https://doi.org/10.15407/scine17.06.097

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THE PROBLEMS OF THE CREATION OF A PATENT LANDSCAPE BY THE EXAMPLE OF BLOCKCHAIN TECHNOLOGY

Introduction. *The growing interest and huge prospects for the development of blockchain technology have indicated a high relevance of research on this ecosystem.*

Problem Statement. *The priority development of patent analysis technologies is a result of rapid changes in the digital environment. In this regard, information support of the problems of innovative development of digital society, which includes the formation of a patent monitoring system for the development of individual technological areas, in particular, blockchain.*

Purpose. *The purpose of this research is to assess the problems of building a patent landscape for determining innovative attractiveness and identifying the development trends of blockchain technology.*

Materials and Methods. *The study has been conducted with the use of international patent resource PATENTSCOPE. The citation of inventions of blockchain technology has been analyzed based on the Derwent database on the Web of Science platform.*

Results. *The problems related to the creation of a patent landscape have been assessed; the modern development indicators and the world trends in the blockchain technology have been analyzed; the features of its development in leading economies and corporations of the world have been identified. The patent activity of firms in the world leading countries at the international and national level has been assessed. The blockchain technological segments have been positioned, with transactions and blockchain platforms found the most attractive ones. The inventions with the greatest number of references, which testifies to their innovative attractiveness have been identified.*

Conclusions. *Patent analytics is a very powerful tool for assessing technological trends by building patent landscapes and monitoring them. Knowledge of the problems related to the study and the construction of patent landscape allows obtaining objective results and correctly interpreting the development trends of the R&D field under review.*

Keywords: blockchain, patent landscape, inventions, patent statistics, and Patentscope database.

The latest digital technologies are the driving force behind the development of the modern global economy, where each country seeks to take its place and to become technologically developed advanced and competitive.

Citation: Artamonova N. O., and Kapinos M. M. The Problems of the Creation of a Patent Landscape by the Example of Blockchain Technology. *Sci. innov.* 2021. V. 17, no. 6. P. 97—109. https://doi.org/10.15407/scine17.06.097

Digital globalization not only enhances competitiveness but also opens up new channels of access to foreign markets and global electronic value chains.

The development and dissemination of the key technologies underlying the digital economy have a decisive influence on the transformation of the global economic system: it directly affects the production of goods and services, from individual business entities to countries, regions and the global economy as a whole.

In this process, intellectual property gains weight, the amount of which is also growing rapidly. Today, among the leading ICTs, blockchain, Internet of things, 3D printing, artificial intelligence and other digital technologies should be noted. Studies of the development trends of digital technologies and the main directions of their technological improvement will allow us to navigate in this immense space promptly and plan the main directions of the country's promotion on the world market. This certainly applies to Ukraine as an outsider in many of these digital technologies.

The prospect of using the blockchain technology is primarily due to its simplified structure, which is presented as a distributed database and contains a systematic chain of records, that is, blocks, the number of which is growing [1]. This chain of transaction blocks has advantages in protecting its data from distortion and forgery. Secondly, the blockchain has a wide scope, in particular in companies related to finance, trading and investment, computer development and programming, cryptocurrency and cryptography, advertising and marketing.

Despite the lack of in-house developments in Ukraine, the blockchain technology is popular. Over the past five years, the information related to the blockchain technology has reached a new level in Ukraine. The most common areas of the blockchain industry in Ukraine, which are represented by the largest number of companies, are the development and production of goods/platforms followed by the number of financial services. Fewer companies are involved in the public sector, investment, law, media, and education. Separate companies are represented by trading, mining, analytics, security, gaming, marketplaces, locations and marketing [2].

The Blockchain Ukraine Association (BUA) brings together experts from the blockchain industry, whose cooperation dates back to 2014. BUA is a nonprofit organization that actively promotes the integration of blockchain technology into the Ukrainian economy. The main mission of the Association is to develop multilateral dialogue, the result of which will be consensus in all areas of activity. In 2019, BUA proposed a project to create the Ukrainian crypto valley [3].

The growing interest and huge prospects for the development of blockchain technology indicate the high relevance of research on this ecosystem and the prospect of studying the world structure of the blockchain market.

An effective tool for analytical research of innovative scientific and technical areas is patent research with the creation of patent landscapes. Patent statistics as an indicator of technology development objectively captures the changes occurring in technical solutions and ICT. The popularity of these methods has increased in recent years due to the rapid development of the IT industry. Each ICT is actively explored, built patent landscapes and track its development. Among many ICTs for further analysis, we have chosen the blockchain technology, the development of which leads to the transformation of many areas of economic activity.

Since patent documentation includes comprehensive information about technologies and their markets, patent analysis of blockchain technology is a reliable way to identify technological competition, shape future patent strategies in this technology cluster and facilitate the acquisition of sustainable competitive advantages through innovative technologies in a competitive market environment [4].

Blockchain technology has attracted the attention of many researchers from around the world.

These studies cover the multifaceted aspects of blockchain characterization.

Among foreign studies, publications of recent years (2017—2019) can be noted, where such modern tools of data visualization as a patent landscape have been used to one degree or another [5—12].

The first patent research on the blockchain technology market appeared in 2017. Among them are the results of analytical intelligence in the field of blockchain innovations of such leading commercial services as PATSNAP [5], IIPRD [6], as well as Rospatent [7] research.

The experts [5] of these studies focused on the market review, key issues, competitive environment, threats and prospects. As a result, the concept of market trends (the emergence of technology, partnerships), innovative areas, technological areas, the distribution of patents according to the International Patent Classification (IPC) and so on were determined. A forecast has been built for the period up to 2019, where the prospects for the use of blockchain and bitcoins, their impact on future business activities are noted.

More perfect is the study of the intellectual property commercialization company IIPRD (India), in which a blockchain taxonomy was developed for patent analysis, which made it possible to assess individual technological areas (Fig. 1).

The patent landscape was analyzed as of 2017 [6] and the leaders in this area were identified: Bank of America, Bubi (Beijing) Network Technologies Co., and International Business Machines Corporation (IBM).

In contrast to these studies, a comparative analysis of data for previous years was carried out in [7] and a forecast was made until 2019.

Y. Ramasundara and A. Johnson [8] carried out an in-depth analysis (up to and including 2017) of patent family indicators by priority date. At the same time, families were classified as living, dead, or indefinite. A family was considered alive if at least one patent from the family was active or valid. The patent family was considered dead when all patents of family members were not valid

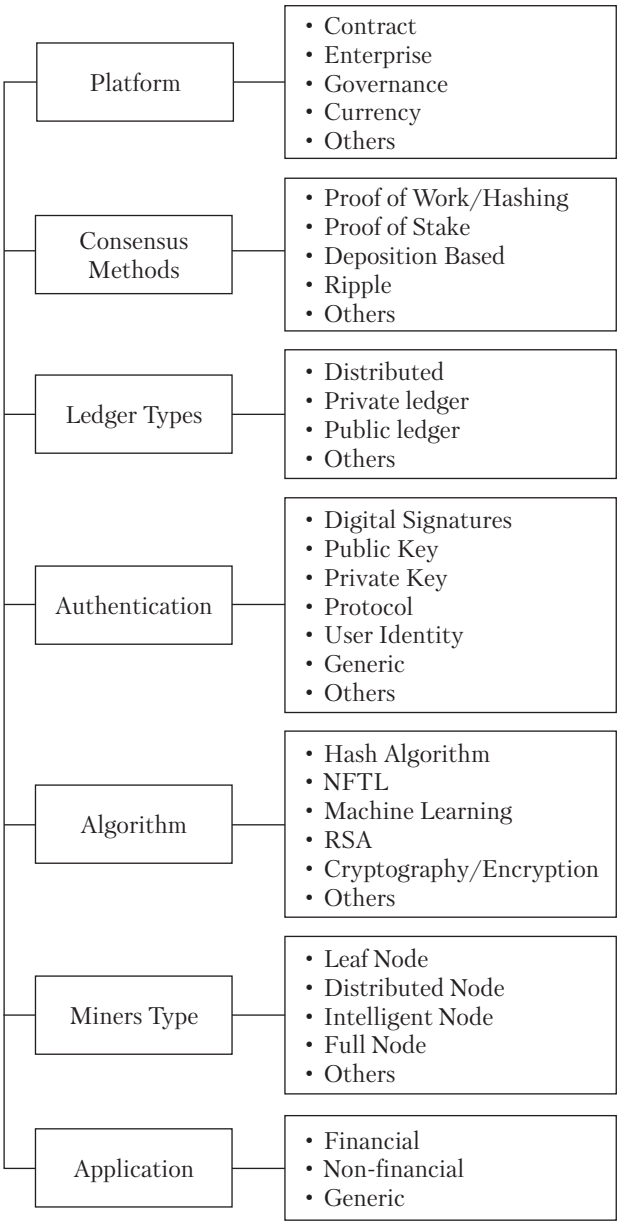

Fig. 1. Blockchain taxonomy according to [6]

or were revoked. The remaining patent families were considered vague due to the lack of information on the legal status of family members. The leading companies in the blockchain ecosystem are highlighted. Coinplug is the company with the largest patent family (69). 92% of portfolio patents relate to the blockchain. Each of these patent families is issued in southern Korea and the

United States. IBM took second place with 12 families, ten of them associated with families from the United States. IBM has a wide geographical coverage worldwide, patents are obtained in Europe, Great Britain, China, South Korea, Germany, Japan and Taiwan. This information, according to the authors, can serve as the basis for strategic planning of research, development, cooperation and commercialization.

Marios Domokos [9] emphasized traditional indicators of distribution of patents by firms, countries, years, separately focused on US developments by firms, by years of filing applications for patents, etc. The study processed the textual content of all patents to simulate topics and identify blockchain processes and technologies. To do this, we used the programming language R and, in particular, the Tidytext natural language processing package developed by Julia Silgi. This made it possible to create word clouds and related networks with the basic terms of all patents and an algorithm for their clustering.

Another study [10] found it more useful to consider patent statistics by firms, financial institutions, universities, and other copyright holders by country and year. The geography of the distribution of patent documents by leading firms (IBM, nChain, EITC Holdings) and an assessment of their technological areas: authentication, smart contracts, finance, identification and consensus were also carried out [11].

In 2019, fundamental shifts are taking place with the blockchain, as a result of which there is a general recognition of technology as a promising reality for solving business problems in various economic sectors. This is primarily due to the great transformational importance of this technology. Although the blockchain has not yet reached its full potential, experienced executives who completed the Deloitte global survey in 2019 [12] are confident in new options for using the blockchain; they still see this technology as a unifying platform that can provide many business processes. They saw the possibilities of using blockchain in practice. So 2019 was a decisive year for transforming the blockchain into a more advanced and mature solution.

Similar studies are conducted in the CIS countries. Russian researchers B. Komleva and A. Chuburkov analyzed a sample of 4461 existing patent families in the blockchain sphere as of September 10, 2018. In terms of the strength and size of the patent portfolio [13]. The quality of the patent portfolio was measured by technological relevance (the number of references to a patent, while the unit was taken as the average number of patent references in a given area of a given age) and market coverage (in how many markets does a patent apply). Accordingly, the quality of the patent family was evaluated by the multiplication of these two factors. The authors noted that the largest patent portfolio (159 patent families in blockchain technologies) belongs to IBM, and the high quality of the portfolio belongs to the World Award Foundation and ServicePower Technologies, while the latter two companies often act as joint applicants. It is recommended that the applicant understand in which jurisdictions patenting innovations in the field of blockchain technology is most widely used because the answer to this question gives the key to identifying jurisdictions in which the best conditions for the commercialization of innovations are created.

Tsvetkova LA analyzed the positions of Russian developers in the global patent landscape. However, she drew attention to the delayed readiness of residents of industrialized countries to expand in the global space of intellectual property associated with the blockchain, as soon as the patentability of the proposed solutions is proven [14]. Bosenko TM highlighted the use of blockchain in the financial and economic sphere and noted that the blockchain as an innovation area has a high potential for commercialization and is of great interest to major players in the technology industry and investment funds [15].

In Ukraine, a study of blockchain technology as an object of industrial property was also conducted [16]. The patent landscape of the blockchain state as of April 15, 2018, is analyzed, the

dynamics of patenting, the thematic structure of patents, their citation are shown. The high patentability of blockchain technology, its prospects and the need for further coverage of specific aspects in the legal and technological field of blockchain are noted.

Thus, we see that blockchain technology attracts a lot of attention, therefore, requires more in-depth analysis over time.

The priority development of patent analysis technologies is due to the rapid changes in the digital environment. In this regard, today there is an urgent task of information support for the problems of innovative development of the digital society, which is to form a system of statistical monitoring of the development of certain technological areas, in particular the blockchain.

The purpose of the study is to assess the problems of building a patent landscape in determining the innovative attractiveness and development trends of blockchain technology. Among the research objectives are important: to monitor patent activity in the field of blockchain technology, to analyze current development indicators and world trends of the blockchain, to substantiate the features of the development of blockchain in the leading countries and leading companies of the world.

The study was conducted on the resources of the WIPO PATENTSCOPE patent portal as of January 1, 2020. Blockchain technology was selected as an object of research with a search in the title field, by name. This type of search was not chosen by chance, since judging by the developed landscapes, the number of patents is overestimated since the search was carried out in all fields. As a result, all works in which the term "blockchain" is used were selected from the database. For example, the term may be mentioned at the end of the description of the invention when listing possible areas of its application. Since blockchain belongs to a new technological direction, which has a rapid development, the search depth is selected in the range of 2014—2019, that is, from the moment the first patent appeared.

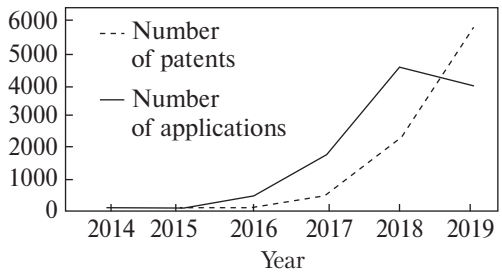

Fig. 2. Characteristics of the patent activity of blockchain technology

The assessment of new markets for blockchain technology was carried out by analyzing the patent landscape according to the following indicators: the number of patents, applications for inventions, distribution by year, country, patent holders, applicants, authors, classifications, subjects, etc. International patent applications were also taken into account in the indicators of patent activity system operating under the Patent Cooperation Treaty (PCT) of the World Intellectual Property Organization (WIPO) and the European Patent Office (EPO). Analysis of the distribution of international applications for the PCT system and European applications allows us to evaluate the significance of the invention because these systems mean the geographical breadth of coverage and reflect the applicant's interest in a specific circle of countries.

The search was conducted for keywords, taxons of the WIPO International Patent Classification (IPC) and the Joint Patent Classification (SEC) of the European Patent Office and the United States Patent and Trademark Office.

Based on the results of the search for the period 2014—2019, 8500 patent documents were found. The number of issued patents increased according to a geometric progression, starting from 1 in 2014 to 5820 in 2019 (Fig. 2).

According to the date of filing applications for inventions, we see a completely different picture, that is, in 2018 the number of applications was maximum (4580 patent documents), and in 2019, their number decreases to 3990. Accordingly, in 2020, an increase in the number of applications is unlikely due to global the Covid-19 epidemic.

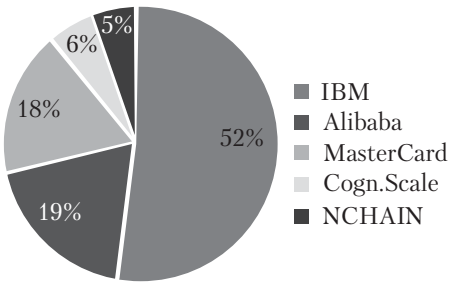

Fig. 3. A group of patent holders in the direction of a blockchain transaction

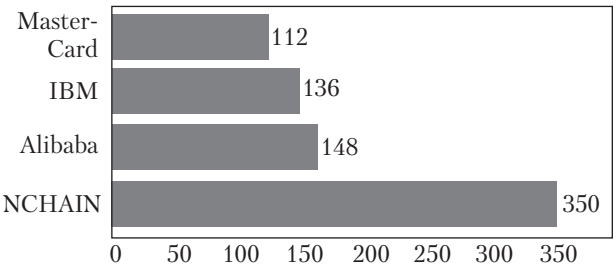

Fig. 4. Blockchain Transaction Applicants Group

The analysis of the division of the blockchain market by countries around the world makes it possible to identify leaders and outsiders. Considering the processes of development of blockchain technology and its gradual transformation into the main direction of globalization of the world economy, we see how the redistribution of the market between the leading countries is gradually taking place. While in 2018, the leader was the United States, in 2019, China came to the forefront [16]. China (3,727 patents) is waging an offensive in the "economic war", gradually displacing advanced countries such as the United States (1,679 patent documents) and confidently occupying leading positions.

The analysis revealed a large number of filed PCT applications (2161 patent documents) and European patent applications (600), which indicates the spread of global processes of influence of leading countries on the monopolization of the blockchain ecosystem.

The keyword analysis (taxons) was made on the following segments: blockchain transactions, database blockchain, blockchain platforms, algorithms, smart contracts, bitcoins and authentication. The search was performed by a combination of fields.

Among these technology segments, the most productive were taxons of blockchain transactions (3895), blockchain platforms (2730), where the largest number of patent documents belonged to IBM USA (Fig. 3), but among the applicants, its main competitor was nChain Holdings Limited. (Fig. 4), which is gradually gaining momentum due to the submission of international applications under the PCT system.

As for other segments of blockchain technology, in particular databases (338 patent documents), Coinplug Inc., Korea; smart contracts or reasonable contracts (335 patent documents) — nChain Holdings Limited and Alibaba Group Holding Limited, bitcoins (466) — the leader of nChain Holdings Limited, authentication (748) — Alibaba Group Holding Limited. Unfortunately, the patent activity of IBM goes out, and Alibaba Group Holding Ltd is gaining momentum and intends to become a leader.

The second methodological tool for organizing patent documents that are internationally identical is the patent classification, including the IPC. This analysis makes it possible to determine which areas of the blockchain are focused on companies that use patents as a basis for innovation, the technological focus of companies operating in the blockchain market. It is technology segments that can be determined using IPC. But to conduct an IPC search, it is not always enough, because digital technologies, in particular blockchain, are new and there are no special subclasses for them.

It is very difficult to determine the necessary class of IPC at the stage of the search, therefore, the search was carried out first by the keyword "blockchain", and then the results are systematized by the information content of the IPC subclasses. Each technological segment was identified by subclasses and subgroups of the IPC, which made it possible to identify the main ones: H04L, G06Q, and G06F, which were refined to subgroups (Fig. 5).

Subgroup H04L9/32 (Arrangements for secret or secure communication, including means for verifying the identity or authority of a user of the system) — 1625 patent documents; G06Q20/38

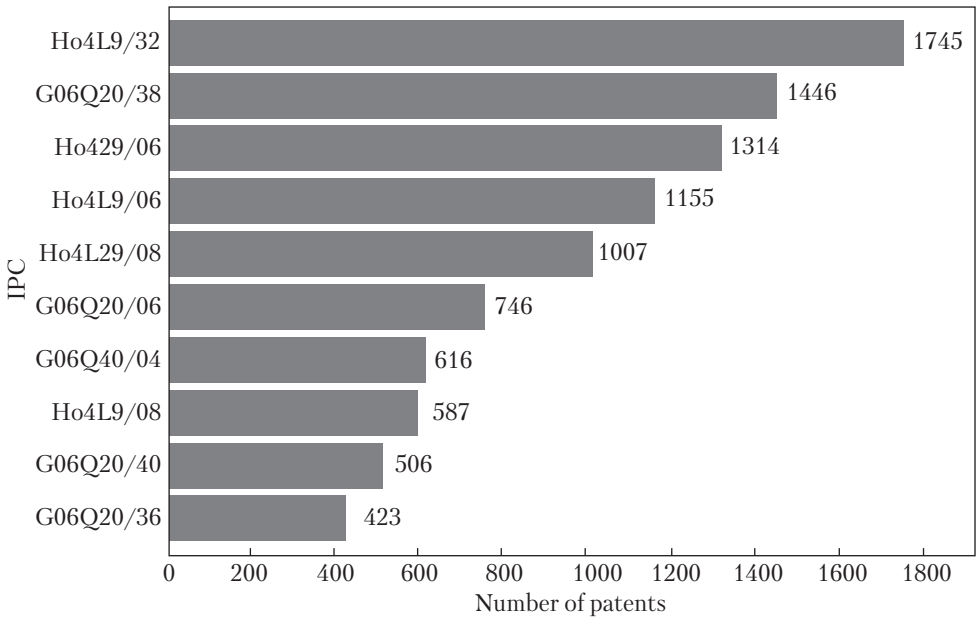

Fig. 5. Distribution of patent documents by subgroups of the IPC

(Payment protocols; details about them) — 1346; H04L29/06 (Arrangements, apparatus, circuits or systems, not covered by a single one of groups H04L 1/00-H04L27/00, characterised by a protocol) — 1229 and H04L9/06 (Arrangements for secret or secure communication the encryption apparatus using shift registers or memories for blockwise coding, e.g. D.E.S. systems) — 1141.

Separately, you can position the leaders in each subgroup (table. 1).

The range of thematic coverage usually characterizes the level of diversification of companies in different technological areas. In this case, this only applies to Alibaba Group Holding Ltd., which leads in two subgroups. But considering the subclass as a whole (H04L), IBM is added, which indicates the importance and relevance of this area. This indicator can be considered as an indicator of the level of competition (scientific, technological and/or market). It should be noted that industry-relevant areas may have a low level of competition at the stage of formation, usually for a short period, such as nChain Holding in subclass G06Q.

These 4 subgroups of the IPC, in which there is a sharp, almost exponential increase in the number of patents over the past 3 years, which indicates the intensive development of new technologies. Such trends in the IPC classification reflect the increased attention of developers and can rightly be considered a breakthrough. Although patenting, as a rule, precedes the implementation of technical solutions at the production level by about 3—5 years, this does not apply to information technology, including blockchain. Their implementation is much faster, almost simultaneously, blockchain technologies are actively implemented in various industries.

The conducted patent analysis with the use of time series of patents based on IPC allows identifying the promising technologies, as well as predicting the emergence of breakthrough technologies. This approach using time intervals allows

Table 1. **Thematic Focus of the Development of Leading Corporations**

Element	Name of Leading Corporation	Number of patent documents
H04L9/32	Alibaba Group Holding Ltd	217
G06Q20/38	nChain Holding	166
H04L29/06	Alibaba Group Holding Ltd	169
H04L9/06	IBM	142

for a short-term (1—2 years) forecast of the development of specific technologies. The formation of such forecast estimates can be useful for identifying or adjusting economic development scenarios in various areas.

More informative is the modern taxonomy of SEC, which is more perfect, contains more technical terms than in the IPC and takes into account the emergence of new terms in the field of ICT (Table 2).

The definition of leading firms in each of the thematic areas shows that according to the SPC, the leading positions were taken by nChain Holding (H04L2209/38 — 100 patent documents; H04L2209/56 — 96; G06Q2220/00 — 57 and H04L9/3293 — 48 patent documents). In this case, the range of nChain Holding's diversification has spread to two subclasses of different technology areas.

In addition to identifying the leading countries and the taxonomy of blockchain technology, there is considerable interest in branded (nominal) analysis to assess the intensity of innovation of companies that occupy leading positions in the intellectual property market of the blockchain ecosystem.

Table 2. **Thematic Content of CPC Groups**

CPC groups	Thematic filling of groups	Number of patent documents
H04L2209/38	Chaining, e.g. hash chain or certificate chain	376
H04L2209/56	Financial cryptography, e.g. electronic payment or e-cash	221
G06Q2220/00	Business processing using cryptography postage metering system using cryptography G06Q2250/05	218
H04L9/3239	Involving non-keyed hash functions, e.g. modification detection codes [MDCs], MD5, SHA or RIPEMD	186
G06Q20/3829	Involving key management	174
H04L9/3247	Involving digital signatures	172
H04L9/3236	Using cryptographic hash functions	172

Before proceeding to the analysis of the activities of companies, I would like to note that when searching all major patent databases, errors are made in the affiliation of firms, and these errors are significant. Each of these records, each affiliation is a separate profile on which statistical calculation of indicators of publishing activity is carried out. The existence of several profiles for one company significantly reduces the reliability and completeness of the obtained scientometric information. The lack of a clear affiliation of the company or author distorts the perception of the organization and the inventor, applicant or patent holder in the world community, isolates them from participation in modern global processes critical today when the general development of science (and grant funding) and its productivity scientific result on innovation) directly depend on international cooperation [17].

That is, when searching by company name, it is not a fact that all patent documents will be found. This is because that there are up to 10 or more options for writing affiliates of the company, its reduction, placement of signs and the like. In our case, also when the leading companies were found, there were four variants of writing the affiliation of Alibaba Group Holding Ltd and two variants of International Business Machines Corporation.

Since the blockchain system since its inception was seen primarily as the development of cryptocurrency and its impact on the manufacturing and business industries, making them more profitable and flexible, much activity in patenting blockchain developments fell on financial corporations. For example, in 2017 the leaders were mainly such financial corporations as MasterCard International Incorporated (40 patents) and nChain Group (37 patents), and in 2019 the first place was taken by Alibaba Group Holding Ltd. (977 patents), on the second nChain Holding Ltd (402 PD), at the third International Business Machines Corporation (323 PD).

All of the above about the activities of companies reflects their international activity. At the same time, analysis of the domestic market of count-

ries makes it possible to get a different picture of the distribution of leaders and evaluate the internal innovative potential of each country individually. So, in the domestic market of China, Tencent Technology (Shenzhen) Co., Ltd has come to the forefront. (214) ahead of Alibaba Group Holding Ltd, (180), which has been a leader for the past three years. Lead Inventor of Tencent Technology Co., Ltd there is Wang Zongyou, which has filed 75 applications, the maximum number of which falls on 2019 and received 52 patents. But this inventor was a coauthor of a group that includes up to 13 authors.

Note that Alibaba Group Holding Ltd focused on conquering the global market, where it maintains its competitive position. It should also be noted the active patenting by Alibaba Group Holding Ltd (144 patent documents) of its developments in the USA.

Alibaba, which occupies a leading position in the most popular patent databases, for example, in Patentscope, was not initially interested in blockchain developments. A sharp increase in patent applications appeared only in 2019, and their total number grew 3 times. It is thanks to the significant growth in patent documents on blockchain technology by Alibaba that leads China to the lead. This fact is not a particular surprise since China is now trying to become a de facto "monopolist" in many areas of IT.

The Alibaba Group is a privately owned, online business group based in Hangzhou, China. The main activities are B2B trading between companies, online retail. The company is patented not only in China since many applications have been filed for a title of protection in the United States. That is, we can conclude that the goal of the company is to be proactive and to obtain patents in those areas that will be of interest to the consumer soon. Since 2017, when the first 12 applications were submitted, their total number increased to 540 in 2019.

The possibilities of such innovative activity are directly related to the policy of the Chinese authorities, which allocate huge funds for the development of blockchain capabilities in the modern economic system. Moreover, China has established the Xiong'An Global Blockchain Innovation Fund (Hangzhou), which invests in the development of blockchain startups. The Chinese Law on Cryptography, which regulates data encryption and cybersecurity, has been in force since 1 January 2020. So, many projects have been implemented in recent years, including the opening of the Hainan Economic Zone, which will invest USD 142 million in the development of the blockchain industry, and OK Group, the operator of the cryptocurrency exchange OKCoin, is investing USD 140 million in a special blockchain development center.

As for the domestic blockchain market in the United States, the undisputed leader is IBM. Like its main competitors, it began its activities in this direction in 2015. It is this year that the first two patent applications from a well-known American holding company appear. In the first year, patent applications were filed to protect both the privacy of online users and the global transactional systems built with this technology. The maximum number of submitted applications is 201, for 2018. However, in 2019, IBM is gradually losing its leadership and reducing the activity of patenting developments to 37 applications in the field of blockchain.

Among the promising inventors in the field of blockchain are Nitin Gaur (25 applications), for which 19 patents have been obtained, the second active inventor is Praveen Jayachandran, who also has 25 applications, for which 20 patents have been obtained.

Another active patentee in the US domestic market is Alibaba Group Holding Ltd, whose leading inventor is Honglin Qiu (37 applications, 22 patents). It should be noted that he is an independent author of 28 inventions.

Thus, it can be stated that all these corporations patent their developments independently without third-party organizations, which indicates the absence and unwillingness to cooperate with others.

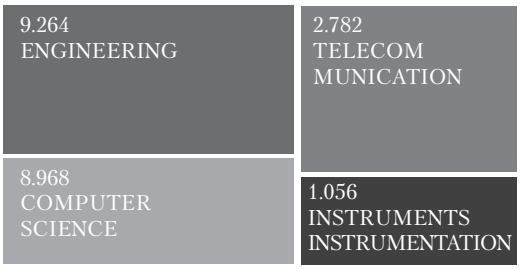

Fig. 6. Analysis of citations of blockchain technology inventions according to the Derwent database

A very important indicator of assessing the significance of the invention is its citation. The number of direct citations of patent documents to the blockchain in other applications is considered an indicator of the economic or technological value of patents. The distribution of citations by thematic focus is shown in figure 6.

The analysis of citations of blockchain technology inventions was performed on the resources of the Derwent database on the Web of Science platform. Selected 49 inventions that have more than 10 references. The largest number of references (58) has the invention of the United States "Method for performing automatic storage of blocks in block chains with cloud computing for providing e.g. digital TV services, involves sending cloud storage objects including received blocks in a block chain with a cloud application to a server" (patent № US9569771), the patent holders and inventors of which are Lesavich S.; Lesavich Z. C.

This invention allows users to obtain a broadband connection to the base station and provides an overall data rate of up to Mbit/s. The method makes it possible to individually determine the location of the received electronic content in the cloud network, thereby providing a level of security and confidentiality for electronic content on the network. The method allows reducing and/or eliminate attacks, eavesdropping and hacker attacks on a secure cloud storage system using the entropy of information to separate parts of the received electronic content.

The second and third places are occupied by two international applications for inventions under the PCT system of corporation Blockchain Technologies «Method for collecting business reviews in a central database accessed by external business review providers involves creating root block payload of root block, where root data hash is computed from the element of root block payload» (WO2016015041), groups of inventors Dixon E., Martin A., Spanos N., Dixon E.T, Martin A.R., Geros A.S. — 45 links.

The method includes generating a root block payload where a set of sliding chain rules is created to describe digital instructions for interpreting data stored in data blocks, and therefore provides the ability to make changes to blockchain control rules and securely store data in blocks.

Another application is "Voting system for securely receiving and counting votes in election, has non-volatile computer-readable memory configured with computer instructions configured to receive private key and public key pair from voter" (WO2016022864), inventors Dixon E., Martin A. and Spanos N. has 36 references. The developed voting system can detect, correct and prevent fraud and errors in the process of counting votes. Votes are stored securely and irreversibly, guaranteeing the speed and accuracy of their verification and counting. Since the counting units deal only with information that is securely stored in the voting chain and does not need access to private keys, there is no security risk.

Accenture Global Solutions, the invention cited 33 times, "System for rewriting blockchains in non-tamper-evident or tamper-evident operation by key secret, has rewrite circuitry for computing collision data with altered data and overwriting original data with collision, should also be distinguished data responsive to commands", inventors Ateniese G., Chiaramonte M.T., Magri B., Treat D., Venturi D., Trea D.

In this case, you should pay particular attention to the fact that this invention is included in the "big family" that includes US patents: US9774578, US10110576, Australia — AU2017269736, AU2017269734, Singapore SG11201809660; European patents: EP3443710-B1, EP3443708-B1, EP344-

3709-B1 and EP3443707-B1, as well as international PCT: WO2017202756, WO2017202757, WO2017202758, WO2017202759, EPO: EP3443709, EP3443707, EP3443708, EP3443710, EP3633916, EP3641220 and applications in other countries: Australia AU2017269736, AU2017269734, Singapore SG11201809660, SG11201809661 and China CN109417478, CN109417479. This indicates, first of all, potential markets that attract the attention of the patent holder.

So, today technologies, knowledge and competencies are becoming the most important resource for the innovative development of the world community. Therefore, it is obvious that the leader will be the one who will own their innovations.

Conclusions

As a result of the study, the following conclusions can be drawn:

1. Assessment of the problems of building a patent landscape of blockchain technology, allowed emphasizing the importance, possibilities of use and interpretation of individual indicators and focusing researchers' attention on such important points as the right choice of the search field (by name, topic or keyword), accounting errors in affiliates.

2. Blockchain technology has prospects for further development, but more in the field of practical application, as the intensity of filing applications for patents is gradually declining.

3. Monitoring of patent activity in the field of blockchain technology allowed to establish a gradual redistribution of players in the blockchain market. Instead of the United States, China is the leader, and these countries account for more than half of the total number of patent documents.

4. The characteristics of each blockchain segment indicate that the most attractive are transactions and blockchain platforms, where the greatest activity belonged to IBM USA. In other segments of the blockchain, in particular databases, algorithms, smart contracts, bitcoins and authentication, Coinplug, Inc., Korea has been identified among the leaders; nChain Holdings Limited and Alibaba Group Holding Limited. The thematic content of IPC and SEC was assessed in detail. Leading subgroups H04L9/32, G06Q20/38 and H04L9/06 are established.

5. The assessment of the domestic market of the leading countries provided an opportunity to get a picture of the distribution of leaders and to assess the domestic innovation potential of each country individually. For example, Tencent Technology (Shenzhen) Co., Ltd, led by Wang Zongyou, has taken the lead in the Chinese domestic market. In the United States, the undisputed leader is IBM., Whose main developers in the field of blockchain are Nitin Gaur and Praveen Jayachandran.

6. Analysis of citations of inventions regarding blockchain technology conducted concluded that the most references have the invention of the United States (patent № US9569771), the patent holders and inventors of which are Lesavich S., Lesavich Z. C.

Thus, patent analytics is a very powerful tool for assessing technological trends by building patent landscapes and monitoring them. Knowledge of the problems arising during the search and construction of the patent landscape will allow obtaining objective results and correctly interpret the development trends of the studied scientific and technical field.

Also promising are scientometric studies of not only patent but also scientific literature in the evaluation of modern technologies, in particular blockchain, using the well-known platforms Web of Science and Scopus.

Conflict of interest. The authors declare no conflict of interest.

This study is a fragment of the planned research work of NTU Kharkiv Polytechnic Institute *Fundamental Research of Modern Problems of Globalization of Intellectual Property in the Digital Economy* (state registration number: 0117U003603, deadline: 2017—2020).

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Received 27.08.2020
Revised 28.04.2021
Accepted 29.04.2021

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ПРОБЛЕМИ ПОБУДОВИ ПАТЕНТНОГО ЛАНДШАФТУ
НА ПРИКЛАДІ ТЕХНОЛОГІЇ БЛОКЧЕЙН

Вступ. Зростаючий інтерес і значні перспективи розвитку технології блокчейн свідчать про високу актуальність досліджень даної екосистеми і перспективність вивчення світової структури ринку блокчейн.

Проблематика. Пріоритетний розвиток технологій патентного аналізу обумовлено швидкими змінами цифрового середовища. У зв'язку з цим на сьогодні актуальним є інформаційне забезпечення проблем інноваційного розвитку

цифрового суспільства, яке полягає у формуванні системи патентного моніторингу розвитку окремих технологічних сфер, зокрема блокчейн.

Мета. Оцінка проблем побудови патентного ландшафту при визначенні інноваційної привабливості та тенденцій розвитку технології блокчейн.

Матеріали й методи. Дослідження проведено з використанням міжнародного патентного ресурсу *Patentscope*. Аналіз цитування винаходів технології блокчейн проведено за даними бази даних *Derwent* на платформі *Web of Science*.

Результати. Проаналізовано сучасні показники розвитку та світові тренди технології блокчейн, визначено особливості її розвитку у країнах-лідерах та провідних компаніях світу. Надано оцінку патентної активності фірм провідних країн світу на міжнародному та національному рівнях. Найбільш привабливими є такі сегменти блокчейн як транзакції та блокчейн-платформи. Виокремлено винаходи, що мають найбільшу кількість посилань, що свідчить про їхню інноваційну привабливість.

Висновки. Патентна аналітика є потужним інструментарієм для оцінки технологічних трендів шляхом побудови патентних ландшафтів та їх моніторингу. Розуміння проблем, які виникають при проведенні досліджень, та побудова патентного ландшафту дозволяє об'єктивізувати результати і правильно визначити тенденції розвитку досліджуваної науково-технічній галузі. Перспективним є подальше удосконалення технологій побудови патентних ландшафтів з урахуванням особливостей об'єктів дослідження.

Ключові слова: блокчейн, патентний ландшафт, винаходи, патентна статистика, база даних *Patentscope*, конкуренція.