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I. Introduction

For a long time, intellectual property rights have been synonymous with encouraging knowledge production and protecting and promoting technological innovation. In particular, for enterprises and producers, applying for patents has become a powerful weapon to protect their legitimate rights and interests from infringement. However, with the arrival of the digital economy, the development of the Internet makes technology innovation more diverse and more complicated. The philosophy of "freedom, sharing and free" in open-source software makes people feel more and more doubt: Are there no drawbacks to intellectual property? When open-source software pursuing knowledge sharing meets intellectual property, can it protect the rights and interests of the original knowledge producers? This philosophical myth has attracted a lot of discussion and thinking in academia and industry.

Lawrence Lessig, a Stanford Law School professor, is a staunch opponent of the "Fundamentals of Intellectual Property Rights," arguing that by copying the systems of Property Protection that exist in the real world, the Internet will undoubtedly change from open to closed. Hence, it will hinder the progress of human civilization and the prosperity and innovation of culture [1]. The United States Public Patent Foundation has gradually realized that the abuse of patent rights may also hinder technological innovation in the opposite direction, so the organization was established to prevent and combat patent misapplication[2]. Of course, open-source science and technology workers engaged in emerging industry forms and philosophical thinking even raised such doubts. If the original innovator who believed in open-source spirit did not apply for patents, but the secondary innovator who was the second innovation applied for patents, whether it would still promote technological innovation without any adverse effects.

Based on the theoretical and practical questions, this paper puts forward the following research questions:(1) What are the breakthroughs in intellectual property theory with the emergence of open-source software? What is the property protection system of open source itself? (2) When open-source software encounters intellectual property rights, is there a dilemma reflected in what aspects? (3) How to solve the property rights dilemma of open-source software, and what are the suggested solutions? Due to many open-source software projects, this paper will take the emerging open-source form of blockchain as a case study. Based on the literature review, this paper will analyze the open-source strategy of blockchain, the intellectual property dilemma encountered, and suggested solutions. Hopefully, it will contribute to the research and practice of open-source software in the field of intellectual property.

II. The Breakthrough of open Source to Intellectual Property and its System Logic

a) The breakthrough of open-source software to traditional intellectual property

Open-source software is the opposite of closed-source software. The former has the typical representative of Linux, and the latter has the typical representative of Windows. Richard Stallman, the founder of the Free Software Movement, a precursor to open-source software, opposed the commercialization of software in the form of closed source code, arguing that it was unethical to prevent users from learning and helping others. He proposed that intellectual property encourages knowledge production by establishing

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private property rights but restricts knowledge sharing by conditional use. On the other hand, open-source software prevents private ownership in the form of shared property rights. The specific approach is to protect the right of anyone to use, modify, and distribute the work and its derivatives. The only premise is to distribute under a Copyleft license. That is to say, open-source must be shared and held accountable if privatized, and knowledge must be shared and held accountable if privatized. The breakthrough of open-source software to traditional intellectual property theory is mainly reflected in the following three aspects.

i. *Copyright*

Copyright, also known as Copyright, is adopted by most countries to protect the intellectual property rights of computer software. The software includes closed source commercial software and open-source free software. The former uses the traditional Copyright (Copyright, also known as right Copyright) to protect the author's exclusive property right to the product. The latter uses Copyleft (also known as left Copyright) to preserve the co-ownership of the owner[3].

Although both use licenses to constrain related rights, there are essential differences in institutional constraints before and after. Commercial software uses software proprietary license to protect the interests of the right holder. Other people acquire the right to use the product in payment, restricting users to modify and spread the software. Open-source software uses left Copyright licenses to protect the freedom and rights of users to the greatest extent. Anyone can change and re-publish the source code under the license, which fully embodies the characteristics of open-source software "free, open, cooperative and shared". As the GPL license authors said, Where as commercial software developers use Copyright to take away our freedom to share software, open-source enthusiasts can also use Copy left to create a new release. We give everyone the freedom to use the source code we provide[4].

ii. *Patent rights*

Patents, whose legal value lies in adding profit to the fire of genius, are often used as a shorthand for "monopoly" instead of the free sharing that open-source software emphasizes. The patent crisis faced by open-source software inevitably falls into patent disputes because it does not apply to patents. Specifically, patents have priority. For example, suppose the original author of open-source software does not apply for a patent, but a third party not bound by the license applies for a patent. In that case, it is difficult for the original author to escape from patent infringement even if he developed the software earlier [5]. A typical case is as follows: SCO prosecuted IBM patent infringement case in 2003. Linux was confronted with an intellectual property lawsuit that shocked the world. Unlicensed use of closed source commercial UNIX code for free, open-source Linux, accused SCO of violating intellectual property rights and trade secrets and demanded up to $1 billion in damages. After a year, the case ended in a settlement. Still, it has become a powerful weapon and strategy for commercial software to attack and bring down open-source software in the form of patent litigation. It also warns open-source software developers and companies to pay attention to patent issues and protect their legitimate rights and interests.

The idea that open-source software can be freely shared does not mean that it cannot be patented or that open source is not patentable. In fact, open-source software patents belong to defensive patents, that is, the original author gets priority in the form of patent, and the software can still be freely distributed after application. Thus, on the one hand, the freedom of knowledge sharing of open-source software can be maintained. On the other hand, it can also obtain legal protection and avoid falling into patent disputes. Blockchain, for example, is a better case for the combination of open-source software and an application for a patent. Association of patent protection in China released the 2020 global authorized patent report blockchain field, pay treasure to 212 authorized patents digital blockchain column first in the world, and blockchain is based on open-source software projects.

iii. *Trademark rights*

Trademark is a critical way to protect computer software earlier than Copyright. To make their products different from other software, software developers often use words, graphics, and other special symbols to put trademarks on the outer packaging of software or embedded in the program to make it displayed during running. As the well-known trademark in the software field hasa certain appeal to consumers, counterfeit trademarks and other pirated software will appear. The specific manifestations are: pirated software developers put the trademark of genuine software in the product packaging or embedded in the software program, or limited to the technical means is not strong, only delete the name of the original software author, but still cannot remove the original software trademark in the process of program display, that is, trademark infringement.

To protect the rights and interests of Open-source software developers, the Open Source Initiative applied for OSI (Open Source Initiative) as a trademark, specifically "OSI Certified" as the symbol, to protect identified Open Source software. The criteria are to examine whether the software is distributed in compliance with the open-source software license and if it is approved, OSIA grants certification marks to the software. A typical case in this regard was My SQL AB prosecuted Progress Software Corp., NUSPHERE Corp. in 2002. NUSPHERE Corp. is a classic example of open-source software using trademark law to protect its rights. The NuSphere MySQL Advantage closed source

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software issued by the defendant contains both MySQL open-source software based on the GPL and its closed source software (Gemini), but the installed software will display the icon of My SQLD program. MySQL AB accuses the defendant of violating GPL rules by forcing the defendant to open the Gemini source code required by the GPL.

b) Open-source software license system

Software License refers to the contract signed by the software publisher and user to guide and regulate how software is used. It is the property rights protection system of the software itself. Traditional intellectual property rights protect the exclusive property rights of individuals to the fruits of labor by law. Anyone needs to obtain the right to use the products in a conditional license, such as payment. A comparison is made between commercial software with proprietary property rights and open-source software with joint property rights (Table 1), which contains the following core hypothesis. In the mode of private supply, any leakage of personal knowledge results will lead to the decline of its income. Therefore, most private suppliers will try to reduce knowledge sharing and protect individual proprietary property rights of products in the form of intellectual property rights[6].

Open-source software in the form of license, so that anyone can use, modify and release source code software free of charge, product rights are entirely open to the outside world, shared property rights. The licensing system breaks the traditional intellectual property misconception that open-source software owned by common ownership does not need copyright protection, which is wrong. Licenses protect open-source software copyright in such a way as to avoid private ownership of shared knowledge products effectively. The lack of motivation is overcome because developers are motivated to volunteer because they have certain stable expectations of participating in contributions.

Table 1: Comparison of property right structure between commercial software and open-source software

Software type	Commercial software (proprietary)	Open-Source software (shared ownership)
rights of possession	Private possession	Open to all, not to any personal possession
right to use	Subject to a conditional license, the licensee is free to use it	Anyone can use, modify and distribute the software for free
usufruct	On a possession basis, the copyright holder earns revenue by selling the software	On a usufruct basis, producers earn revenue by using the software
right of disposition	Producers are free to license or transfer software	Producers must open licenses, and there is no transfer of software

At present, there are 63 kinds of open-source licenses certified and published by the OSI official organization, which can be divided into three types according to the severity of the requirements for open source distribution. The first type is the most strict and can best reflect the spirit of free software, which is the fundamental driving force for developing open-source software, and is represented by GPL and LGPL licenses. The second category is the traditional commercial software companies actively engaged in the open-source software world, represented by the MPL license. Finally, the third category is the most comprehensive open-source in the world of open-source software. Open-source code can be freely combined with proprietary commercial software source code, and it is the most typical business-friendly license, represented by a BSD license [7]. The prevailing open-source software licensing rules are shown in Table 2.

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Table 2: Classification of mainstream Open source software Licenses [5]

Similarities	1. Obligation to distribute -- redistribute the source code acquired; 2. Requirements for distributed source code -- integrity and disclosure of source code must be guaranteed; 3. Allow modification - Work can be developed and performed based on the source code obtained

Contrast of points	Whether it can be mixed with other non-open source software code	Whether changes to source code can be kept secret	Whether the patent license is specified	Whether a "LEGAL" indication is required regarding the intellectual property rights that may exist in the obtained source code	Whether it is clear that infringement actions result in termination of the license agreement	Whether the source code can only be distributed under this license
GPL license	×	×	×	×	×	√
LGPL license	√	×	×	×	×	×
BSD license	√	√	×	×	×	×
NPL license	√	√	×	×	×	×
MPL license	√	√	×	×	×	×
Apache license	√	√	×	×	×	×
QPL license	√	√	×	×	×	×
QNCL license	×	√	×	×	×	×
Ricoh license	√	√	√	√	√	★[1]
SISSL license	√	×	√	×	√	★
SPL license	√	√	×	√	×	×
Jabber license	√	√	×	√	√	×
MOTOSOTO license	√	√	×	√	√	×
NOKOS license	√	√	√	√	√	★
OGTS license	√	√	×	×	×	×
AFL license	√	√	√	×	√	×
Artistic License	√	√	√	×	√	×
APSL license	√	√	√	×	√	×
Common License	√	√	√	×	√	×
IBM license	√	√	√	×	√	×

[1]★, Means that the original source code and the modified source code must be distributed under this license and subsequent versions of this License, but the source code and the modified source code may be distributed as a new product in combination with other types of code not subject to this License. As long as the source code obtained under this license and the modified source code are distributed as required by this license.

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III. Blockchain and its Open-Source Strategy

Blockchain and open-source software have similar underlying technical architecture and governance logic, which both emphasize mobilizing all parties' enthusiasm in a decentralized way, thus promoting distributed and open innovation. Furthermore, both are the results of fostering collective action or collaboration in the face of dispersed individuals without administrative orders[8]. The development of blockchain technology has gone through three stages. The first stage is Bitcoin, which solves the centralization problem in digital transactions and successfully realizes the possibility of anonymous transactions[9]. The second stage of development is Ethereum, which proposes innovative contract technology to run in the blockchain network. It enables users to develop decentralized program applications in Ethereum freely, thus significantly improving the technological innovation level of blockchain and enhancing and expanding application scenarios[10]. Next is the third phase, which will facilitate the integration of blockchain with various technologies and application scenarios to build trust networks similar to those within open-source software and communities.

a) Bitcoin and its open-source strategy

In 2008, Satashi Nakamoto published Bitcoin: Peer-to-peer Electronic Cash System[11], which is the world's first introduction of bitcoin proper names and peer-to-peer cryptocurrencies[12] and is widely recognized as the white paper of Bitcoin. On January 3, 2009, Nakamoto released the first version of the blockchain, bitcoin 1.0, using the open-source C++ programming language for Windows only.

Bitcoin is currently the most important digital currency, allowing users to conduct online transactions and payments without a financial intermediary. Bitcoin is called cryptocurrency mainly because it is protected by complex encryption technology[13]. Blockchain as the underlying technology of COINS, every user currency blockchain ACTS as connected nodes, and through a password Hash as a public key (Hash)[2] [14]. When the user starts a new node, each node will store the public and private keys automatically generated by the Bitcoin blockchain system [15]. The user with bitcoin can send it to another user through the recipient's public key signature and the hash of the previous transaction.

Blockchain is a decentralized network structure where each node can display or obtain any information and transaction records [16]. In general, blockchains operate like "proof of work" or "proof of stake"[17]. When information or transactions are sent to nodes in the blockchain, Computers at each node (commonly known as "miners") compute mathematical functions in a competitive manner ("mining"). Miners repeatedly add the input data and the hash value of each calculation until the hash value is below the difficulty target set by the Bitcoin blockchain. Miners who complete the calculation first have the right to send the information and transaction records to the nearest new block[18] and will be rewarded with new bitcoins automatically generated by the blockchain[19].

Because each block contains its ID and the last block's ID, all blocks can be linked without a central server, making it possible for people to keep track of everything on the blockchain and keep their jobs safe. Furthermore, information can be encrypted by hash functions before being directed to the blockchain since hash functions are one-way functions, so the hash values generated by hash functions and stored in the blockchain are not reverted to the original information [20]. Based on this, identity information pointing to the blockchain can be verified by repeatedly manipulating the hash function to see if it generates the same hash value to maintain confidentiality. In this case, the transparency, immutability, and non-repudiation of information will all be verified. Therefore, blockchain technology can be used as a sound "proof of existence" in electronic documents.

Regarding Bitcoin's open-source strategy, its official website Bitcoin.org provides users with a free link to download "Bitcoin Core", an open-source software-driven by the Bitcoin community and licensed under the MIT license. According to the OFFICIAL OSI (Open Source Initiative) website, all copies or most of the software under the MIT license shall display the following copyright notice: "Anyone may obtain the Software and related documentation free of charge and process the Software without restriction, including, but not limited to, using, copying, modifying, merging, distributing, sublicense and/or selling copies of the Software and the right to permit those providing the software to do so [21]. "Thus, any blockchain developer can download the "Bitcoin Core" and its associated documentation for free to use or modify the Bitcoin blockchain to develop and distribute their applications. For example, the Machine Learning Laboratory of the Massachusetts Institute of Technology (MIT) released an open-source project on January 8, 2016, aiming to build an ecosystem of creating, sharing, and verifying educational certificates based on blockchain technology. The project's source code was published on Github in an MIT license[22].

[2] Hash (Hash), refers to the Hash function, is the input of arbitrary length by Hash algorithm into fixed length of the output, the output is the Hash value. Hash is an algorithm, but also an idea, using hash can effectively improve the utilization of storage space, improve the efficiency of data query, but also can do digital signature to ensure the security of data transfer.

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b) Ethereum and its open-source strategy

Since the scripting language of the Bitcoin blockchain is incomplete, it has minimal programming capabilities. Until it is widely accepted as legal tender by governments worldwide, the commercial use of Bitcoin is still very limited. In this case, the second stage of the blockchain, Ethereum, has been ushered in.

In 1997, Nick Szabo published an article entitled The Idea of Smart Contracts, defining intelligent contracts as "the form of embedding contracts into various valuable properties through digital intelligence" [23]. In 2013, the idea of smart contracts was realized by a 19-year-old computer genius named Vitalik Buterin, who publicly identified Ethereum as another peer-to-peer decentralized blockchain. However, due to Bitcoin's incomplete blockchain and limited scripting capabilities, Ethereum blockchain uses a more sophisticated scripting language that allows users to write and deploy smart contracts and other applications.

Ethereum blockchain has two types of accounts, including external accounts and contract accounts. External accounts are for ordinary users only. When a user creates an external account, they are asked to enter a password. The Ethereum blockchain then generates a pair of public and private keys for the external account, represented by the address of a sequence of numbers generated by the account's public key. There is no concept of an account name on the Ethereum blockchain. The address of an external account is independent of the user's identity, as the blockchain system does not require users to register under their real names. Hence, users are anonymous on the Ethereum blockchain[24].

The contract account stores the smart contract code, and its address mainly comes from some information related to the smart contract, such as the address of the creator and the number of transactions.Smart contracts in the Ethereum blockchain are treated as autonomous scripts. Ethereum writes a programming language for users to develop smart contracts. An Ethereum Virtual Machine (EVM) was also created to deploy and execute smart contracts in the Ethereum blockchain. The server allows users to write smart contracts and translateactual contracts into programming code, compiled them into EVM bytecode, and deployed them to the Ethereum blockchain for execution.

Once deployed to the blockchain, smart contracts cannot be modified and are automatically executed once the conditions of the agreement are met without human intervention. Therefore, smart contracts can solve problems in real life and significantly reduce labor costs, administrative expenses, and time costs[25].

Ethereum provides a command interface called Geth to run a complete Ethereum node in terms of open-source strategy. Ethereum's official website states that the Ethereum core license is licensed under the GNU LGPL and runs all front-end client software. On the other hand, Geth is licensed under the GNU GPL general public license, a free copyright license issued by the free software foundation that guarantees all users of software four freedoms. (1) Any user can use it for any purpose; (2) Users have the freedom to change the software at any time according to their own needs; (3) Freedom to share software with the user's neighbors and friends; (4) The freedom to share any changes made by users.

The current version of the GNU GPL is GNU GPLv3, which was released on June 29, 2007. Under GNU GPLv3, the Ethereum blockchain should expose the source code of each software program so that users can access and use it freely. Furthermore, to ensure that users are free to use all software versions, GNU GPLv3 acknowledges that all users are free to run, modify, and distribute copyrighted software under the GNU GPLv3 license without restriction. However, to achieve the goal of free access and sharing software, GNU GPLv3 does not allow users to use or modify open-source software published by others, nor does it allow others to use or distribute modified versions of the software.

IV. Blockchain open Source in Intellectual Property Dilemma and Suggested Measures

a) Blockchain open source in the intellectual property dilemma

Most initial blockchain developers are believers in open-source software, setting up the core blockchain program, development interface, and application software as open-source, making it freely available to all developers or hobbyists. In recognition of the open-source culture, the original developers did not intend to collect licensing fees or royalties from other blockchain developers or users and therefore did not apply for patents.

However, subsequent application developers have filed so many patents that the original blockchain developers have begun worrying whether patent applications could hinder or jeopardize the next blockchain innovation. Blockchain inventions usually involve many technical features, not just abstract ideas like software or e-commerce. These patent applications were initially based on the earliest blockchain developers, but some modifications have to be made due to the rapid iterative nature of the software and the need for continuous improvement. Furthermore, when subsequent developers build on what the original developer developed and patent the product, those applications are often quickly approved. In this case, many of the initial blockchain developers may not

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continue to improve and develop the product because of subsequent patent applications by other developers.

Therefore, the dilemma of blockchain open source in the field of intellectual property is particularly obvious and anxious: Early blockchain developers, because of open source culture, will choose to share and not apply for a patent, but late developer and protect own intellectual property rights, choose to apply for a patent, instead of the initial and subsequent caused sure open-source developers, this contains the open-source philosophy of speculative behavior for the concern of technology innovation is certainly worth attention.

b) A proposed solution to the blockchain open-source dilemma

i. *Industry standard licensing program*

As technology advances and product complexity increases, much new technology research and product development are often not done by a single company. When different companies carry out collaborative innovation, there will be compatibility and interoperability problems between various components. Therefore, the establishment of a unified industry standard is an effective measure to improve product compatibility.

Australia is one of the fastest countries to promote blockchain industry standards. In April 2016, the Australian Standards Body proposed a new initiative for the International Organization for Standardization (ISO) to develop a blockchain standard to support technology development. According to the proposal, some of the most severe problems facing blockchain open-source are data sovereignty, privacy, and lack of consensus, creating issues for policymakers and regulators alike. In April 2017, The Australian Standards Body, in collaboration with the International Organization for Standardization ("ISO"), hosted the first International Blockchain Standards Conference, which was attended by many countries, including China, the United States, Germany, the United Kingdom, Japan, Russia, France, And Singapore. As a result, ISO issued "Blockchain and Distributed Ledger Technology (ISO/TC307)"as one of the standards under development, and the rest of the ongoing standards include reference, architecture, governance, compatibility, security, privacy, identity, smart contracts, distributed ledger technology and more than ten other standards[26]. Currently, the Committee has 37 Member States and 14 observer states. While this international collaboration is a work in progress and its effectiveness remains to be seen, it at least shows that industry standards are a trend.

ii. *Blockchain open-source license scheme*

Traditional blockchain did not resolve for downstream users to modify the terms of the license source code and submit an application for a patent, intellectual property rights. Whether the currency to the MIT license, the etheric fang core protocol LGPL, or etheric fang Geth command to the GNU GPL license, even if the subsequent developers don't make any programming code, it's still patentable.

The third edition of the GPL license is expected to help solve this problem. The GPLv3 license defines a "contributor" and proposes the copyright owner use its program under the license, called a "contributor version." Each Contributor shall grant a non-exclusive, free-to-use patent license to others under this license to enable Users to make, use, sell or otherwise run, modify and disseminate versions of participants in their content. This, to a large extent, solves the situation that original blockchain developers are "isolated" because they do not apply for patents. In addition, it can better solve the problem that "contributors" who apply for patents still have the freedom to participate, contribute and share after submitting patent protection, and their concerns about technological innovation can be well solved.

iii. *Disclose the patent scheme*

An Open Patent, also known as the Patent Pledge [27] or Patent Commons [28], is a public commitment made by the Patent holder at their will. The patent holder does not claim all or part of his patent rights against any person or a particular group.

IBM was the first advocate of open patents. In order to promote technological innovation in the information industry and express its support for open-source software, IBM listed 500 patents held by IBM and related foreign patents on its official website in 2005 and promised that the open-source community could freely use this patented technology and would not claim patent infringement under any circumstances. IBM also announced that its commitment not to Sue the open-source community is legally binding. IBM's open patent movement includes the user interface, data storage and management and operation of a multifunctional application, data processing, man-machine interface, image processing technology, the Internet management, compression and encryption technology, as well as the method of electronic commerce essential technologies, such as the public for open source in solving problems of intellectual property rights, which has a fundamental enlightening significance. In addition to IBM, Google made the same move in 2013, promising to open up 200 patents to the open-source community and promising not to Sue for patent infringement. Tesla also announced in 2014 that, in the spirit of the open-source movement, to promote the progress of electric vehicle technology, Tesla Motors would disclose its patents to the outside world and would not Sue for patent infringement.

Studies have shown that opening patents positively encourages participation and contribution and promotes technological innovation[29]. Thus, not only will it benefit the industry as a whole, but it will also help

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guide participants to open technologies and markets built by patent owners, thus making strong network effects.

V. Research Conclusions and Prospects

The breakthrough of open-source software on intellectual property theory is reflected in three aspects: copyright, patent, and trademark rights. It has its own property rights system constraints in the form of license, requiring joint ownership of property rights. Product rights are entirely open to the outside world, and anyone can use, modify and release source code software free of charge.

As a product of rapid technological innovation in today's society, blockchain plays an essential role in many financial and non-financial industries. The first generation of Bitcoin takes MIT license's open strategy, and the second generation of Ethereum takes GNU GPL, which can't solve the innovation difficulties. The original blockchain developers made everything open for free based on the recognition of open-source culture. However, neither individuals nor enterprises can prevent many subsequent blockchain developers from applying the core program for further development and filingmany patent applications. It will cause the original blockchain developers to worry whether these patents will slow down or even endanger blockchain technology innovation.

According to the dilemma mentioned in the article, this paper tentatively proposes three possible solutions: industry-standard license plan, blockchain open-source license plan, and open patent plan. First, an industry-standard licensing program, aimed at resolving from different companies, different projects, different communities, and even different countries encountered in open source software collaborative innovation problems, is helpful to improve compatibility between open source components, improve joint operation, to reduce the system transformation between time cost and workforce cost, promote the further incremental innovation and open innovation. Second, whether the MIT license of Bitcoin or GNU GPL of Ethereum cannot solve the problems that some developers can apply for patent successfully even without code contribution. The emergence of the GPLv3.0 license with the "contributor" and "contributor version" would help original innovators freely participate and contribute. This can alleviate the concerns raised by open-source believers that patent protection could hinder technological innovation. Third, open patent scheme, that is, the legal commitment of the patent holder to disclose patent information and allow external participants to use it, and not to file patent litigation. Advanced technology companies such as IBM, Google, and Tesla have all made attempts. Studies have shown that the disclosure of patents can guide the construction of the technology and market of the disclosed patent holders and help establish network effects.

Taking blockchain and its open-source strategy as an example, this paper puts forward the intellectual property dilemma encountered by open-source software. Its uggests solutions, which are of great significance for filling the research space in this field and expanding the theoretical research on open source intellectual property. The next step will be a valuable attempt to deepen the effects of different schemes further and explore their detailed mechanism of action.

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