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Promoting Regional Cooperation and International Harmonization of Trademark Law with Frontier Technological Innovation

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Abstract: In the era of globalization, international harmonization of trademark law is essential. At the same time, the emergence of cutting-edge technologies such as AI and blockchain has completely provided a new solution to trademark protection and management, while also challenging the existing legal framework. These technologies require cross-border cooperation to effectively harmonize trademark law. This article examines the role of innovative technologies in enhancing international harmonization of trademark law, with a focus on improving trademark protection and administration. This paper combines legal analysis, technology assessments and case studies to explore the impact of these technologies on international harmonisation. The study aims to answer the following key questions: How do current challenges in international trademark harmonization affect global cooperation? What is the potential of technology to solve these problems? The expected conclusion is that innovative technologies can significantly simplify international harmonization of trademark law, facilitate cross-border cooperation and strengthen legal frameworks. This paper may help to advance global IP protection and provide new insights into international trademark law harmonization, contributing to a more cohesive and efficient global IP landscape.

Keywords: Regional cooperation, trademark law, international coordination, intellectual property protection, cutting-edge technological innovation

1. Introduction

This study's importance stems from its examination of how these technological breakthroughs can be harnessed to expedite the harmonization of trademark laws on an international scale. By delving into the confluence of technology and legal systems, this research endeavors to pinpoint avenues for bolstering the efficacy and potency of trademark protection worldwide. It also aims to tackle the hurdles that come with integrating these technologies into the legal fabric, such as concerns regarding privacy, security, and the digital divide.

To navigate this study, a diverse research approach will be adopted. This encompasses an exhaustive literature review to lay a solid groundwork for existing knowledge and practices. A comparative legal analysis will scrutinize the variances and commonalities in trademark laws across different jurisdictions and their potential transformation through technological integration. Case studies of exemplary technology implementations within trademark law will yield tangible insights

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into the advantages and impediments faced. Moreover, consultations with legal authorities, tech experts, and industry stakeholders will contribute a multifaceted view on the matter.

This research endeavors to enrich the dialogue on the trajectory of trademark law in the digital epoch, offering strategic guidance for policymakers, legal professionals, and tech innovators on how to steer through the intricacies of international trademark harmonization in the age of technological advancement.

2. Current Situation and Problems of International Harmonization of Trademark Law

2.1. Evolution and Changes of International Harmonization of Trademark Law

The Paris Convention for the Protection of Industrial Property, signed in 1883, is the earliest milestone in the coordinated protection of international trademark law. In 1893, the Madrid Agreement Concerning the International Registration of Marks was signed. Half a century later, not only was the Nice Agreement concerning the Classification of Goods and Services for the Purposes of the Registration of Marks adopted, but so was the related Protocol. In addition, with the establishment of the World Trade Organization in 1994, the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) summarized the results of the development of trademarks over the past century and set new standards of protection. The Trademark Law Treaty signed in the same year has also made important progress in simplifying trademark registration procedures.

In recent years, the World Intellectual Property Organization has accelerated the process of international harmonization of trademark law by promoting the formulation of joint recommendations on well-known trademarks, trademark licensing and even the Internet. This kind of international harmonization is profoundly affecting the integration process of national trademark legislation. The most recent example is India's new trademark law, which came into force on September 15, 2003. The Trans-Pacific Economic Partnership Agreement (TPP), concluded in October 2015, further enhances the protection of intellectual property rights, including trademarks [1].

2.2. Main Issues of Current International Harmonization of Trademark Law

With the rapid development of production technology, the way of trade is also experiencing earthshaking changes, product circulation channels are increasing, circulation speed is accelerating, and circulation scope is also expanding. In this context, the challenge for trademark law lies in the conflict between its inherent territorial limitations and the growing need for international protection. As a result, many trademarks are unable to obtain effective legal protection when they are used across borders, so trademark owners cannot realize their due benefits, and the public cannot obtain due convenience and benefits from the trademark system.

Since the 1980s, the progress of technology and the lack of trademark protection measures have made trademark infringement more difficult to control. By means of modern science and technology, trademark counterfeiting has become increasingly common, and the protection of the rights and interests of trademark owners is facing severe challenges. At the same time, with the rapid development of international trade, product markets are gradually developing towards internationalization and integration. Under this trend, no country can stay aloof and must be integrated into the international economic and trade system. With the continuous expansion of the market scale, the economies of all countries will participate in international competition, which makes the original strict regional trademark law face the pressure of change. Although the international protection of trademarks has made some progress, countries have signed the *Paris Convention for the Protection of Industrial Property* and the *Madrid Agreement Concerning the International Registration of Marks*. As an open international convention, the Paris Convention has

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established the national treatment and the right of priority, but it does not deny the regionality of trade mark law. The Convention also does not make unified and specific provisions on the scope of the object of trademark rights, the exclusive right to use trademarks and its restrictions, and the specific protection system of well-known trademarks [2].

At the same time, a variety of trademark infringement forms emerge endlessly, forming many obstacles to the normal transaction and smooth flow of international trade, and creating some abnormal and distorted situations in international trade. It has become a common voice to correct and curb trademark infringement, and to regulate trademarks uniformly in the international context.

In addition, the provisions of the content of the national trademark law are inconsistent, there are differences, controversial, and even some contents that are completely opposite. For example, China's trademark law holds that the defendant's use of the disputed mark must be "use in the sense of trademark" to constitute infringement of registered trademark rights, and non-trademark use behavior is the legitimate use of registered trademarks. The newly amended *Trademark Law of the People's Republic of China*, which was promulgated on August 30, 2013, seems to have elevated this view to the status of a statute. However, from a worldwide perspective, this is far from the consensus of trademark jurisprudence. Infringement of a registered trademark as defined in Articles 57 (1) and (2) of the *Trademark Law* (2013) corresponds almost exactly to Article 5 (1) (a) and (b) of the European Council Directive on the Harmonization of Trademark Law in Member States [3]. In Arsenal Football Club v. Matthew Reed (2002), the European Court of Justice (ECJ) ruled that, regardless of whether the alleged act is a trademark use or not, any infringement of the core function of the trademark may constitute trademark infringement. In May 2013, the United States Court of Appeals for the Second Circuit also pointed out in Kelly-Brown v. Winfrey that trademark use is not a prerequisite for trademark infringement; in commercial activities, any unauthorized use can constitute trademark infringement. Moreover, Article 16 of the TRIPS Agreement explicitly provides that: “the owner of a registered trademark enjoys exclusive rights, it may prohibit any third party from using identical or similar signs on identical or similar goods designated in its registration in commercial activities without its permission, which may cause confusion to the relevant public”.

3. The Impact of Frontier Technological Innovation on Trademark Law

3.1. Artificial intelligence and trademark applications

With the continuous advancement of artificial intelligence technology, it plays an increasingly important role in promoting social progress and change. This technology has been widely used in several industries, and its development has benefited from the availability of large amounts of training data and the decreasing cost of computing. AI is closely linked to the field of intellectual property, especially at all levels of commercial standards, and AI technology is bringing significant changes in a gradual and far-reaching way.

According to statistics from the World Intellectual Property Organization (WIPO), the number of global trademark applications reached 13.4 million in 2020, an increase of nearly 1.9 million compared to 2019, an increase of 16.5%. In the same year, the number of valid trademarks registered by 149 intellectual property offices worldwide was nearly 64.4 million. Faced with such a large number of trademark applications and registrations, trademark examiners are undoubtedly faced with the more difficult task of reviewing and dealing with more risks of conflicts with existing trademarks [4]. Fortunately, the application of artificial intelligence technology provides an effective solution to alleviate this pressure, allowing examiners and applicants to devote more energy to resolving more pressing conflicts.

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3.2. Application of Blockchain Technology in the IP Ecosystem

As an important innovation in the field of information technology, blockchain technology has formed a new type of database software by integrating distributed networks, encryption technology, smart contracts and other technologies. With its transparency, immutability and traceability of data, this technology is expected to solve the problem of trust and security in cyberspace, promote the transformation of the Internet from information transmission to value transmission, and reshape the information industry system.

The deep integration of blockchain technology with other information technologies such as the Internet, big data, and artificial intelligence has shown its application potential in the field of trademarks. Because blockchain technology has the characteristics of decentralization, data immutability, consensus mechanisms and timestamps, it has been widely used in many fields [5]. At present, blockchain technology has been widely used in intellectual property fields such as copyright and patent rights. In the field of trademarks, the application of blockchain technology is being continuously explored by professionals and has achieved initial results in the process of judicial evidence collection. Blockchain technology provides strong technical support for the confirmation and use of trademark rights, and its application in trademark registration and monitoring shows great potential. It can not only improve the efficiency and accuracy of trademark registration, protect the legitimate rights and interests of trademark owners, but also provide strong data support for trademark management. With the continued development of blockchain technology, there is every reason to believe that trademark registration and monitoring will become more efficient, secure and transparent in the future.

4. The Necessity of Promoting Regional Cooperation and Promoting International Harmonization of Trademark Law with Frontier Technological Innovation

4.1. The Need to Break Down Barriers and Resolve Regional Disputes on Trademark Law

In the field of trademark law, the principle of territoriality followed by different countries leads to significant differences in legislation, which makes multinational investors think before making investment decisions. Careful consideration must be given to the following key issues: whether trademark rights are acquired on the basis of registration with a patent office or on the condition that the trademark has been used prior to registration. When multiple applicants meet the same conditions for registration, only the person who applies first will be granted the right. Whether trademark registration needs to be examined by the patent agency is the basic principle of registration. Whether the application for trademark registration not only needs to be examined by the patent office, but also needs to be published and accepted by the public. For the same or similar goods, whether it is not allowed to use the same or similar trademarks, that is, whether to follow the principle of one trademark one registration. Whether a patent office can itself hear a dispute over a refusal of examination or an opposition to a registered trademark. The names and functions of trademark registration and enforcement agencies vary from country to country, and the establishment of specialized intellectual property courts has become a global trend. Since the establishment of the trademark registration system, the registration agency has always been at the core of maintaining the reputation of the trademark. Due to historical reasons, the names of trademark registration agencies vary from country to country, and some are directly called trademark offices, such as the Trademark Office of China; Some patent offices are responsible for trademark registration, such as the German Patent Office and the Japan Patent Office; The United States also initially adopted this model, and later established the United States Patent and Trademark Office; Others belong to industrial property offices or intellectual property offices, such

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as the National Industrial Property Offices of France, Portugal, and Spain, the Swiss Federal Intellectual Property Office, the British Intellectual Properties Office, and the Singapore Intellectual Property Office [6]. In order to build a single market, the European Community will be responsible for trademarks and designs designated by the Office for Harmonization in the Internal Market. A European Trademark Office will also be established under the forthcoming European Takasone Regulation.

The functions of these bodies also vary. Some institutions are responsible for the whole process from formal examination to substantive examination on absolute and relative grounds, as well as opposition supervision, such as the China Trademark Office, the United Kingdom Patent and Trademark Office and the Japan Patent Office; Others only examine absolute grounds and are basically open to applications, with issues resolved in invalidation proceedings, such as the Benelux Trademark Office; there are other bodies in the middle, which are only responsible for examining absolute grounds and providing an opportunity for prior right holders or prior trademark owners to oppose, such as the Office for the Harmonization of the Internal Market, the French National Institute of Industrial Property and the British Intellectual Property Office. The last scenario is relatively more common.

On the issue of extraterritorial use of trademark law, there is a lack of a uniform rule system in the legislation and judicial practice of various countries, which leads to inconsistent application standards in judicial trials and contradictions. Due to the territorial nature of trademark rights, the use of trademarks is also subject to geographical restrictions. Whether the use of a trademark outside the territory of a country has the legal effect of that country's trademark has become a difficult point in dealing with the issue of extraterritorial use of trademarks. In China, there is a lack of systematic rules on the extraterritorial use of trademarks in legislation and judicial practice, and the applicable standards in judicial trials are not uniform. For example, regarding the legal effect of foreign-related OEMs, China denies that foreign-related OEM of unregistered trademarks belong to trademark use in trademark acquisition procedures, thus denying that it has a legal effect against trademark registration in China. In the maintenance of trademark rights, the foreign-related OEM of a registered trademark is recognized as trademark use, so as to maintain trademark rights. In the latest judgment on trademark infringement, the court also recognized that foreign-related OEMs of infringing trademarks are trademark infringement. China's trademark law should learn from the successful experience of the EU trademark law and gradually recognize the legal effect of the extraterritorial use of trademarks in legislation and judicial adjudication.

4.2. The need to actively respond to new issues and challenges of intellectual property innovation

With the rapid development of information technology and network technology, as well as the innovative breakthrough of traditional industrial technology, the complexity of trademark protection is increasing day by day. The nature of goods and services has also undergone profound changes, such as the emergence of domain names and other new objects of trademark law, trademark itself from the traditional text, graphics or a combination of the two, to the integration of smell, music and other media diversification directions. The differences in the specific provisions of the trademark system in various countries constitute a serious obstacle to the international circulation of goods. These factors urge the legitimate rights and interests of trademark owners and consumers to be better reflected in the existing trademark legal system, thus promoting the development of the international trademark protection system in the direction of unification, concretization and integration. In view of the limitations of the existing conventions, the formulation of a new, more scientific and reasonable international trademark convention has become an inevitable trend.

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The rapid development of artificial intelligence technology has brought global challenges, and no global regulatory consensus has yet been formed. Regions such as China, the European Union, and the United States have adopted different models of AI governance, and cooperation between different countries and regions is crucial for AI governance and this cooperation is gradually strengthening. The existing research is mainly based on the "consumer + artificial intelligence" human-computer interaction consumption decision-making model, but the arrival of the era of comprehensive artificial intelligence decision-making may bring more severe challenges. If consumers gradually become invisible in their direct interactions with operators, commodities and brands, the weakening of human subjectivity may touch on deeper issues of scientific and technological philosophy [7].

In the current trademark examination process, the examination of graphic trademarks mainly relies on the examiner's manual comparison of graphics. As the number of trademark applications continues to grow rapidly, so does the pressure and time required for examination. In the face of a graphic trademark, examiners need to compare tens of thousands of prior trademarks, and even if they work overtime, it is difficult to alleviate the examination pressure caused by the surge in applications. This problem does not only exist in our country, other countries also face the same challenge. With the accumulation of historical trademark data, the difficulty of image matching is also increasing in geometric progression. Using the progress of information technology to improve the efficiency of trademark image retrieval has become the consensus of all countries. The Trademark Office is actively cooperating with national trademark authorities and domestic graphic technology leaders to explore the application of artificial intelligence technology in trademark graphic comparison.

The combination of trademarks, artificial intelligence and policy responses has attracted wide attention from relevant international institutions. In 2019, the World Intellectual Property Organization (WIPO) took the lead in sorting out issues related to commercial standards law; In the same year, the U.S. Patent and Trademark Office issued a request for public comments on intellectual property protection for AI innovations, including trademarks; In 2021, the UK Intellectual Property Office launched a public consultation on issues relating to trademark infringement and the application of existing trademark law; The European Union Intellectual Property Office (EUIPO) has embarked on an AI project aimed at further developing its current AI technologies in the areas of formalities, classification, image search, comparison of goods and services, and chatbots. In new economic forms such as virtual reality and Internet economy, the application of trademark law may change, but the law itself and the methods and rules of it application will remain unchanged [8].

5. The Application of Frontier Technological Innovation in International Harmonization of Trademark Law

5.1. Application of cutting-edge technological innovation in trademark application and registration

Throughout the creation, use and protection of trademarks, human intelligence (AI) has begun to show its influence. During the design and registration phase of the trademark, the applicant can use AI to search for and design the trademark style; in the trademark review stage, the trademark administration uses AI technology to assist in the review process, which helps to improve administrative efficiency; and in the determination of trademark infringement, AI technology can assist in quickly detecting infringements and performing similarity comparisons of trademark signs.

As an important tool for expanding human capabilities, the role of AI in improving the efficiency of trademark systems is obvious. AI technology is already playing a role in different stages of

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trademark registration, such as helping applicants choose the classification of goods and services, enhancing consistency in registration decisions, detecting false applications, analyzing and predict potential conflicts when applying for new trademarks, and providing advice and assistance to applicants via chatbots [9]. Overall, AI can bring efficiency and precision to the trademark registration process.

For example, the intellectual property collaborative innovation management system has launched a trademark cloud synchronization service function, which can meet the diverse needs of trademark management, reduce trademark management costs, and quickly solve problems in trademark management, thereby enhancing trademark protection capabilities. The trademark data of the trademark cloud synchronization function comes from the trademark database, and once the system is deployed and implemented, the trademark data will be automatically synchronized to the management system, and the trademark office information can be updated regularly.

Blockchain technology also plays an important role in trademark registration. With blockchain technology, the automated processing of trademark registrations becomes possible. Applicants can submit a trademark application through the blockchain network, and the system will automatically verify the legitimacy of the application and decide whether to accept it. This will greatly increase the efficiency and accuracy of trademark registration.

At present, the Bureau has made significant progress in using AI technology to service trademark graphic examination. Since July 2018, the Bureau has introduced AI technology-assisted trademark graphic search in the trademark review process. After the system is launched, through continuous optimization of the algorithm, the trademark pattern with high similarity can be displayed preferentially, which greatly reduces the time for the examiner to view the trademark and improves the efficiency and quality of the examination work.

5.2. Application of Innovative Technology in Trademark

Human Artificial Intelligence (AI) technology has made progress in aiding online infringement identification, but assessing the use of trademarks in different contexts remains a challenge. With the advent of AI online regulatory tools, they have become effective assistants in combating counterfeit goods and other abuses on online platforms. Therefore, when online platforms execute notice removal procedures in order to avoid joint and several liability for trademark infringement, they can adopt algorithmic filtering and automatic supervision techniques in the copyright field. AI technology can also help law enforcement agencies identify online abuses, especially in the regulation of online marketplaces, which have become the focus of legitimate merchants. In response to infringement, trademark holders can file a complaint through a reporting system. At the same time, AI's automated detection systems are becoming more widely adopted, although these systems still largely rely on human surveys and reporting.

5.3. Application of innovative technology in trademark information sharing and exchange

In the traditional market, there are barriers to information sharing between market players, which can easily lead to the phenomenon of information islands. In addition, the traditional data storage medium is easy to damage, and the trademarked data is also easy to be tampered with. In response to these issues, blockchain technology can provide a more effective solution to prove the continuity and coverage of trademark publicity activities. Through blockchain technology, it becomes relatively easy to prove the amount of advertising, the form of advertising, the coverage, and the duration of advertising, thereby reducing the difficulty of the parties in providing evidence. In the application of the trademark field, the alliance chain is a more suitable choice. As a semi-centralized blockchain system, the alliance chain makes it easier for nodes to access and

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control the data on the chain [10]. When data users access the data on the chain, they need to strictly review the qualifications of third-party depository institutions and limit their management authority, so as to prevent third-party institutions from obtaining malicious evidence and protect the legitimate rights and interests of trademark rights holders from infringement.

6. Conclusion

In the era of globalization, the harmonization of trademark law on an international scale is essential for fostering regional cooperation and safeguarding intellectual property rights. This paper has underscored the critical role that cutting-edge technologies play in facilitating this harmonization and the indispensable nature of regional collaboration.

The disparities in trademark legislation across jurisdictions present significant hurdles for businesses operating across borders. A unified approach to trademark law is needed to streamline the process and ensure robust protection for trademarks worldwide. The international community must unite to forge a cohesive legal framework that mitigates conflicts and enhances global trademark safeguarding.

Technological innovations such as blockchain, artificial intelligence, and big data analytics are at the forefront of this endeavor. Blockchain's ability to provide secure, transparent, and tamper-proof record-keeping is invaluable. Artificial intelligence streamlines the trademark review process and bolsters the detection of infringements, while big data analytics offers predictive insights into potential infringements, enabling preemptive measures.

Regional cooperation mechanisms, exemplified by the European Union's trademark legal system, demonstrate the effectiveness of a unified legal environment within a region. Such initiatives not only streamline trademark processes but also strengthen intellectual property rights across member states, setting a precedent for broader international cooperation.

Despite the promise of technology and regional alliances, challenges persist. The harmonization of technical standards and the alignment of legal implementations across different jurisdictions are ongoing concerns. Continuous dialogue and collaborative efforts are imperative to navigate these challenges and ensure the successful international coordination of trademark law.

In essence, the synergy between regional cooperation and technological innovation is a powerful catalyst for the international coordination of trademark law. By working collectively, we can cultivate a legal landscape that is equitable, transparent, and conducive to the robust protection of intellectual property on a global scale.

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