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Using Blockchain Evidence in China's Digital Copyright Legislation to Enhance the Sustainability of Legal Systems

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Abstract: To achieve sustainable development of social systems, it is necessary to modernize the legal system, which is the foundation of any society, to increase the efficiency of resources and simultaneously optimize the performance of the environment and society. The immutable and timestamped features of blockchain offer a robust solution for tracking and authenticating digital copyright evidence, thereby enhancing the integrity and transparency of judicial systems. This ensures that the integration of blockchain into legal systems not only advances technological efficiency but also promotes environmental consciousness. Through comprehensive analyses that integrate questionnaires, interviews, case studies and legislative assessments, this research reveals that there are still problems in the application of blockchain evidence in China's judicial practice, such as insufficient and stable credibility, inadequate database storage, deficient original rights mechanisms, and the imperfect application of rules of evidence. These problems can be solved by enhancing correspondence legal systems, such as establishing an officially trusted copyright certificate blockchain, creating a blockchain copyright certificate technology supervision system and formulating specific laws and regulations on the application and identification of blockchain evidence. As such, our study contributes to aligning blockchain with judicial records, supporting the sustainable development goals of social systems, fostering institutional justice and social progress.

Keywords: blockchain; digital copyrights; electronic evidence; legal systems

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1. Introduction

The legal system serves as the cornerstone for maintaining social order, protecting individual rights and facilitating economic activity. Moreover, it promotes social change through legislation and judicial decisions, thus acting as a catalyst for social progress and equity. However, under technological innovation, every technological advance challenges the existing legal system. Well-adapted and prospective legal rules can create an environment conducive to innovation, while strong technical standards can enhance the effectiveness of legal protection, suggesting that the development of technology and the formation of legal rules should be seen as integral parts of a whole to ensure mutual progress and harmonious growth. Intellectual property legislation affects all aspects of society, including culture, education, technology and business, etc., through which it shapes the way creative works are protected, used and distributed.

Looking back at the history of intellectual property rights, almost every major technological advancement has given rise to theoretical disputes. Recording technology and radio technology have led to the protection of neighboring rights; the emergence of photographic technology has given rise to the discussion of whether a photograph is a copyrightable work; network technology and biotechnology have brought about theoretical problems in the fields of copyright, patents and trademarks. As a result, the theory of intellectual property rights has been forced to make constant adjustments, which has weakened the

stability of the system. Currently, blockchain technology has a new impact on the evidence systems in China's copyright law.

1.1. Blockchain Technology and Use of Evidence

Blockchain is a type of distributed ledger in which value-exchange transactions are sequentially grouped into blocks. Each block is chained to the previous one and immutably recorded across a peer-to-peer network by using cryptographic trust and assurance mechanisms. The chain then maintains a coherent state, as agreed upon by all participants, without requiring trust or a central authority. Blockchain provides a new paradigm for data storage security on the basis of the principle of decentralization [1]. Its main features are transparency, redundancy, immutability and disintermediation. Currently, the best-known example of the successful implementation of blockchain-based distributed ledger technology is Bitcoin [2].

A blockchain-based code copyright management system consists of full nodes and lightweight nodes. Each author or miner can choose the node type. First, the authors submit the code and set the transaction fee. After the eigenvalues of the code files are generated, the full nodes broadcast the code copyright information to the miners. The miners can then verify the originality of the code files by calculating the similarity between the target code and the chained code files (see Figure 1). A code for which the similarity with all the chained code files is lower than the predefined similarity threshold can be marked as an original code file. The copyright information of the original code includes the code fingerprint, ID, similarity result and the author's name (see Figure 2). Moreover, all this information is recorded in a block and linked to the blockchain. After the block is verified, the miners can receive rewards. Therefore, the system supports the permanent storage and protection of the original source code files. In addition, the data stored on the blockchain can be queried by all the nodes in the proposed system [3].

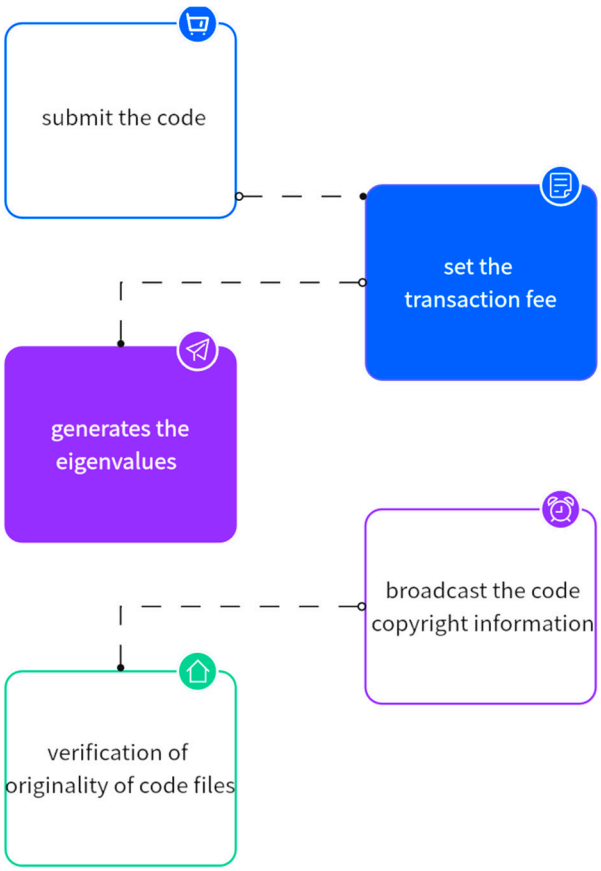

Figure 1. Verification of the originality of code files.

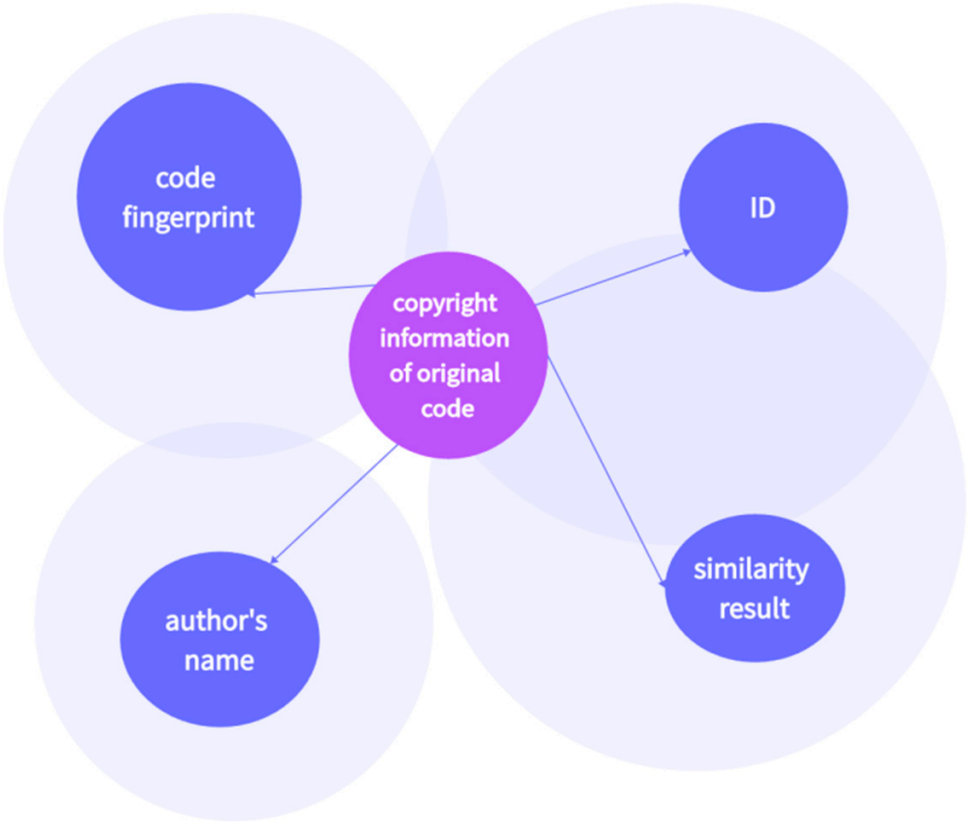

Figure 2. Composition of the copyright information of the original code.

1.2. Related Work and Existing Approach in China

The dissemination and utilization of digital works on the internet have created serious challenges to traditional copyright laws. For example, obtaining and presenting evidence in copyright infringement litigation are much more complicated than those in litigation for traditional copyright infringement. This is because technologies such as data crawling, digital screen capture and intelligent editing have made proof of copyright infringement more elusive, which makes tracking the uses of copyrighted works on the internet difficult [4]. The copyright holder and plaintiff may be able to spot infringement, but find it difficult to preserve the evidence of the infringement. Moreover, unauthorized use of digital works has become another problem, as with internet technology, it is far more convenient for people to copyright content that is used without authorization, owing to its open architecture. Large-scale unauthorized uses of copyrighted works on the internet could form great impediments to obtaining evidence of infringement because they substantially increase the costs and difficulties of tracking down the infringing activities and the identities of the infringer.

For example, as one of the typical cases of blockchain security protection, copyright infringement risk related to nonfungible tokens (NFTs) will also have a great effect on the field of evidence in China's digital copyright litigation.[1] In the casting process of NFTs, the use of specific technical means to create a unique digital ID for existing works on the blockchain can be seen as marking the original works with specific codes to provide identification. The relevant rights holders can also be divided into the original work copyright holders and NFT founders. The copyright owner of the original work enjoys the copyright of the work anchored by the NFT, whereas the NFT caster enjoys the relevant rights, such as possession, disposal, income, etc., of the digital mark NFT. Therefore, when the copyright owner of the original work is different from the NFT foundry, the foundry's casting of the NFT may infringe on the rights of the copyright owner. In this case, copyright infringement can be divided into two categories: the first involves the content

of the original work, where the content in the NFT is pirated; the second occurs when the original work is turned into an NFT without the permission of the copyright owner. At this time, any NFT copyright infringement, as exemplified by the ANTCHAIN[2], involves the collection and storage of infringing content, which is very different from traditional copyright infringement litigation.

Many scholars believe that these problems, including evidence of the copyright infringement of NFTs via blockchain technology, can be solved using blockchain technology [5,6]. Yuan Yong and Wang Feiyue [5] indicated that blockchain technology has been widely used in the field of digital copyright protection because of its characteristics of decentralization, high reliability and the use of timestamps. For example, blockchain technology can be used to prove the existence of a work at a low cost and to prove that a copyright work has been infringed upon. Zhang [7] suggested that blockchain technology is conducive to the application of digital rights registration because of its security, anonymity, data integrity and other characteristics. Yu and Gu [8] suggested that the current online copyright protection system has certain limitations, and that blockchain technology can support copyright confirmation, evidence protection and intelligent transactions. Evans [9] argued that blockchain technology can protect and manage copyright works and smart contracts can better protect authors from infringements such as unauthorized compilations. Fisher [10] proposed that the development of new technologies such as blockchain and nonhomogeneous tokens has alleviated the problem of copyright protection and suggested that the Congress review relevant laws. Bell [11] indicated that the public blockchain can solve the difficult problem of conflict between copyright and privacy and create a system with relatively harmonious copyright and privacy through blockchain technology. Hauck [12] proposed that blockchain technology has high evidentiary value in cases of the infringement of intellectual property rights and takes the first case of the Hangzhou internet blockchain certificate as an example. In addition to China's internet court jurisdiction, many other jurisdictions use blockchain data storage technology to preserve and introduce evidence.[3] For example, in the case "Guangzhou Kugou Computer Technology Co., Ltd. vs. Chengdu Lingxingnote Cultural Communication Co., Ltd.", the Chengdu Intermediate People's Court used the evidence provided by blockchain technology to determine whether the defendant infringed on the plaintiff's information network transmission rights [13]. Although many scholars believe that blockchain technology can be a good solution to the evidence problem of litigation, there are still many technical and legal problems in the use of blockchain in court proceedings in China, such as the low credibility of blockchain evidence in some cases and the imperfect rules of evidence application. The internet court established in 2017 in China hears cases involving intellectual property rights and blockchain, most of which are concentrated in the field of copyright law, in which technical and legal issues are more urgent. In addition, the "Blockchain White Paper 2023" issued by the China Academy of Information and Communications Technology mentioned that blockchain in various cities has been used in many fields, such as judicial storage and public services, and that blockchain is also developing with the continuous optimization of technology. On 17 July 2023, the "2023 Chinese City Blockchain Composite Index Report (Second Quarter)" was officially released. It scores the blockchain development composite index of major cities (see Figure 3). As one of the key points of digital development in China's 14th Five-Year Plan, the application and development of blockchain in judicial depository are also in line with the institutional justice goals of the United Nations Sustainable Development Goals (SDGs). Therefore, this paper attempts to provide a more feasible reference path for solving the above problems.

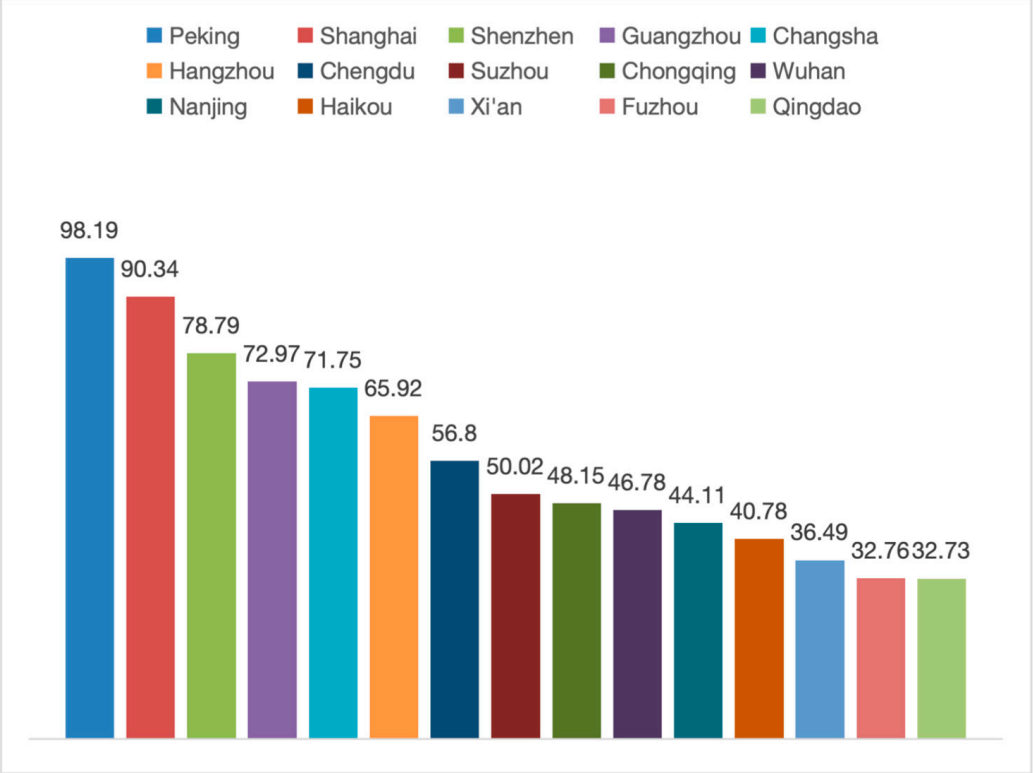

Figure 3. Ranking of major cities by blockchain composite index.

2. Research Methodology

This section elaborates on the methodological framework designed to explore the practical deployment of technological measures protected under copyright law in the digital realm, to evaluate public awareness of these measures, and critically examine the status of the market and industry, all within the context of a sustainable social system. The research strategy is structured to analyze and synthesize a wide range of information, aiming to uncover societal issues that may arise, particularly those impacting the long-term viability and ethical dimensions of digital ecosystems.

To this end, a comprehensive survey titled "Public Awareness of Copyright Technological Measures and Their Circumvention" was disseminated through the online survey tool Questionnaire Star. Over the course of one month, nearly 500 valid and insightful responses were meticulously collected for in-depth analysis. The descriptive statistical analysis of responses is shown in Table 1. This quantitative investigation served to capture the breadth of public sentiment and knowledge, providing foundational insights into the sustainability of legal system in digital practices concerning copyright measures. To supplement the survey, in-depth one-on-one interviews were conducted with key stakeholders from typical internet enterprises and China's specialized internet courts. These qualitative insights offered a nuanced perspective on the operational dynamics and legal interpretations surrounding copyright technological measures, thereby enriching the empirical basis of this study with a focus on sustainable legal systems.

The combination of quantitative and qualitative methodologies ensures a balanced and comprehensive analysis, enabling a thorough dissection of the subject matter from multiple angles. This integrated approach not only assesses public perception but also explores the practical implications and legal nuances within the industry, all with the aim of fostering a sustainable and equitable digital-environmental system.

Table 1. Descriptive statistical analysis of respondents.

Items	Options	Amount	Percentage
Gender	Female	238	47.50%
	Male	263	52.50%
Age	18–25	369	73.65%
	26–33	66	13.17%
	33–40	57	11.37%
	Over 40	9	1.80%
Career	Students *	334	66.70%
	Other fields	76	15.22%
	Legal practitioners *	65	13.04%
	Internet industry practitioners *	14	2.80%
	Developers in related technology industries *	11	2.17%
Province/City	Hunan	172	34.33%
	Guangdong	151	30.14%
	Beijing	82	16.37%
	Shanghai	67	13.37%
	Chongqing	29	5.79%

* The word students refers to individuals who have attended college, including undergraduates and master's students. * Legal practitioners include legal scholars, lawyers, judges and legal consultants. * The term internet industry practitioners refers to the employees in internet companies, working as programmers and product managers. * Related technology industries include micro-electronics, energy and supply chain.

2.1. Questionnaire Design: Mapping Public Insights on Copyright Technology Measures

The questionnaire was meticulously structured to encompass several critical dimensions, aiming at the systematic capture of relevant insights. Initially, it incorporated demographic data to delineate the occupational profile of participants, so as to ensure the diversity and representativity of the samples, reflecting various societal sectors. This segment was crucial for contextualizing the findings within a broader social framework. The questionnaire subsequently delved into respondents' familiarity with and awareness of copyright technological measures, including their understanding of possible circumvention practices. This inquiry served to gauge the public's comprehension of these protective mechanisms and their implications for sustainable digital practices. Moreover, the questionnaire scrutinized the types of copyrighted works encountered by respondents in their daily routines, seeking to establish correlations between exposure to different media formats and attitudes towards copyright protection. This exploration was pivotal for discerning how varied engagement with copyrighted materials could influence opinions on the necessity and efficacy of technological safeguards, thereby informing strategies for enhancing public engagement and education.

A critical component of the questionnaire was dedicated to evaluating respondents' knowledge of the legislative environment governing copyright technological measures. By pinpointing gaps in public understanding, this study aimed to identify obstacles to compliance and support for such measures, which are essential for advancing sustainable legal frameworks. Conclusively, the questionnaire sought qualitative feedback on the existing rules concerning copyright technological measures. This input was instrumental in understanding the public's vision for potential enhancements or innovations in the regulatory framework, contributing to a more nuanced comprehension of societal expectations and preferences for future policy formulation.

The utilization of the questionnaire as a research instrument in this context offers a systematic and standardized methodology for collating data directly from a broad audience. It enables the quantification and comparison of attitudes, behaviors and levels of understanding related to copyright technology measures, facilitating the identification of trends, disparities and areas necessitating intervention. This data-rich approach enriches the empirical foundation for scholarly discourse and policy recommendations, fostering sustainable and inclusive digital ecosystems.

2.2. Interviews: A Dual-Perspective on Blockchain and Legislative Dynamics

To deepen our understanding of blockchain technology's influence within the legislative domain, this study adopted a meticulously planned interview strategy that targeted authoritative perspectives from both technological and judicial vantages. On the technological front, interviews were conducted with China's premier internet conglomerates, Baidu and Tencent, which are recognized as pioneers and implementers of blockchain technology. These conversations yielded profound insights into the technical complexities, emerging industry trends and the transformative roles of blockchain in copyright protection, contributing to a robust technological discourse.

From a judicial standpoint, interviews were held with the Guangzhou and Hangzhou Internet Courts, which are institutions renowned for their expertise in handling digital copyright disputes. These courts, with substantial experience in validating blockchain evidence, provided a distinctive judicial viewpoint on adjudication, enriching this study's legal and practical dimensions.

By integrating this dual-pronged interview design, this study aspired to collect comprehensive information from diverse perspectives, fostering a multidimensional analytical framework. This framework provided insights from technological advancements led by industry leaders with practical judicial experience garnered by courts specializing in digital rights, culminating in a holistic perspective on how blockchain technology shapes the legal landscape around copyright protection. This paves the way for a nuanced dialogue on the legislative adaptations required to effectively harness this transformative technology, promoting sustainable and equitable digital governance in the fields of legal system.

3. Findings

3.1. Analysis of Questionnaire Results

3.1.1. Demographic Distribution of Respondents by Occupation

As illustrated in Figure 4, influenced by the thematic nature of the subject matter, its inherent sophistication and the composition of the research team, the majority (66.77%) of our respondents comprised college students. Individuals employed in the legal sector accounted for 13.04% of the surveyed population. The remaining participants represented a diverse and highly educated group, whose occupations were dispersed across a myriad of industries. These included, but were not limited to, the internet sector, the technology sectors, education, with teachers in higher education institutions, healthcare, environmental protection, transportation and animal health care, among others. Additionally, we received responses from a few retirees, contributing to a broader spectrum of perspectives and life experiences within our dataset.

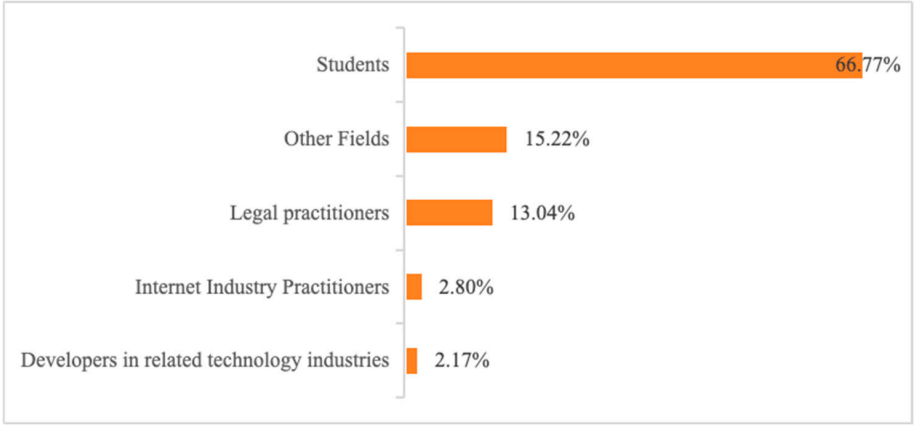

Figure 4. Occupational distribution of respondents.

This skewed distribution towards students, nonetheless, provides valuable insights into how different societal segments perceive and interact with issues related to copy-

right technological measures and their circumvention. The wide occupational diversity enhances this study's depth and applicability by capturing multifaceted public awareness and attitudes across demographics, highlighting the importance of inclusive education and outreach programs that promote sustainable digital literacy and ethical practices in copyright law.

3.1.2. Familiarity of Respondents with Copyright Technological Measures and Their Circumvention

As depicted in Figure 5, among the surveyed individuals, 63.66% of respondents acknowledged having heard of copyright technological measures and their circumvention in daily life but not understanding it. A smaller proportion, 19.88% of respondents, demonstrated a comparative level of familiarity with these topics. Meanwhile, 15.22% of respondents reported never having come across this concept before, and a minuscule 1.24% of respondents claimed to have an in-depth understanding. Given that the surveyed population largely comprised highly educated individuals, including numerous professionals in intellectual property and law, as well as faculty and students from higher education institutions, the prevailing lack of understanding of these technical measures is striking, which means the dissemination, awareness and application of technological measures by citizens remain at a superficial level.

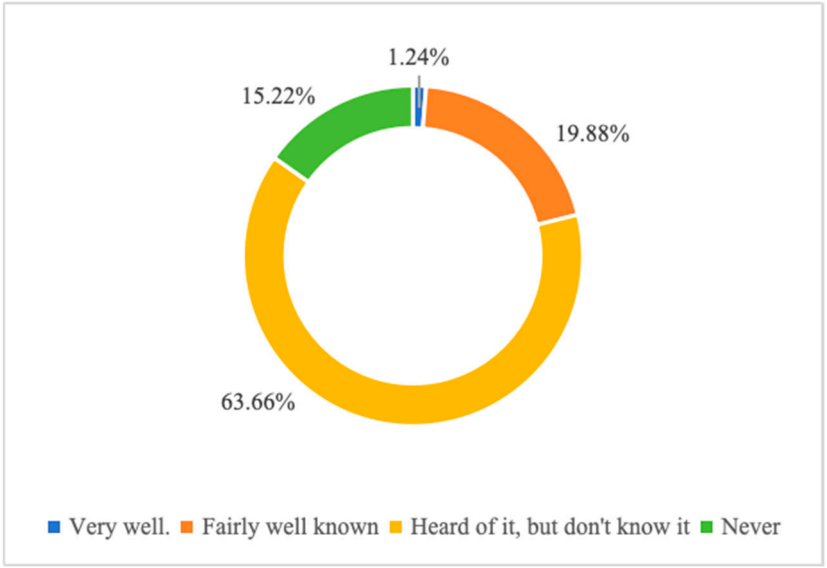

Figure 5. Distribution of understanding.

These outcomes suggest that, irrespective of the specialized backgrounds of many respondents, there is a low level of societal comprehension of copyright technological measures and legal restrictions on their circumvention, along with the associated exceptions. This highlights a lack of public awareness concerning the detailed legal framework governing these measures. These findings emphasize the urgent need for meticulous research and analysis to develop strategies that safeguard public interests effectively. There is a critical demand for science-based and rational approaches to address these knowledge gaps and enhance implementation, contributing to a more informed and equitable copyright environment, which is foundational to fostering a sustainable digital ecosystem.

3.1.3. Types of Copyrighted Works Encountered in Daily Life by Respondents

As illustrated in Figure 6, this question allowed for multiple responses, revealing a diverse range of copyrighted material regularly encountered by the public. Textual works emerged as the most prevalent, with an impressive 85.71% of respondents reporting frequent interactions with this genre. Music, theatrical works, variety shows, dance,

acrobatic arts, cinematic works and similar cinematographic productions also registered high engagement rates, each exceeding 70%. Online games and computer software, both of which were accessed by more than 45% of the respondents were next in line. The fine art pieces, architectural designs and engineering diagrams available through websites also had a notable presence, with more than 30% of the respondents indicating exposure to these forms.

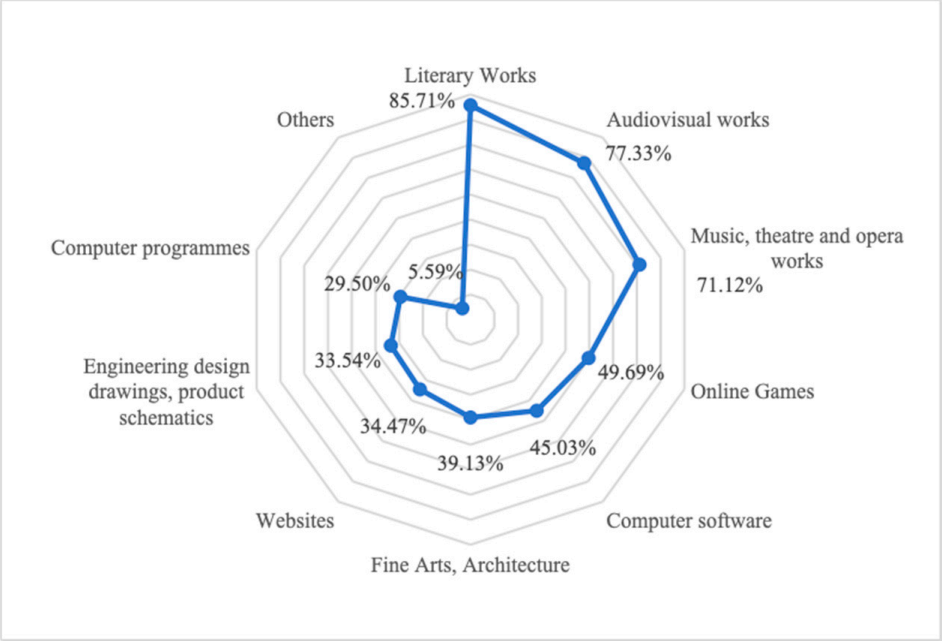

Figure 6. Distribution of types of public access to copyrighted works.

Building a comprehensive digital copyright legal system is crucial for protecting the rights of creators, fostering innovation and ensuring the sustainable growth of the digital economy. It supports a healthy ecosystem, where creativity and technology can thrive, while also promoting the digital social system. These findings underscore the ubiquitous presence of copyrighted works in daily life, which are deeply embedded in our activities and experiences. The vast range of creative content consumed highlights the omnipresent role of copyright in modern society and the necessity of robust mechanisms to protect and regulate its use, which are essential components in sustaining a vibrant and innovative cultural landscape.

3.1.4. Understanding of the Legislative Situation Regarding Copyright Technical Measures

The results of the survey on the public's awareness of current domestic legislation concerning copyright technical measures, as shown in Figure 7, reveal that more than half of the respondents, amounting to 61.18%, indicate a lack of understanding of the legislative situation in China regarding these measures. Conversely, 35.09% of the participants claimed to have a relatively good understanding, whereas a mere 3.73% expressed thorough comprehension. These findings indicate a conspicuous deficiency in public legal education efforts surrounding the copyright technical measures in the country.

Given the surveyed group's predominantly strong educational background, as 66.7% of the interviewee attended at least some college, it can be inferred that a broader public survey would likely reveal an even greater proportion of individuals who are unaware of these legal provisions. Within the computer technology sphere, if a significant number of professionals are unaware of circumvention prohibitions, they risk unintentionally participating in infringements or facilitating such breaches. If the public is oblivious to exceptions, they may inadvertently face limitations in accessing cultural products, restricting societal and cultural engagement and potentially undermining fundamental

rights such as freedom of expression. This highlights the urgent need to strengthen public education and community outreach to ensure that all stakeholders understand the subtleties of copyright law and its impact on creativity, innovation and individual freedom, which is a key step towards achieving a sustainable and equitable digital society.

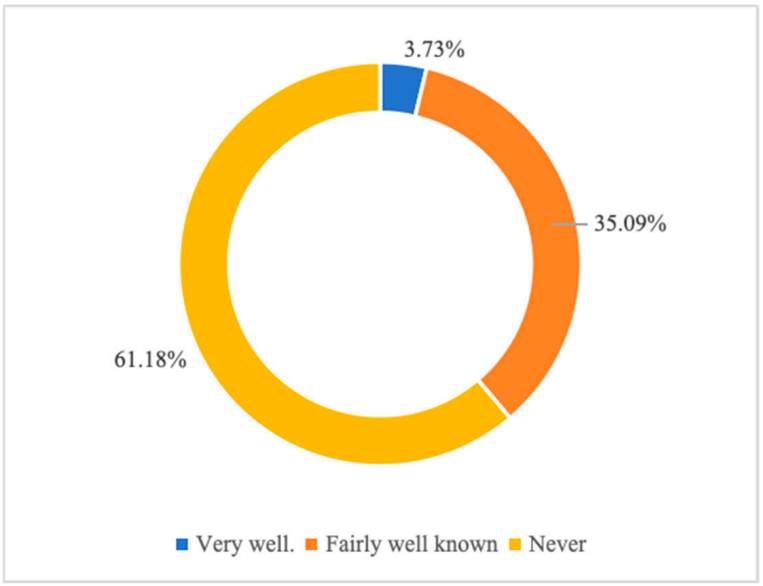

Figure 7. Legislative awareness.

3.1.5. Suggestions for Regulations Pertaining to Copyright Technical Measures

The public's perspectives on the future development of copyright technical measures in China, as illustrated in Figure 8, highlight a near-consensus on the need for improvement. Close to 90% of respondents advocate for refining regulations concerning technical protection measures, emphasizing that the advancement of copyright technology measures is contingent upon a robust and comprehensive rule framework. Approximately 75% or more of the respondents called for increased oversight of these measures and clearer demarcation of their protective scope. Additionally, approximately 64% of the participants emphasized the exceptions of refinement, the prohibition of circumvention, suggesting a desire for balanced legislation that accounts for legitimate uses.

Furthermore, the respondents advocated for improved public awareness campaigns and stricter penalties as supplementary measures. Collectively, these findings demonstrate a strong public demand for legislative enhancement, emphasizing the need for a set of rules that meticulously examines and balances the scientific and rational aspects of exception provisions to anti-circumvention rules. The overwhelming response reflects the public acknowledgment of the necessity for a comprehensive and nuanced approach to copyright law that fosters innovation, safeguards creators' rights and ensures public access to cultural expressions, which are essential pillars for building a sustainable and resilient digital social system future.

3.2. Analysis of Interviews

On the basis of the interviews, the companies and courts all agree that there exists an interface between technology and judicial trials. In judicial practice, owing to the characteristics of blockchain, which is difficult to tamper with and easy to store, it is more often used in the field of depositing and taking evidence, but there is the problem of uncertainty in the use of blockchain to deposit evidence.

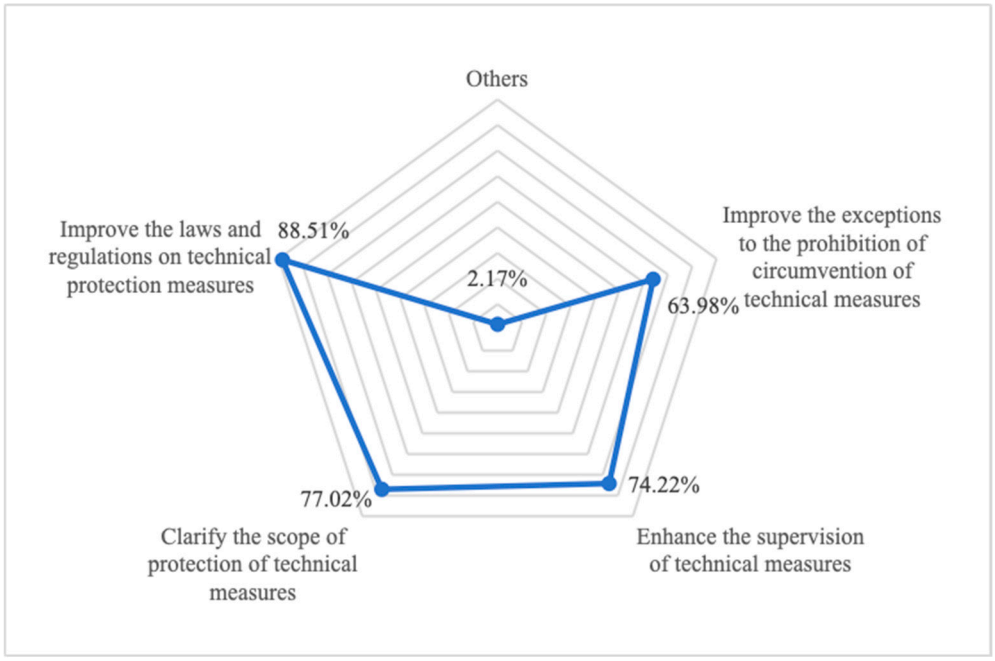

Figure 8. Proposals for improving the rules on copyright technical measures.

3.2.1. Interviews with Baidu Inc. and Tencent Co.

Interviews conducted with Baidu Inc. and Tencent Co. provided a deep dive into the intersection of technology and legal frameworks, particularly highlighting the role of blockchain in facilitating a sustainable copyright ecosystem. Baidu underscored the intricacies involved in confirming the identity of data uploaders and establishing true ownership rights, emphasizing that blockchain, despite its integrity and tamper-evident features, is primarily a ledger system that can only attest to the upload of data at a given time by a specific identity, falling short of verifying actual ownership conclusively. This insight highlights the need for complementary systems that ensure the accuracy and reliability of identity and ownership claims, which are crucial for a procedural justice where rights are respected and protected.

Baidu posited that resolving identity confirmation and rights attribution goes beyond the realm of technology, advocating for the principle of technological neutrality. They suggested supplementing technological solutions with a record registration system to enable the authorized circumvention of technical measures, a proposal aimed at fostering a balanced and inclusive digital environment, where access and protection coexist. This proposal was met with a different perspective from Tencent, which maintained that current identification methods adequately address the issue without necessitating additional registration procedures. This situation indicates a need for further dialogue and collaboration among stakeholders to achieve consensus on practices that can be authenticated.

With respect to concerns over the manipulation of timestamps, Tencent acknowledged the skepticism of judges regarding blockchain-based evidence. Their strategy to counteract timestamp tampering involves two approaches: enhancing the legal framework to align with technological realities, improving technical capabilities to detect timestamp alterations and underscoring the importance of harmonizing technological advancements with legal frameworks to support a sustainable digital social system.

3.2.2. Interviews with Guangzhou Internet Court

The Guangzhou Internet Court's perspective on blockchain integration in copyright registration and protection was enlightening. The Court's noted that the use of blockchain technology is highly important for copyright registration and copyright protection, etc. The authenticity of blockchain evidence can only be traced back to the starting point of

the initial upload. If the copyright owner does not focus on uploading the information of the work from the beginning of the creation, to form a series of linked hash values, it is difficult to prove the attribution of the right by relying on the blockchain evidence alone. This highlights the importance of a complete digital footprint from the outset of creation for effective rights management, reinforcing the need for robust and sustainable digital social system.

Judge Deng addressed fears of excessive technological measures leading to restricted information access. He confirmed that such scenarios are unlikely, considering the fact that not all copyright holders employ technological barriers, preferring open access instead. He suggested that expanding exceptions to anti-circumvention laws could mitigate potential access limitations, encourage direct communication between users seeking access and copyright holders, and highlight the role of flexible legal frameworks in promoting a sustainable balance between protection and access.

The court advocated respecting copyright owners' rights to implement technological measures, viewing this as a step towards regaining control over their creations. Blockchain's role in facilitating this shift from loss of control to reasonable management underscores its potential in empowering creators, contributing to a scientific and rational social system that supports creativity and innovation.

3.2.3. Interviews with Hangzhou Internet Court

The Hangzhou Internet Court's experience with blockchain centered on evidence preservation, showcasing a refined judicial blockchain operational model. The court's approach to blockchain-based evidence involved rigorous scrutiny, independent review and case-specific determinations, regardless of blockchain platform origin or court partnerships, demonstrating a commitment to ensuring the reliability and sustainability of evidence management systems.

Innovative applications, such as creating blockchain accounts for writers to upload works, have exemplified how blockchain can address authorship verification challenges. This model, involving upfront identity validation, could potentially reduce instances of unauthorized uploads, although the process remains exclusive and requires stringent account application protocols, indicating a path towards more secure and sustainable digital rights management.

The Hangzhou Internet Court's use of blockchain for copyright protection was largely confined to evidence fixation. The court acknowledged the absence of blockchain as a standalone technical measure against infringement, attributing this to pre-existing encryption and watermarking techniques. The inherent limitations of blockchain in preventing infringement independently were also noted, with its role being primarily evidentiary, pointing to the need for a multifaceted approach that integrates various technologies for comprehensive and sustainable copyright protection.

For the exception system regarding anti-circumvention of technological measures, no detailed inquiry was made due to time constraints and judicial specialization. However, the interviews indicated that Hangzhou Internet Court's blockchain deployment is predominantly for electronic evidence management, with explorations into procedural justice and cost-effective evidence fixation, reflecting a focus on efficiency and sustainability in judicial processes.

The court's approach to integrating blockchain for copyright protection remained experimental, emphasizing evidence preservation over the development of new technical measures. As blockchain technology advances and addresses cost and efficiency challenges, its potential applications in copyright protection could expand, offering new avenues for both rights holders and judicial systems, and suggesting a promising trajectory for the evolution of impartial copyright practices.

4. Legal Problems of Digital Copyright Blockchain Evidence

The questionnaires and interviews described above highlighted several impartial related issues with digital copyright blockchain evidence. Specifically, the electronic data obtained through blockchain technology can hardly be acknowledged by a court because they are different from traditional electronic evidence under China's evidence rules in the civil procedure law. China's Civil Procedure Law recognizes the evidence category of "electronic evidence"[4], but the review and identification of online electronic evidence are still difficult to be recognized in actual practice. This is because electronic evidence is easy to change, and the probative value of electronic data as evidence is usually not recognized by judges. Although the application of blockchain technology makes it impossible for the public to tamper with relevant evidence expressed in digital form under normal circumstances, it does not rule out that many digital technology experts and hackers can overcome the limitations of blockchain technology to forge, change and delete relevant data and information. There are some legal problems in the field of evidence, such as insufficient original rights confirmation mechanisms, lagging blockchain evidence and technical credibility, which need to be strengthened. These issues underscore the need for a green development strategy in the judicial system, where the integration of blockchain technology for evidence management should be approached with a focus on the scientifical and reasonable allocation of the burden of proof.

4.1. Insufficient Mechanisms for Confirming Original Rights

Blockchain technology has a timestamp. Once an author uploads the information regarding a work created by himself or herself to a chain, a time point is recognized by the whole chain. This time point can prove the first person of uploading the work, and this person is often identified as the author. Therefore, if someone wants to prove himself or herself to be the original owner of the copyright of a work, he or she should upload relevant information about the entire creation process on the blockchain. However, currently, blockchain technology can objectively record only the first uploader. It cannot verify whether the first uploader is the true author. For example, if users upload other people's works or photos to a chain, then the system automatically identifies each uploader as the author, regardless of whether he or she is the true author [14].

In addition, blockchain technology only proves that electronic documents have not been tampered after uploading, and the authenticity of electronic data is not supported sufficiently. This is also one of the meanings behind the court requiring the original evidence in the field of traditional evidence rule, that is, to prove that there is no tampering. When China's copyright law stipulates the copyright owner, it is generally believed that the person who signs the work is the author, unless there is evidence to the contrary.[5] In addition to proving that there is no tampering, the provision of original evidence also plays a role in identifying the responsible party. However, when blockchain technology is applied to the field of copyright confirmation, it is unknown whether similar rules can be effectively applied. In the field of patent systems, the internationally recognized rule is the first principle applied. During the examination and authorization stage, the specific inventor is not verified, but a reconsideration procedure will be provided later to protect the original rights of the real inventor of the invention or technology. Therefore, whether it is more effective to learn from the "first application principle" mode in the patent system, we recognize that determining whether the "first uploader" should enjoy the ownership of any work on the blockchain or whether the "real creator" should benefit from the ownership of all his works, requires further research and discussion.

Even more notarial staff have said that, in the field of blockchain, the authenticity of the evidence before the chain cannot be guaranteed. For example, when illegally obtained information or works without the consent of the author have been uploaded to a chain, the node will not verify the authenticity of the content but simply identify the behavior and the corresponding time. Accordingly, any application of blockchain technology can only present evidence to more people, which makes it more difficult to tamper with

evidence repeatedly. Moreover, it is almost impossible to solve the problem that uploading other people's works will lead to more complicated copyright disputes. Therefore, the traditional mode of "evidence chain + national notarization" is still adopted, and the effectiveness of blockchain evidence is recognized by endorsement of the credibility of notarial institutions.[6] This is because Article 72 of the Civil Procedure Law of the People's Republic of China stipulates that there must be sufficient evidence contrary to overturning a notarized certificate.[7] The reversal of the authenticity of evidence affects the trial trend of the whole case, which is very different from the traditional evidence in the court of evidence, cross-examination and debate rebuttal. Rebuttal only opposes the evidence and statements of the other party. If it is not proven, the burden of proof is relatively low. To overturn is to refute the evidence and statements of the other side, comprehensively denying their position. It not only requires proving the refutation, but also proving the counterclaim. The burden of proof may shift, making the difficulty of proof relatively high.

4.2. Insufficient Credibility of the Blockchain Evidence System

The technicality and vulnerability of electronic evidence make it difficult for a court to judge its authenticity through judicial review and judgement [15]. The laws do not specify the standards of illegal electronic evidence in China, and investigators generally lack professional technology. There are some difficulties in reviewing the legitimacy of blockchain evidence. However, legislative work on blockchain evidence has been carried out in the U.S and the EU, such as the *Blockchain Promotion Act of 2021* in the U.S and the *Legal and Regulatory Framework of Blockchain and Smart Contracts* in the EU. To solve these problems, the Supreme People's Court issued the *Provisions on Several Issues Concerning the Trial of Cases by Internet Courts* in 2018 and declared the following:

> "The authenticity of electronic data submitted by parties can be proved through an electronic signature, trusted timestamp, hash value verification, blockchain and other evidence collection, with fixed and tamper-proof technical means, or through the authentication of electronic forensics and storage platforms, which internet courts should confirm." (see Figure 9)[8]

This was the first time that China legally admitted blockchain and other technical means as evidence in the form of a judicial interpretation. Next, the Hangzhou Internet Court issued the first national blockchain certificate when it recognized a plaintiff's means of copyright protection through blockchain evidence preservation. In 2020, the Ministry of Justice of the People's Republic of China issued the first domestic *Technical Specification for Electronic Evidence Storage (SF/t0076-2020)*, which discusses the realization of blockchain technology. The Supreme Court also issued the *Opinions on Strengthening the Protection of Copyright and Copyright-Related Rights* by pointing out that it is necessary to improve the evidence rules in intellectual property litigation by allowing parties to preserve, fix and submit evidence through blockchains and other means.[9] Moreover, in 2021, the Information Center of the Supreme Court spearheaded these efforts by formulating the Technical Requirements for Judicial Blockchain and the Judicial Blockchain Management Specification to guide and standardize the data chaining of courts across the country and issuing the Provisions on Several Issues Concerning the Online Handling of Cases by the People's Courts. These provisions detail the effectiveness of blockchain evidence, the rules for the review of blockchain evidence, the authenticity review of data before linking and the identification of blockchain evidence reinforcement. However, based on the existing computing power and the insufficient number of nodes in some Consortium Blockchain Systems, isolated blockchain evidence still lacks sufficient probative power in some cases and the credibility is still limited.

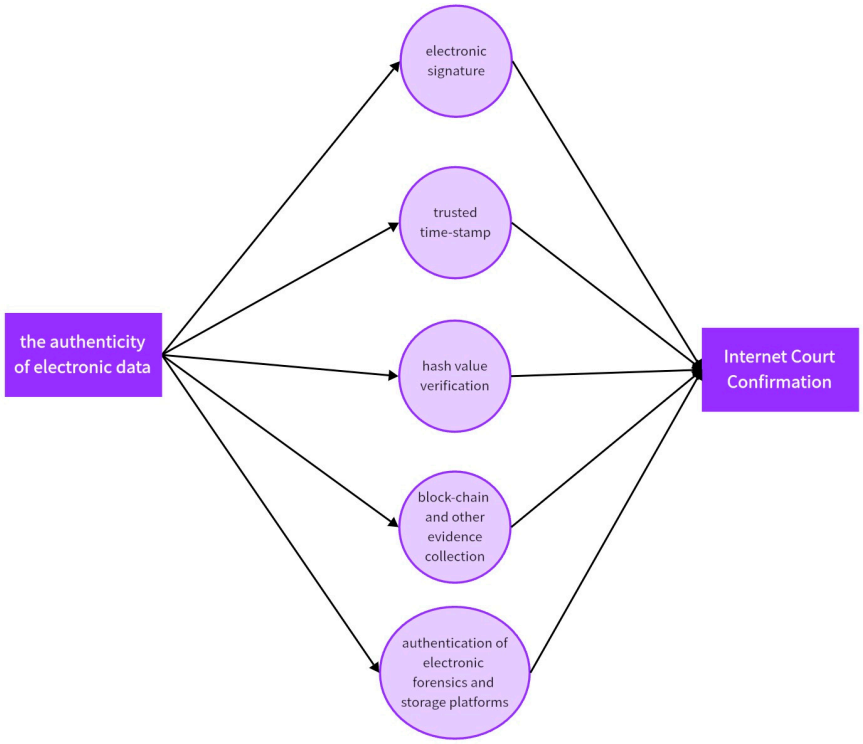

Figure 9. The authenticity of electronic data.

4.3. Lack of Clarity on the Rules of Evidence Applicable to Blockchain Evidence

Although considerable efforts have been made to improve the existing system, China still lacks special laws and regulations regarding blockchain evidence. The issuances mentioned above are almost all departmental rules and judicial guideline formulated by judicial organs or administrative agencies, but blockchain has not been regulated by specific laws in the copyright field. Legal governance regarding important areas of blockchain application remains uncertain, which makes it impossible to realize effective norms for blockchain applications.

Currently, most of practices apply the E-Commerce Law of the People's Republic of China, the Electronic Signature Law of the People's Republic of China, the Regulations on Security Protection of Computer Information Systems, and other relevant legal issues, but none of these laws or regulations include any application of copyright blockchains to regulatory objects. With respect to the ongoing rapid development of the blockchain copyright industry, neither existing laws nor relevant regulations can address the increasing need for regulation in this industry because they are either lagging or lack pertinence and comprehensiveness.

Moreover, the contents of existing normative documents are relatively general. The Regulations on the Management of Blockchain Information Services, which was officially implemented on 15 February 2019, is the first normative document related to blockchain information services in China, but its definition of relevant basic issues is inexact and lacks a definition of "information services" or "blockchain technology". There is also a lack of provisions about blockchain information services. These factors suggest that this provision is not applicable and cannot guide the blockchain copyright industry due to its insufficient operability, which implies that third-party platforms are not enthusiastic about using blockchain technology to protect copyrights [16].

5. Improvement of the Rules Relating to the Application of Digital Copyright Protection Blockchain Evidence

To create a high-quality business environment and establish a robust incentive mechanism and legal system for the further development of technology, it is necessary to

formulate clear and specific legal provisions to reduce uncertainty and ensure that regulatory frameworks are transparent and publicly accessible. Additionally, there needs to be an enhanced protection of intellectual property to encourage innovation, as well as strengthened data security and privacy protections to safeguard user information. It is also essential to maintain fair competition in the market, prevent monopolies, and clearly define liability in cases of technological failures or misuse.

In any lawsuit, evidence is crucial to support the claims of the copyright owner and the judgement of the court. However, the proof of digital copyright is very difficult to obtain on the internet, which undoubtedly increases the burden of proof for copyright owners. Blockchain technology has the potential to alleviate this burden because, in judicial copyright practice, blockchain can be used as a new evidence mode of "res ipsa loquitur".

However, when the evidence conflicts with other evidence or there is no corresponding evidence, such evidence is very likely to be overturned. For example, in the case of copyright ownership and infringement disputes between Wang Yongtao and Shenzhen Tencent Computer System Co., Ltd., the court observed that the electronic data evidence submitted by the plaintiff was easy to tamper with, unstable and not credible when reviewing the copyright ownership of Wang Yongtao [17]. The court also emphasized that, thus, without other corresponding data or evidence, it was challenging to substantiate the facts that required proof. This scenario illustrates the legal challenges in employing blockchain evidence for digital copyright protection. It is recommended to address these legal obstacles through legislation and rule design, while simultaneously ensuring that these measures support sustainable and green judicial practices.

The incorporation of blockchain evidence in judicial procedures can facilitate procedural simplification, speed up case resolution, decrease reliance on paper documentation, and adhere to the green ethos of sustainable development. This underscores the significant role of blockchain in fostering environmentally conscious legal practices. By doing so, the legal system can advance both the protection of intellectual property rights and environmental sustainability, contributing to the development of the whole social system.

5.1. Establishment of a Blockchain Copyright Supervision System

The creation of a blockchain-based system for registering and verifying the initial ownership of digital assets is imperative to overcome the deficiency in original rights mechanisms. This would entail implementing protocols that timestamp and authenticate the creation or first upload of a work and providing a clear trail of provenance. The incorporation of sustainability and green development principles into this system is essential for ensuring that the blockchain technology used for copyright protection is energy-efficient and environmentally friendly. This includes the adoption of consensus algorithms that minimize energy consumption, such as proof-of-stake over proof-of-work, and the use of renewable energy sources for powering blockchain nodes.

Implementing a blockchain copyright supervision system could require the Chinese government to institute a rights authentication protocol prior to blockchain linkage, incorporating a publicity phase for potential copyright holders to voice objections. To further promote green judgement, the system should also incorporate mechanisms to discourage frivolous litigation by imposing penalties on parties that frequently contest copyright claims without substantial evidence. This will help reduce unnecessary legal proceedings, save resources and minimize the carbon footprint associated with court activities.

Moreover, laws governing blockchain copyright evidence should delineate regulatory authority rights and obligations, within the scope of monitoring powers, ensuring legislative guidelines for copyright storage technology oversight. Although blockchain systems reduce governmental oversight costs[10], designated regulatory nodes must inhabit the blockchain. As chain constituents, government regulators can comprehensively download and scrutinize copyright license data, track blockchain database personal information in real-time, and swiftly trace data alteration origins [18]. This approach partly deters storage

certificate forgery and fraud, streamlining supervision and curtailing costs and enhancing the legal and operational sustainability of blockchain systems.

A rules-based framework that is compliant with legal norms should govern blockchain smart contracts. Smart contracts, embodying distrust in centralization and the pursuit of free markets, require careful alignment with legal frameworks and public oversight to protect state, society and third-party interests, avoiding smart contract misuse. To ensure legal stability, the interpretive function should bridge smart contracts and legal rules, accommodating digital copyright transactions. When smart contracts are coerced, deceived or subjected to gross inequity or significant misunderstanding, their decentralized and automated nature hinders aggrieved parties from exercising non-performance, interpretation, cancellation and termination rights, recognized under traditional contract law [19]. Blockchain smart contracts must conform to the copyright law-centered digital copyright protection system, respect fair use and legal licensing tenets, and adhere to private law autonomy and good faith principles. Conflicts between these legal principles and blockchain smart contract laws should leverage the interpretive function, applying diverse interpretive methodologies to reconcile blockchain contracts with legal rules. Obsolete regulations, such as administrative department registrations, should be abandoned to enhance legal adaptability. Smart contract legal effects could mirror those recognized in jurisdictions such as Arizona and Tennessee, defining applicability and protection scopes. Copyright law should clearly outline smart contract transaction types and scopes, incorporating restrictions for unsuitable objects. Coordination between smart contracts and civil law theory should be established, setting civil legal capacity confirmation standards, adding cancellation provisions, devising remedies, and building review and transformation benchmarks between smart contract and contractual language, strengthening smart contract normativity and technical supporting for a sustainable legal system.

5.2. Establish Official Trusted Copyright Data Store and Transact Blockchains

To address the issue of insufficient and unstable credibility, establishing an officially sanctioned copyright certificate blockchain can serve as a foundational step, ensuring that the evidence stored is recognized and trusted by the judiciary. This would involve the government or a credible authority overseeing the blockchain's operations, thereby enhancing its credibility. By incorporating sustainability and green development principles, this officially sanctioned blockchain should prioritize energy-efficient consensus algorithms and utilize renewable energy sources to power its nodes, contributing to green judgement practices. By promoting a sustainable and eco-friendly infrastructure, the blockchain can support the judicial system's transition toward more environmentally conscious operations, aligning with global sustainability goals. This green and synergistic development strategy in blockchain implementation ensures that while enhancing the integrity and accessibility of digital copyright evidence, we also consider the environmental impact of technology use in the legal sector.

If the copyright ownership of a work on the internet is acknowledged by crediting institutions, then it will be recognized by society and the court at higher levels. Madison said, "the circulation of trust is better than the circulation of money" at the meeting to approve the Constitution of the United States of America in Virginia on 20 June 1788 [20]. While building a trust mechanism, blockchain technology also requires users to trust the reliability of technology, which transforms the trust in interpersonal relationships into trust in technology. Currently, however, China's public has some misunderstandings about blockchain technology. Thus, it is necessary to introduce government credibility to realize the construction of a copyright blockchain system to reinforce its reliability. Therefore, government credibility refers to the trust of the public in the administrative work of its government, which involves a public trust relationship between the government's administrative actions and the social public's evaluations. It is a type of public understanding of and support for government actions [21]. According to Bentham, people's obedience to government rule is based on a consideration of their own interests, and the establishment

of a government is intended to foster social interests [22]. Therefore, the credibility of any government is based on the recognition of its public. In this case, the introduction of government credibility to realize the construction of the system in China can maximize the public interest and reduce the waste of social resources.

Furthermore, introducing government credibility into the construction of a block-chain system can help decisively establish a complete blockchain certificate system. Government credibility is an important part of the social credit system because government behavior plays a guiding and exemplary role in society as a whole [23]. A government can guide and order its public and contribute to the efficient operation of the system. Currently, the development of the immature copyright blockchain market in China depends on government promotion to facilitate public trust in blockchain technology to counter the lack of such trust. As a guide for public trust, the government can regulate and guide the public's use of blockchain technology. Under the guidance of the government, an official trusted copyright storage blockchain can thus be established, and the copyright information on each private chain can be integrated to form a relatively complete database, which effectively prevents the emergence of information islands. Moreover, on the basis of the common dependence on the government's credibility, the number of users in any official industry or alliance chain will increase rapidly, which will further increase the transparency of these systems and reduce the possibility of data tampering, contributing to a relatively safer overall copyright storage system.

5.3. Complete the Regulations Applied to Blockchain Evidence

In the field of rule design, specifically regarding responsibility, all measures need to contribute to a sustainable legal ecosystem for blockchain applications, fostering equitable and impartial judgements. By establishing a robust regulatory framework that encourages the responsible use of blockchain technology, China can ensure that the growth of blockchain applications aligns with a just responsibility system. The rule needs to not only enhance the ability of the legal system to address emerging technologies but also position China as an example in sustainable innovation and governance. Emphasizing the importance of green development in blockchain regulation can lead to more efficient and environmentally friendly practices, setting a precedent for other countries to follow.

Specifically, it can start from two aspects: legal adjustment, i.e., the establishment of administrative supervision institutions, and the construction of their systems (see Figure 10). First, following the legislation in the United States and the European Union, China should simply provide the technical definition of a blockchain, clearly define the legal meaning and status of a blockchain and smart contract, uniformly supervise blockchain applications and smart contracts, and clarify the responsible subject, imputation principle and relief measures of a blockchain platform [24]. In specific legislation, China should pay attention to the characteristics of blockchain technology; issue specific laws, regulations and supporting systems; specify the data, technology and platforms of blockchain technology; and revise the lagging laws and regulations, such as the relevant examination standards related to blockchain electronic data storage in the Civil Procedure Law. With respect to the administrative governance systems, regulations governing blockchain copyright applications should be formulated to clearly define foundational concepts such as blockchain copyright platforms and services, delineate the service providers of blockchain copyright platforms and set industry entry barriers, stipulate legal responsibilities and remedial measures for blockchain copyright platforms, penalize transgressions by blockchain copyright platforms to regulate their oversight, devise supervisory methodologies for blockchain copyright platforms' data collection and management that align with blockchain technology characteristics, meet legal requirements for safeguarding data subjects' rights, and enabling effective blockchain copyright platform supervision, all of which contribute to a developed legal ecosystem for blockchain applications.

Figure 10. Rule design for blockchain evidence.

First, the formal authenticity and substantive authenticity of blockchain evidence need to be reviewed separately. The functional equivalence method can be used when substantive authenticity is reviewed. Accordingly, any blockchain evidence can be regarded as a legal and effective original if it is functionally equivalent or essentially equivalent to the effect of the original, and if the differences between upload nodes and backup nodes are no longer strictly distinguished. A piece of blockchain evidence can be deemed complete if it is not modified after the backup. Thus, the integrity and visibility of the information are taken as the criteria for judging the origin and can be used as the best evidence. To examine substantive authenticity, the focus is not only on investigating the reliability of the processes and methods involved in the formation, transmission, acceptance, storage and extraction of blockchain evidence but also on the possibility of tampering and whether the methods used in each link comply with the corresponding legal norms. In addition, the focus is on verifying the credibility, popularity and professional ability of the source subject of the evidence and clarifies whether there is an interest relationship between the submitter of blockchain evidence and its source subject. For example, in the case where Huagai Creative (Beijing) Image Technology Co., Ltd. sued Rongxin (Fujian) Investment Group Co., Ltd. for copyright infringement [25], the Fujian High Court determined that Huagai's evidence collection operation was completely carried out on its own computers and that the relevant functions of the timestamp service center were used only for uploading. Therefore, the authentication behavior was aimed only at the time of uploading, not at the file itself. Moreover, since the source and operation process of the documents were unilaterally controlled and operated by Huagai, and there was a lack of effective supervision by a third party, ensuring the objectivity, impartiality and legitimacy of the documents was impossible, which is why the court did not approve. Accordingly, the whole process, from the generation and transmission of blockchain evidence to its use in a court, requires the participation of reputable subjects and reliable technical support.

Second, expert opinions better reinforce the authenticity of copyright blockchain evidence compared to notarization. For example, in the case of a computer software copyright infringement involving the Leiruo software company and Wuxi Kaiqi Technology Co., Ltd. [26], Leiruo solidified the evidence through a timestamp and notarization, and the evidence was recognized by the court. However, if all blockchain evidence is notarized, then this is obviously a waste of judicial resources and does not reflect actual needs or social realities. Traditional notarization is also time consuming and expensive, which is not in line with the characteristics of high efficiency and low-cost third-party certificate storage. Therefore, it is unrealistic to reinforce blockchain evidence through notarization. However, expert opinions do not have these drawbacks. Article 77 of the provisions on evidence of the Civil Procedure Law of China stipulates that the probative power of expert opinions is generally greater than that of other evidence. Expert opinions are conclusive opinions provided by individuals with expert qualifications from legal expert institutions that are obtained through specific methods. With respect to form, an expert opinion presents facts through its content, meeting the characteristics of documentary evidence. When an expert opinion is used as reinforcing evidence, cross-examination can not only involve a review of textual content but also require the expert to appear in court. This makes it more comprehensive in terms of evidence compared to other types of evidence. Its probative power is also greater than other general evidence, so it can support blockchain evidence. Depending on the difficulty of obtaining evidence, appraisal opinions can be applied by

the interested parties or conducted by the court ex officio. The parties can contact an appraisal institution for appraisal, and there is no need for them to obtain evidence directly. Thus, compared with other evidence, blockchain evidence is easier to obtain. Blockchain evidence can therefore be strengthened through experts' appraisal opinions. One of the functions of the traditional original evidence is to prove that the copy of the evidence has not been tampered with. When blockchain evidence is strengthened by expert opinions, its authenticity is considerably enhanced. In court, blockchain evidence includes expert opinions and even an expert appearance, and its nature and effectiveness can be recognized as the original evidence.

Third, it is necessary to form a chain of electronic evidence to make it credible. The legitimacy of blockchain evidence often involves the validity of evidence. The elements on the chain are composed of time, location, IP verification, an identity confirmation system, trusted forensic equipment, trusted algorithms and trusted witnesses. The identity confirmation system can be solved by the identity information system issued by the public security organ system. Similarly, IP verification and trusted forensic equipment can be resolved through IP address and equipment cleanliness monitoring issued by the national security organ. The time and location are authorized by the national time service center of the Chinese Academy of Sciences and the Beidou satellite navigation system. The combination of hash algorithms with notary systems or trusted expert opinions can solve the problem of trusted algorithms and the trusted witness at the end of the evidence chain. After the above problems are solved, the formed electronic evidence can be sealed in the form of a blockchain. Such blockchain evidence also meets the requirements of Chinese laws for electronic evidence. That is, it has legitimacy and effectiveness. For example, one party needs to generate electronic evidence, and the party adds the network ID card, IP verification code, official authorization time and location, equipment cleanliness code or report to the evidence. The above electronic documents form a hash value through a hash algorithm, and then the hash value is copied to the judicial identification center, the Court Notary Office, the depository company, the trusted expert office and other objective institutions. These institutions will demonstrate the legitimacy of this electronic evidence. If confirmed, then this blockchain evidence can be fully applied in the judicial system. If the electronic document is modified for a second time, then the above information must be verified for a second time, and the original hash value must be packaged together and submitted to an objective institution to verify the legitimacy again.

Blockchain copyright certificates, although susceptible to forgery in select instances, can function as circumstantial evidence. They necessitate conjunction with other evidence types to form a coherent, unified and inter-corroborative evidence chain, forging a comprehensive certification system for judicial acceptance. When faced with contradictory evidence, courts should weigh the probative force and value of opposing evidence, corroborate references to pertinent case evidence, and render judgements holistically. The integration of blockchain electronic evidence facilitates procedural simplification, accelerates case resolution, diminishes paper documentation usage and enhances the operationalization of the legal system [27].

Finally, the relevance of evidence is related to the degree of connection with the case itself, that is, the causal relationship between the facts reflected by the evidence and the facts to be proven. Evidence with high relevance is more likely to be accepted by the court, and evidence with low relevance is less likely to be accepted. Blockchain evidence still belongs to the category of electronic evidence, and its relevance is still one of the elements to be tested. Although the advantages of blockchain technology can be used to trace the whole process of evidence relevance, isolated blockchain technology cannot play a great role in evidence relevance itself. In some more complex copyright cases, the collection, extraction and uploading of evidence may be carried out by some trained professionals, and the qualifications, methods and contents of these professionals may have an impact on the relevance of blockchain evidence. Therefore, when examining the relevance of blockchain evidence, more attention can be given to the preprocessing of

depositing evidence, that is, the extraction process [28]. The extraction process of blockchain evidence and the qualifications of professionals are guaranteed, and the relevance of evidence is also guaranteed.

6. Conclusions

The accelerating pace of technological innovation has prompted ongoing scrutiny of established legal frameworks, exacerbating vulnerabilities within the intellectual property system, particularly concerning copyright law. The evidence rules regarding network digital copyright infringement in China are currently relatively insufficient. Owing to the tamper-proof and timestamped characteristics of blockchains, blockchain technology can record every link in the formation of electronic data to help judges determine the probative value of evidence and ease the difficulties of courts in determining authentic electronic data. The relevant evidence identification rules have only just been established, and more time is needed to be implemented to confirm their rationality and operability. In copyright disputes, electronic blockchain evidence can confirm only that the uploader owned the document at an earlier time. Once another party provides earlier proof, it is difficult to presume that the uploader is the real author without other evidence. Therefore, it is necessary to rationally address the application of this technology in the copyright industry and judicial field, to strengthen risk prevention and control similar to NFT copyright infringement and to further research the safety and efficiency of blockchain copyright data storage and transmission. In many judicial practices, courts have clearly articulated the argument that "there are no relevant data to confirm each other, and it is difficult to confirm the facts to be proved" in their judgements. This shows that no court recognizes general timestamped electronic data. To maintain the scientific and operationalization of the use of blockchain evidence in China's digital copyright legal system, it should therefore establish official governmental copyright data storage and transaction blockchain, integrate it with cloud storage, build an insurance system, solve the technical problems, establish a blockchain copyright supervision system, and improve the regulations regarding applications of blockchain evidence.

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Notes

1 NFTs refer to nonhomogeneous tokens. In essence, an NFT is a unique trusted digital equity certificate in the blockchain network. It is a data object that can record and process multidimensional and complex attributes on the blockchain. NFT is a new application of blockchain technology in the field of copyright. According to public data, at present, more than 20 listed enterprises in China have started digital collection-related businesses, and internet companies such as bat, byte and Kwai have all entered the market. In the three months from February to May 2022, more than 200 digital collection platforms have emerged. However, NFT digital collections may involve the infringement of others' copying rights, information network transmission rights, and copyright issues, such as publication rights and distribution rights.

2 Antchain is a representative technology brand of Ant Group, formerly known as Ant Blockchain. On 23 July 2020, the brand was upgraded to Antchain (ANTCHAIN), which is dedicated to building a new infrastructure of trust in the era of digital economy.

3 The three Internet courts in Hangzhou, Beijing and Guangzhou have built a judicial blockchain platform to achieve full process recording, full link credibility and full node witness of electronic evidence. For example, Guangzhou Internet Court uses the "Netcom legal chain", Hangzhou Internet Court uses the "judicial blockchain" supported by the underlying technology of the

"ant chain", Beijing Internet Court uses the "balance chain", and the Shanghai High Court cooperates with the "security network" of Digital Qin Technology. On 25 May 2022, the Supreme People's Court of the People's Republic of China released the "Opinions of the Supreme People's Court on Strengthening Blockchain Application in the Judicial Field", facilitating the people's courts to accelerate the digital transformation with the support of key technologies represented by blockchain and to achieve a higher level of digital justice, the Opinions will promote the in-depth integrated development of the rule of law and technology as well as the higher-quality intelligent rule of law. See https://www.court.gov.cn/zixun/xiangqing/360281.html (accessed on 28 August 2024).

4 Civil Procedure Law of the People's Republic of China, NPC. Article 66-5 (2021).It stipulates that "electronic data" are a type of evidence. "Provisions of the Supreme People's Court on Several Issues concerning the trial of cases by internet courts" was deliberated and adopted at the 1747th meeting of the judicial committee of the Supreme People's Court on 3 September 2018.

5 Copyright Law of the People's Republic of China, NPC. Article 11-4 (2020).It stipulates that "if there is no evidence to the contrary, citizens, legal persons or organizations without legal personality who sign their names on the works shall be the authors".

6 Provisions of the Supreme People's Court on Several Issues Concerning the People's Court's Online Handling of Cases (Draft for Comments), SPC. Article 16 (2021). It stipulates that the authenticity of the data prior to the link should be reviewed. If the parties propose that the data has no authenticity when it is stored in the chain, and provide evidence to prove it or explain the reasons, the people's court should review it. In judicial practice, blockchain evidence is faced with the awkward situation of "tradition". See http://ntcc.jsjc.gov.cn/zt/jcll/202110/t20211021_1293315.shtml (accessed 28 August 2024).

7 Civil Procedure Law of the People's Republic of China, NPC. Article 72 (2021). It stipulates that "legal facts and documents notarized and certified in accordance with legal procedures shall be taken by the people's court as the basis for ascertaining facts, except when there is evidence to the contrary sufficient to overturn the notarized certificate".

8 *The Provisions on Several Issues concerning the trial of cases by Internet Courts*, SPC. Article 11-6-2 (2018).

9 *Opinions on Strengthening the Protection of Copyright and Copyright Related Rights*, SPC. Article 2 (2020).

10 The transparent distributed ledger transfers a large part of the verification task of information authenticity to the public, greatly reduces the workload of the supervision authorities and improves the ease of supervision.

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