakeholders from the core layer, strategic layer, and peripheral layer based on the influence, nature, and relationship of stakeholders, establishing a performance evaluation system for the classified

management of stakeholders. Wang Chunyang et al. (2012) classified stakeholders into core, dormant, and potential stakeholders, based on the criteria of initiative, urgency, and importance.

This paper will take Freeman's definition of stakeholders as the foundation, combined with the role and interaction of corporate entities and user groups in the upstream, midstream, and downstream of the music industry chain in digital music copyright distribution, focusing on the behavior and value realization of these stakeholders. Please note that this translation is provided for reference and may require further adjustments to meet the specific style and formatting requirements of the target journal.

3. THEORETICAL FRAMEWORK AND RESEARCH METHOD

3.1. Theoretical Framework

This study will employ the Agent-Based Model (ABM) as an analytical tool. This is a bottom-up modeling approach, particularly suitable for examining how individual behaviors in complex systems generate patterns and trends at the collective level. ABM allows us to simulate the behaviors and interactions of different stakeholders (musicians, copyright agencies, and listeners) in a blockchain environment, thereby assessing the actual impact of blockchain technology on music copyright distribution. This includes analyzing key indicators such as real-time distribution of copyright revenues, transparency of copyright transactions, accessibility of music works, changes in user payment behavior, and the total number of transactions. We will consider musicians' income as one of the main indicators for assessing the overall economic health of the music copyright distribution system, and we will also regard the efficiency of smart contracts as a primary indicator of the efficiency of music copyright distribution in a blockchain environment.

3.2. Research Method

Model Construction We will design an ABM that includes agents representing musicians, copyright agencies, and listeners. Each agent will make decisions based on preset rules and strategies, such as musicians deciding on the pricing of their works, copyright agencies managing copyrights and conducting copyright transactions using smart contracts, and listeners choosing to purchase music. To study the efficiency of copyright distribution and its impact on musicians' income in the context of blockchain, this study simplifies the research subjects by reducing copyright agencies to smart contracts, and considers musicians, smart contracts, and listeners as the three main entities in the entire model. Although the types of entities in this study may be fewer than those in the actual market, they can form a relatively complete market structure for music copyright distribution.

(1) **Parameter Setting** The model will include a series of parameters reflecting various real-world situations, such as the initial price of music works, transaction records and fees of smart contracts, and the payment willingness of listeners.

(2) **Simulation Running** By running the model multiple times, we will analyze the results under different scenarios, including the adoption rate of blockchain technology, the distribution ratio of copyright revenues, the transparency of copyright transactions, and the market performance of music works.

(3) **Result Analysis** We will statistically analyze and compare the simulation results to identify how blockchain technology affects the efficiency, fairness, and sustainability of music copyright distribution. This translation aims to convey the original meaning accurately while adhering to academic standards and language conventions in English-language journals. Adjustments may be necessary to fit specific journal requirements or to refine the academic tone.

4. MODEL DESIGN

In this section, we will model the various agents and their interactions within the blockchain environment using an agent-based modeling approach, laying the foundation for computer simulation.

4.1. Agent Definition

The main stakeholders involved in music copyright distribution in the blockchain environment are defined as follows:

- (1) Musicians: Entities that create music and own the copyright. The primary behavior of musicians includes creating musical works and setting prices.
- (2) Copyright Agencies (Smart Contracts): Organizations that manage copyright registration, transactions, and revenue distribution. Their main behaviors include handling copyright transactions and distributing earnings.
- (3) Listeners: Consumers of musical works, whose primary behavior is purchasing musical works.

4.2. Agent Attributes

- (1) Musicians: The main attributes include a list of songs, which contains the list of works and their prices.
- (2) Smart Contracts: The attributes include:
- (3) Processing Time: Measures the time required for a smart contract to process a transaction. This can be a fixed value or a dynamically calculated value, depending on the complexity of the transaction or network load.
- (4) Total Income of Musicians: The cumulative net income that musicians earn from copyright transactions. This is a key indicator for measuring musicians' income.
- (5) Listeners: The main attribute is the cost paid for the musical works.

4.3. Agent Behavior Rules

In the music copyright distribution model supported by blockchain technology, the three types of agents will interact in a sequential order throughout the entire process of copyright distribution, ultimately completing the distribution of copyright. The behaviors of each agent are described below:

- (1) Musicians: Upload works to the music platform and set the price of the works.
- (2) Smart Contracts: Receive transaction requests, verify transactions, and distribute earnings.
- (3) Listeners: Select and purchase musical works.

4.4. Parameters

- (1) Price: The selling price of the musician's musical works.
- (2) Transaction Fee: The transaction fee for selling musical works by the musician. This translation aims to maintain the clarity and precision of the original text while adapting it to the conventions of English-language academic publications. Adjustments may be necessary to align with specific journal guidelines or to enhance the academic tone.

5. NETLOGO SIMULATION

To assess the actual impact of blockchain technology on the efficiency of music copyright distribution and musicians' income, we designed and implemented an Agent-Based Model (ABM) based on NetLogo. Our model focuses on three coreagents: Musicians, SmartContracts, and Listeners. By simulating the interactions of these agents in a blockchain environment, we aim to explore the real-time allocation efficiency of copyright transactions, the accessibility of music works, changes in user payment behavior, and the dynamic changes in musicians' income.

5.1. Parameter Settings

- (1) Work Price: Set by musicians, ranging from 100 to 1100 in the simulation.
- (2) Transaction Fee: Fixed at 50 units per transaction.
- (3) Payment Willingness: Ranging from 100 to 1100 in the simulation, representing the listeners' willingness to pay.

5.2. Simulation Run

We conducted multiple simulation runs to analyze results under different scenarios. In each run, we allowed listeners to attempt to purchase music works with a probability of 1%, while smart contracts processed transactions and recorded relevant information. By varying parameters such as work price, transaction fee, and payment willingness, we observed changes in copyright transaction efficiency, musicians' income, and the total number of transactions.

5.3. Data Analysis

(1) Data Results

Average Transaction Time: Under high transaction fee conditions, the average transaction time increased by 15%, indicating that increased transaction costs can affect transaction efficiency. **Musicians' Income Growth:** With moderate work prices, the average income of musicians increased by 20%, demonstrating the importance of a reasonable pricing strategy. **Total Number of Transactions:** Under low transaction fee conditions, the total number of transactions increased by 30%, proving that lower transaction costs can promote transaction activity.

(2) Interpretation and Discussion

Transaction Costs and Efficiency: Higher transaction fees reduce transaction efficiency as the increased costs may lead some listeners to abandon purchases, thereby reducing the number of smart contract processes and increasing the relative time cost per transaction. **Pricing Strategy and Income:** Musicians can attract more listeners and increase income by setting moderate work prices. Excessive prices may deter listeners, while too low prices reduce the income per transaction, making it crucial to find a balance. **Transaction Costs and Trading Activity:** Reducing transaction fees can significantly increase the number of transactions as lower costs lower the purchase threshold for listeners, encouraging more transactions. This indicates that in copyright distribution, reducing transaction costs can stimulate market vitality and increase overall transaction volume.

6. CONCLUSION

Through the NetLogo simulation of the simplified model, we have gained preliminary insights into the impact of blockchain technology on the efficiency of music copyright distribution and musicians' income. The results show that reasonable pricing, lower transaction costs, and efficient smart contract processing mechanisms are crucial for promoting the healthy development of the music copyright

market. Future research can further explore more complex market dynamics, including changes in musical tastes, market competition, and the impact of different copyright distribution strategies.

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REFERENCES

- [1] Zhu Xin. "Discussion on the Management Mechanism of Interests in China's Digital Music Copyright", China Publishing, Vol.04, pp. 67-70, 2009.
- [2] Hagel III J, Rayport J F. "The new infomediaries" The McKinsey Quarterly, Vol.04, pp.54, 1997.
- [3] Meng Na. "Research on the Institutional Protection of Innovation in China's Digital Music Business Model" Shanghai: East China University of Political Science and Law, 2018.
- [4] Song Yao. "Media Supervision", Pollution Control Investment and Green Innovation. Dalian: Dalian University of Finance and Economics, 2018.
- [5] Chakham J P. "Corporate governance: Lessons from Abroad". European Business Journal, Vol.02, pp.8-16,1992
- [6] Mitchell A W. "Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts". The Academy of Management Review, Vol.04, pp. 853-886, 1997.
- [7] Swarbrooke J. "Sustainable tourism management". Annals of Tourism Research, Vol.02, pp. 523-525,1992.
- [8] Wu Ling, Chen Weizheng. "Research on the Quantitative Model for Enterprises to Implement Classified Management of Stakeholders". China Industrial Economics, Vol.06, pp.70-76, 2003.