



# Absorption or Rejection: A Bibliometric Study of Internet-Enabled Development of Intellectual Property (2001–2022)

Ziqian He<sup>(✉)</sup>

Wuhan University of Technology, Wuhan 430000, China  
hzq\_whlg@163.com

**Abstract.** Background: China has entered an era of Internet enabling, which makes intellectual property in the Internet context attract increasing attention. Methodology: based on 400 core pieces of literature on internet intellectual property on the CNKI Database between 2001 and 2022, this paper uses CiteSpace V6.2.R2 to analyze modules of Chinese internet intellectual property research, including author, institution, and keyword, to acquire corresponding knowledge graphs. Also, analysis and anticipation are made for future research trends. Results: These studies are highly influenced by China's policies. The authors and institutions barely cooperate, and most conduct research independently. The keyword analysis suggests that some keywords are internet-enabled, some have unique legal attributes, and some forecast new research interests. Conclusions: There is a close relationship between the Internet and intellectual property. Mutual integration can be recognized as the general trend, but attention should be paid to the rejection between the boundaries of the two disciplines and the controversy of priority. Further research is needed.

**Keywords:** Internet Intellectual Property · CiteSpace · Knowledge Graph · Visualization Analysis · Literature Review

## 1 Introduction

Xi Jinping, general secretary of the Communist Party of China (CPC) Central Committee, held the 25th group study session of the Political Bureau of the 18th CPC Central Committee and pointed out, "Innovation is the primary driving force for development and protecting intellectual property is protecting innovation." It is urgent to keep protecting intellectual property with the continuous development of the Internet to construct a safe, stabilized environment for Internet intellectual property. The Internet, in fact, has long been expediting new industrial formats and the digitization and informatization of various fields and industries in China. Back in 1994, when China realized full-service access to the Internet, distinct absorption could be noticed between the Internet and intellectual property; by June 2022, Chinese netizens reached 1.051 billion, and the Internet penetration rate was 74.4% [1]. The network size and user size have been increasing for Over 20 years. From the proposal of the Internet Plus Plan of Action at the Third Session of the

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12th National People's Congress (NPC) to the initiative of carrying out in-depth "Internet Plus" actions in the 2018 Government Report, they created intellectual property new formats, new connotations, new characteristics, and new development concepts. While physical absorption is of more practical significance since the supervision of intellectual property platforms and the summarization of data are based on the Internet. Admittedly, there are many instances of theoretical and conceptual absorption, including internet intellectual property, domain name right, and other emerging keywords.

Despite the mutual absorption between "Internet+" and intellectual property, it also shows theoretical research and discipline system rejections for the significant essential span between the two disciplines. The rejection of the discipline system stems from the overlap between liberal arts and sciences and the mere absence of relevant interdisciplinary practices. In this context, it further raises an argument about which discipline should be the absorber or absorbed; that is, a question of the master-subordinate relationship and the tendency of integration.

Above, some questions are proposed in this research: (1) in an internet-enabled environment, what are the characteristics of the research status and stream of intellectual property and the correlation between samples? In what patterns are they clustering; (2) what are the research trends and hotspots of internet intellectual property in the future? How should we understand and interpret the process to be absorptive or rejective? The answers may provide some references and ideas for the theoretical research and practical application of Internet intellectual property in China.

## 2 Concept Definition

### 2.1 Internet

The Internet is a vast, logically-consistent global computer network consisting of interconnected networks using standardized communication protocols [2]. The Internet has distinct features. According to Xu [3] and Han et al. [4], it breaks the limitations of space and geography, along with a broader range of information receivers, improved dissemination speed and cycle of information, and convenient, efficient replication function. The all-embracing Internet allows diverse research interests. For instance, Xie et al. [5] investigates the modes of payment, information processing, and resource allocation in Internet finance; Huang et al. [6] are realistic to focus on the impact of the Internet's development on manufacturing; particularly in the law field Ma [7] proposes a set of new ideas of law that adapts to the development requirements in the era of intelligent Internet to establish an integrated legal system.

### 2.2 Intellectual Property

Extensively, intellectual property refers to all rights generated based on creative results and trademarks. Scholars embrace various opinions on its features. According to Zhang et al. [8], intellectual property is immaterial, proprietary, and temporal. Gong [9] considers intellectual property intangible, time-efficient, and regional. Nan [10] believes that intellectual property has a short life cycle and frequent technological updates.

On the other hand, the diversity of intellectual property makes room for its various manifestations. Zhang [11] thinks one of its manifestations is discipline construction because the intellectual property has become an independent discipline that can be integrated with law, management, economics, and other disciplines. Feng [12] analyzes the manifestations of abuse of intellectual property rights (IPR). Xu [13] presents a brief conclusion and analysis of the specific manifestations of abuse of IPR encountered by Chinese enterprises in foreign trade.

### 2.3 Internet Intellectual Property

Internet intellectual property is a new area that emerged owing to the development of Internet technology, including computer software, databases, multimedia, domain names, digital works, and the right to communication on networks [14]. Because of the openness and freedom of the Internet, intellectual property is characterized by its intangible carriers, geographical dispersion, and various forms. Therefore, the community of internet intellectual property mostly emphasizes the protection of IPR. For instance, Li et al. [15] proposes a discussion on the protection of the subject of right and the responsibility of the subject of infringement, the obligation of Internet service providers to notify the subject to delete the infringing content, whether keyword auctions of Internet platforms constitute an infringement of trademark rights, whether punitive damages should be applied to malicious infringement of IPR, and other issues. However, with the rapid development of the Internet, issues involving Internet intellectual property rise ceaselessly and are complicated, which restricts the traditional IPR protection system in this area. According to Cen [16], there is still much progress to be made in the legal system, supervisory measures, and technology to protect internet IPR. It needs to further improve and optimize the legislation and IPR protection systems.

## 3 Data and Method

### 3.1 Data Sources

On CNKI Database, the research takes “internet intellectual property” as the subject term for advanced search in Chinese. The retrieval date is between January 1, 2001 and December 31, 2022. The first retrieval excludes 2,875 dissertations, 74 conference papers, 163 newspaper articles, 5 books, and 4 achievements and acquires 1,587 pieces of literature. To guarantee comprehensive, authoritative, and normative research, the second retrieval for only three journal sources (i.e., Beida Hexin (Peking University core periodical catalog), CSSCI, and CSCD) is applied to exclude another 1,185 pieces of literature. At last, 402 are acquired. The equation shows below:

(Subject% = ‘internet intellectual property’ or title% = ‘internet intellectual property’) and ((Year between (‘2001’, ‘2022’)) and ((Beida Hexin = ‘Y’) or (CSSCI = ‘Y’) or (CSCD = ‘Y’))).

### 3.2 Analytical Method

Citespace is a literature visualization analysis software developed by Dr. Chen Chaomei as the team leader at Drexel University, which explores the development frontiers and progress of a specific area by analyzing the keywords, authors, institutions, co-citations, and co-words [17]. In light of the attribute of the internet intellectual property discipline and its logic of disciplinary characteristics, the research uses CiteSpace 6.2.R2 to carry out a visualization analysis of the data to generate knowledge graphs for authors, institutions, and keyword burstiness and clustering, which visualize the research trends and hotspots of internet intellectual property. Then a conclusive analysis of the literature is achieved to provide an in-depth insight into its research stream in China.

## 4 Results of Empirical Analyses

### 4.1 Publication Output Analysis

The analysis of annual publication output intends to embody the overall significance and degree of interest in internet intellectual property [18]. Based on 400 literature samples, the descriptive statistics in time order for the publication output between 2001 and 2022 are achieved using Excel (Fig. 1).

According to the publication output, three stages may be recognized. In Stage 1 (2001–2013), the output is stable and grows slowly, with an annual average of 8. It is the initial research stage for Internet intellectual property, where most studies focus on the theoretical analysis of the combination between the Internet and intellectual property. Stage 2 (2013–2017) realizes a rapid growth in publication output. The community

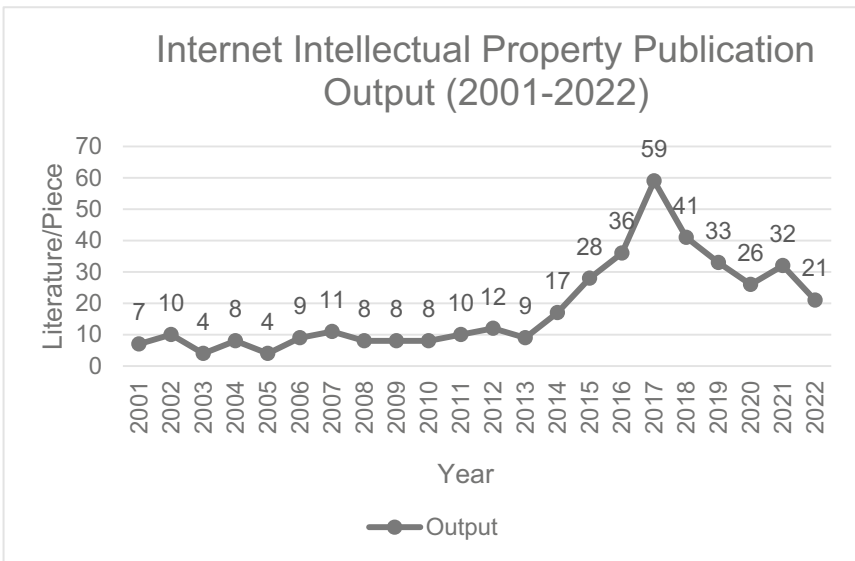


Fig. 1. Internet Intellectual Property Publication Output

came to its first productive period, and the two disciplines started to absorb each other. Significant progress was made from 2014 to 2015. As shown in the figure, the slope indicates a significant increasing trend. It may be because the *Promotion Plan for the Implementation of the National Intellectual Property Strategy* was officially published in 2013 to improve further the IPR system, for which intellectual property was highly enabled by and integrated with the Internet.

Moreover, with the release of the *Promotion Plan for the Implementation of the National Intellectual Property Strategy and Acceleration of Building an IP Powerhouse in 2017* by the State Council, the publication output reached a peak of 59. In Stage 3 (2017–2022), the output is declining yet maintains an annual average of 35. The year 2021 witnessed slight growth. However, during the 5-year practice, the two disciplines failed to realize a perfect integration and tended to separate. Thus, attention needs to be paid to the latter period of their interaction. Considering the interval from research execution to publication, the literature is subject to the time lag in reflecting hot issues [19].

Above, in China, the publication output of internet intellectual property has been growing, and the subject is drawing increasing attention. In this case, these studies highly relative to China's IPR policies are practical and lay stress on policy guidance, which fully demonstrates that internet intellectual property is a research area where theory and practice are closely connected.

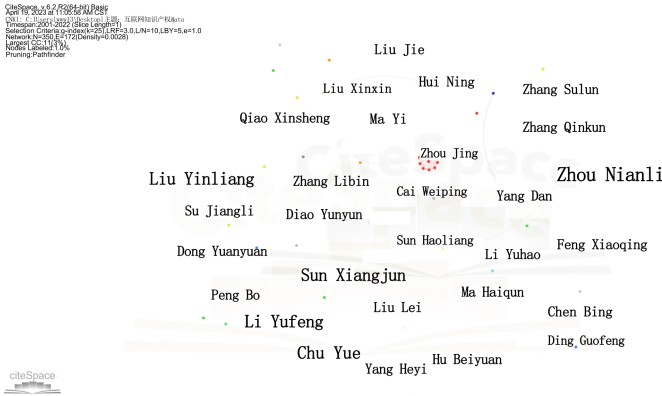
## 4.2 Author Analysis

The author collaboration network reveals the social relations between scholars and researchers of interest in a particular field [20]. The research selects “Author” for the node type, “1” for the time slice, and “topN (N = 30)” for the node threshold to acquire the author graph. There are 350 nodes and 172 lines (indicating 172 collaborations among these authors), and the density is 0.0028, as shown in Fig. 2. The larger the node circle and font, the higher the author's output. In this case, Zhou Nianli, Sun Xiangjun Liu Yinliang, Li Yufeng, and Chu Yue publish the most articles in the area. The research interests of Zhou from the University of International Business and Economics include digital trade, economy & trade, and intellectual property; the research interests of Liu from Peking University include copyright, intellectual property court, etc.; the research interests of Chen from Nankai University include digital trade, antimonopoly law, artificial intelligence (AI), etc. Due to their diverse research interests, absorption and integration can be noticed between different fields.

The colors of the nodes or lines indicate the time of the cooperation. In 2022, Qiao Kaiwen, Liu Ke, He Xiaodong, Zhang Dan, Zhang Jie, Lou Ying, Wang Jie, Zhang Ming, Zhang Baiqiu, and Zhang Lingyu cooperated repeatedly. Based on the cooperative relationship, the network is decentralized for the scattered nodes, which suggests that most scholars conduct their research independently.

## 4.3 Institution Analysis

The research selects “Institution” for the node type and “1” for the time slice to acquire the visualization analysis graph for institutions, on which the size of the font and the



**Fig. 2.** Author Graph of Internet Intellectual Property Research

connecting line indicates the magnitude and cooperative relationship, respectively [21]. Figure 3 shows 287 nodes and 129 lines, and the nodes and lines between nodes are scattered and thin (Density = 0.0031). In light of the information on primary institutions, it can be seen that these institutions rarely cooperate and tend to conduct research independently as high-level universities, among which Peking University has the highest publication output, followed by Sun Yat-sen University and China University of Political Science and Law (see other institutions in Table 1). While law schools are the majority, other institutions, including the State Internet Information Office, China Academy of Information and Communications Technology, School of Economics & Management at Northwestern University, and China Institute for WTO Studies at the University of International Business and Economics, have published studies concerning internet intellectual property to indirectly demonstrate the absorption and integration between intellectual property and other fields.

**Table 1.** Primary Institutions of Internet Intellectual Property Research

No.	Output	Institution	No.	Output	Institution
1	5	Peking University	6	3	Shanghai University of Finance and Economics
2	5	Sun Yat-sen University	7	3	Zhongnan University of Economics and Law
3	5	China University of Political Science and Law	8	3	Southwest University of Political Science & Law
4	4	Renmin University of China	9	3	University of International Business and Economics
5	4	Huazhong University of Science and Technology	10	3	Fudan University



**Fig. 3.** Institution Graph of Internet Intellectual Property Research

### 4.4 Keyword Analysis

Keywords are essential indexes and indicators for literature, reflecting articles’ focuses and correlations. The research selects “Keyword” for the node type, “1” for the time slice, and “Top 50 per slice” for the threshold. The visualization analysis graph for primary keywords is acquired using Pathfinder and pruning sliced networks. The node’s size indicates the frequency of the keyword, and the lines between the keywords indicate the co-occurrence intensity. As shown in Fig. 4, there are 423 nodes and 595 lines (Density = 0.0067). The graph is compact, for the keywords are closely connected. A keyword’s centrality indicates its magnitude, and the keyword has a strong radiation capacity if its centrality is greater than 0.1 (Table 2). Other than the search term, internet intellectual property, keywords including “copyright”, “literary property”, “e-commerce”, and “Internet+” need additional attention because they tend to absorb or be absorbed by internet intellectual property. In essence, “copyright” and “literary property” concern the ownership of rights; “innovation” and “fair use” lay stress on the usage of internet IPR; “tortious liability”, “infringement”, and “protection” focus on the protection of rights and the division of responsibilities.

**Table 2.** Primary Keywords of Internet Intellectual Property Research

No.	Freq.	Centrality	Keyword	No.	Freq.	Centrality	Keyword
1	66	0.37	Intellectual Property	7	8	0.02	E-commerce
2	47	0.24	Internet	8	5	0.02	Infringement
3	16	0.08	Copyright	9	5	0.02	General Terms
4	11	0.04	Innovation	10	5	0.02	Tortious Liability
5	7	0.03	Protection	11	6	0.01	Fair Use
6	12	0.02	Literary Property	12	11	0.00	Internet +

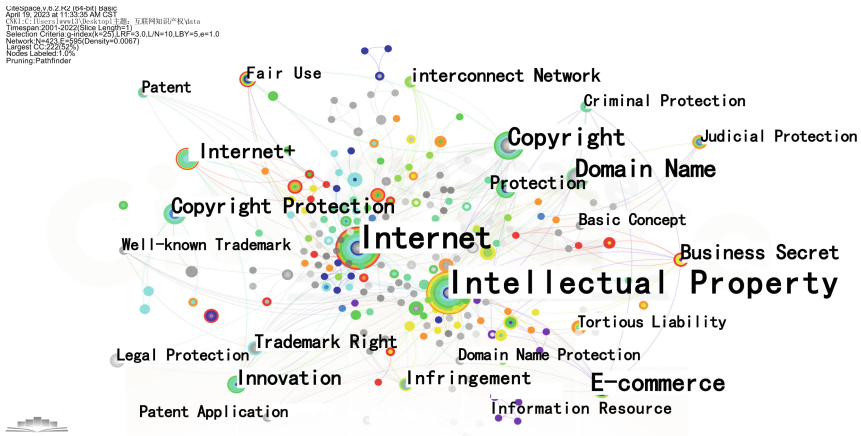


Fig. 4. Keyword Graph of Internet Intellectual Property Research

### 4.5 Keyword Clustering Analysis

K-means clustering and LLR are applied for the keyword clustering Analysis. The research will not present the keywords whose number is less than 10, and 11 clustering graphs are acquired in total. Figure 5 shows 8 representative keywords (#0 Internet, #1 E-commerce, #2 Domain Name, #3 Copyright, #5 Infringement, #6 Trademark Law, #7 Internet +, and #8 Collective Management Organization). It is generally recognized that  $Q > 0.3$  indicates a significant clustering structure,  $S > 0.5$  indicates reasonable clustering, and  $S > 0.7$  indicates convincing clustering [22]. In this research, the clustering is effective and reasonable ( $Q = 0.8348$ ,  $S = 0.9617$ ). Then a time graph is realized, with the vertical axis presenting the clustering tag and the horizontal axis presenting the time (year). Based on the occurrence time, the keywords are spread over their belonging clusters (Fig. 6).

The results of keyword clustering are analyzed from three perspectives. Firstly, the Internet enables the intellectual property to spread to other fields in the course of gradual deepening evolved from the “1 + 1” pattern in the first place to the current “embedding and integration” pattern; from “#0 Internet” to “#7 Internet +”, for instance. Previous research focuses more on intellectual property in the Internet context or based on Internet technologies. Cui [23] analyzes and discusses the challenges and problems incurred by the Internet’s worldwide expansion on the jurisdiction in the dispute about international intellectual property. Starting from the concept of intellectual property and the features of the Internet, Sun et al. [24] discuss the characteristics, trends, and key issues of IPR in the network environment and propose corresponding countermeasures. After that, “Internet +” emerges as the dominant keyword. “+” indicates no mere addition but embedding and enabling. Scholars including Pan [25], Mo [26], Wang, et al. [27], and Zou [28] investigate the archives work of intangible cultural heritages in museums, cross-border cooperation of libraries, development of the film industry, and university patent administration, respectively. They integrate their areas with intellectual property based on “Internet+.” However, currently, there are many difficult problems that some scholars



have offered analyses and solutions for. For instance, Xu [29] emphasizes the construction of an “Internet+” intellectual property operation platform, through which intellectual property operation industrial chains are connected to solve the issues in the traditional intellectual property operation and release the potential value of the intellectual property.

Secondly, intellectual property has its unique legal attribute. The clusters represented by “#3 Copyright” and “#5 Infringement” superficially do not concern the Internet. In contrast, its fundamental legal attribute endows it with commerciality and ownership of copyright that align with copyright, literary property, infringement, trademark, and other research subjects concerning intellectual property. These internet-enabled subjects are not absorbed by the Internet but rather improve themselves during the interaction. The research stream becomes increasingly characteristic. According to Xiong, the direct effects of the mobile internet on copyright can be recognized in the creation, transmission, and usage of works realized digitally. In this context, it urges the related parties to improve their requirements for the transmission efficiency of the copyright law.

At the same time, the invisibility of the Internet triggers more infringements on network works. Therefore, Gu [31] emphasizes that support must be provided from the legal and technological dimensions. Additional regulations should be established and improved to protect the IPR of the network works to expand the copyright law’s applicability. And innovations in big data and blockchain should be encouraged to protect network works’ IPR from the source and provide trackable evidence for infringement acts. According to Han et al. [4], the government should release and perfect laws and regulations based on China’s actual situations, increase the public’s awareness of copyright protection, reshape the rights and obligations of short-video platforms, apply high and new technology-enabled rights protection, etc.

Thirdly, rooted in intellectual property, many new research interests emerge. Taking “#2 Domain Name” as an example, intellectual property enabled by “Internet+” provides a new research background and forms another branch for intellectual property research. Cheng et al. [32] propose countermeasures to protect enterprises’ domain names from self-protection, legal action, and other dimensions. Mao [33] and Feng [34] focus on the conflicts between domain names and trademark right. Chen [35] propose a remedial measure to protect domain name right – anti-cybersquatting. He recommends using legal means to protect legitimate domain name rights, establish specialized agencies and procedures to solve domain name disputes, and bring the international domain name management mechanism in line with China’s mechanism.

In general, it can be seen from the clustering results that clustering keywords themselves fail to become independent research subjects of internet intellectual property. It is safe to say that the rejection between them has not yet formed a robust concept system. So far there are no proper nouns like internet intellectual property.

#### 4.6 Research Trend Analysis

Citespace is provided with burst detection to capture significant citation variations in a certain period. In this case, the function is used to detect the rise and decline of a subject term or keyword so as to understand emerging trends in the field. As shown in Fig. 7, there are 12 bursting keywords, among which “Domain Name” is the first research frontier in the field and has been bursting for the longest time.

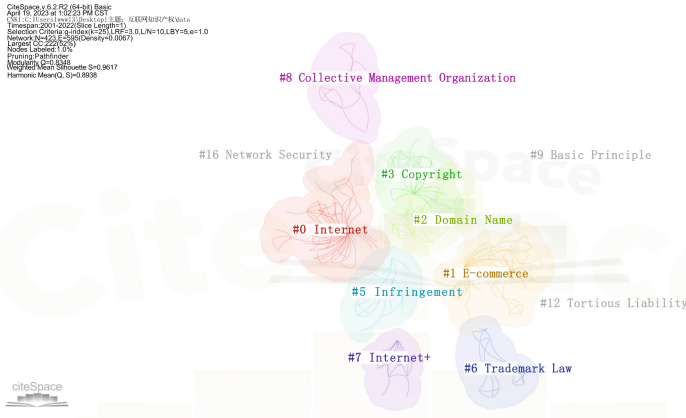


Fig. 5. Keyword Clustering Graph of Internet Intellectual Property Research

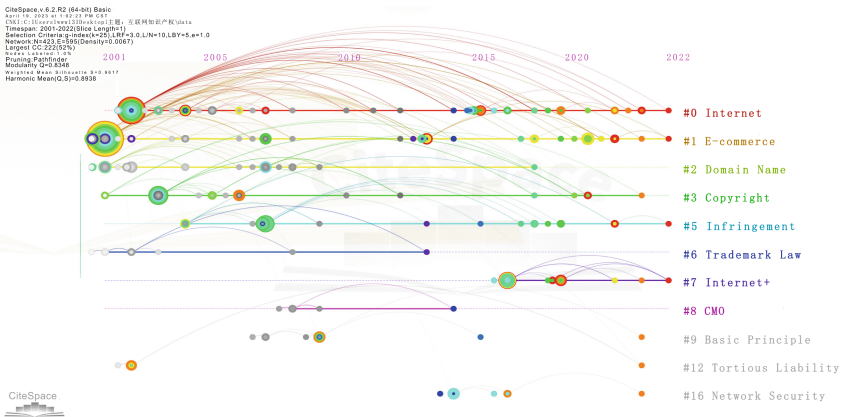


Fig. 6. Timeline graph Graph of Internet Intellectual Property Research

From 2010 to 2020, this area was highly characterized by innovation and fluctuation. “Copyright Protection”, “Digital Trade”, “Innovation”, “Cultural Industry”, “Internet”, “Business Model”, “Broadcasting Right”, and “Protection” burst and kept bursting for 2 or 3 years. The diversity of the keywords burst but short durations indicate that the research interests at this stage were highly innovative but scattered, with insufficient stability and durability.

“Business Model” and “Digital Economy” are representative hot research interests until this study, so it is safe to say that they will become two of the future research interests of internet intellectual property. Also, no integration is found between the two keywords and the knowledge of internet intellectual property to indicate their rejection.

### Top 12 Keywords with the Strongest Citation Bursts

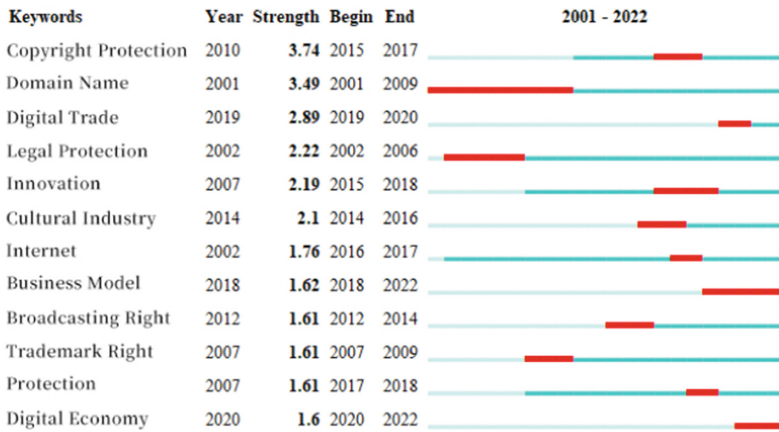


Fig. 7. Graph of Bursting Keywords of Internet Intellectual Property Research

## 5 Conclusions

This research applies CiteSpace for macroscopic description and retrospective analysis of Internet intellectual property and finds a close relationship between intellectual property research and the Internet. They both absorb and reject each other. Such absorption is reflected in various dimensions. In form, the carriers for the traditional intellectual property as the object were tangible, whereas the rapid development of the Internet and people's demand for access to various resources endow the current information transmission paradigm with intangibility. In this case, the Internet is active in promoting the evolution of intellectual property from tangible to intangible. In carrier and format, the Internet and intellectual property interact with each other, during which the former serves as the important basic carrier. Thus, it encourages an increasing number of studies on the impact of the Internet on intellectual property and how intellectual property shapes new formats for the Internet. Overall, as a highly dynamic system with striking characteristics of change, the Internet attaches intellectual property research with many uncertainties that can both be an opportunity and a challenge.

On the other hand, the rejection can be apparent. In research, the two disciplines have different research duration, topics, and methods. Regarding research duration and topic, while few research hotspots have a 10-year burstiness (e.g., "Domain Name"), many emerging topics burst only 2 or 3 years (e.g., "Innovation" and "Cultural Industry"). Regarding research method, the community largely conduct research from the law, economics, management, and different dimension of intellectual property itself. Those highly rejective disciplines with vivid attributes are subject to intimidating barriers to entry and thresholds. In light of the literature cited, one of the indicators of such rejection is that, at present, internet intellectual property research is not prevalent in China, and a proper research system for internet intellectual property is absent. Moreover, the clustering analysis shows that the keywords tend to be separated from each other instead of deeply integrated. In addition to the inadequate integration, it was quite late for Chinese

scholars to pay attention to Internet intellectual property. According to the author and institution analyses, few studies concerning internet intellectual property are published, and most are completed independently. More importantly, the development of the Internet endows the resources with intangibility and uncertainty to aggravate the difficulty of internet-intellectual property integration and indirectly complicate the research of Internet intellectual property.

Above, we would like to raise two topics that need to be focused on and discussed in the future. Firstly, the rejection of disciplinary boundaries requires attention. It is of significance for us to reflect on how to break through the boundaries of the two disciplines to realize the integration and mutual development. Thus, we should first discuss their integrative development and rejection from the disciplinary perspective. Secondly, we should avoid unnecessary controversy and ambiguity of priority. A proper solution to the problems above will further promote a new round of in-depth integration between the Internet and intellectual property.

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