TYPES OF OPEN MODELS FOR HIGH-TECH INNOVATION CREATION AND INTELLECTUAL PROPERTY PROTECTION

INTRODUCTION

In the modern economy, the formation and implementation of cooperative strategies, including competitive cooperative strategies (coopetition) (NEVEROV, 2019), is one of the most effective tools for gaining access to new knowledge at the level of enterprises and organizations. These cooperative strategies are collaborations (cooperation) between competitors in business, established to achieve mutually beneficial results (RITALA & HURMELINNA-LAUKKANEN, 2009). This strategy is discussed from various angles (in the context of its pros and cons) in the literature, for example, in the works by James M. Crick and Dave Crick (2016), Krupić, Gračanin and Corrc (2016) and others.

Indeed, in creating innovations, companies pay attention to supporting in-house (intra-company) research and development and attracting new ideas, intellectual results, and competencies from outside. For example, in the Russian manufacturing industry, the analysis of cooperative relations showed that several typical models of innovative cooperation could be distinguished, which are characterized by a focus on vertical cooperation – interaction only within the supply chain; horizontal cooperation – cooperation with various “horizontal” market participants; institutional cooperation – active interaction with the research and development sector and network cooperation – combinations of different cooperative strategies in the development of innovations (Table 1), and so on.

Table 1. Innovation cooperation models in the Russian manufacturing industry

| Cooperation model          | Company strategy features                                      |
|----------------------------|-----------------------------------------------------------------|
| Simple vertical cooperation| Interacting only with consumers, suppliers of raw materials and basic supplies, and service providers |
| Horizontal cooperation     | Collaborating with related companies and competitors, not collaborating with science |
| Institutional cooperation  | Collaborating with scientific organizations, high schools/ universities, not collaborating with market participants |
| Network cooperation        | Collaborating simultaneously with market participants (related companies and/or competitors) and the knowledge production sector (scientific organizations, high schools/ universities) |

Source: Vlasova et al. (2016, p. 1-2)

Open innovation (OI) strategy is a kind of cooperative strategy. It was introduced to the scientific community by Henry Chesbrough (2003). Chesbrough defines open innovation as “purposeful use of internal and external knowledge flows to increase the speed of internal innovation and develop the market for external use of innovation.” This concept suggests that companies and businesses should be more open to innovative processes. It can lead to the attraction of more talents and the transfer of innovative ideas and development and research technologies to other companies. Companies use the open innovation concept for innovative internal ideas that can flow our and external ideas and technologies inside a company. It allows the effective use of potential internal ideas by external companies. Open innovation means that valuable ideas can originate from inside or outside the company, and their commercialization can be done inside or outside the company. Companies accept interests and risks by opening the fences locating between the organizational knowledge and the outside (MORADI et al, 2021).

Interest in open innovation has skyrocketed in the last two decades (see, e.g., Gassmann, (2006); West and Bogers, (2014); Bogers et al., (2017); Bogers, Chesbrough, and Moedas, (2018); Bogers, Chesbrough, and Strand, (2020). Today, open innovation scholars run dedicated conferences, give Ph.D. courses, and top journals have developed an appetite for open innovation special issues. The field has surely matured.
Networking of various industries and social life is another trend of our time. It is studied in general terms, for example, by Benkler (2006), who offered readers the results of a global study of the networks development and their impact on the economy, and from the standpoint studying specific industries, for example, Hsua, Lin, and Weic, (2008), Heredia Pérez et al., (2018). They develop the thesis that studying the knowledge-based economy features and creating an appropriate economic paradigm to accelerate technological innovations is an urgent task for governments. Issues related to the challenges and adaptation of competition policy in the knowledge-based economic system require in-depth discussion. The authors also emphasize changing the role of key institutions of competition law and the competition itself and the increasing role of R&D in the competition success. Avdasheva, Golovanova, and Katsoulacos (2019) describe the approaches and legislative initiatives supported by the antimonopoly Service of the Russian Federation to find answers to the new challenges posed by the network economy for competition and its maintenance. Demsetz and Villalonga (2001), Zhou, Leenders and Cong (2018) investigate implications of networking in property law and property as such.

In this format, the purpose of this article is to identify the features of the network model of innovation activities in the field of high-tech technologies embodied in the equipment of civilian use (computers, household appliances, etc.) in the context of intellectual property protection, regarding the provisions of economic theory, the OI strategy features based on the analysis of real "acting" projects implemented within the framework of this strategy in the high-tech sector abroad. The working hypothesis is that the use and selection of open models for innovative interactions of interested parties when creating high-tech innovations of civilian use is based on different cooperation strategies in the intellectual property development and protection but always gives advantages over working alone.

At the same time, although relations between enterprises participating in a consortium (pool, etc.) to create a joint technology portfolio that combines research results are built according to the traditional scheme, new technologies - distributed ledgers (blockchain), smart contracts, etc. - are able to significantly modernize traditional approaches to the protection of intellectual property rights in such a way that the need for its protection by patents in the traditional sense will be practically reduced to zero (MASHDUROHATUN et al, 2021a). Considering the approaches to achieving this goal, we proceed from the standpoint of the research subject significance, necessity, need for answers to the questions posed in the article for the development of society in the context of life networking (blockchain implementation, etc.) and the practice of such business strategy as the use of open innovation strategies based on competitive cooperative collaboration while applying and developing new technologies (blockchain, smart contracts, etc.).

The goal itself determines the novelty of this research in this format.

The theoretical and practical significance of the results obtained lies in providing the readers with advanced scientific information on possible approaches to the designated area of regulation from the standpoint of the law, economic benefits, and the resolution of controversial legal issues arising from the development of new technologies and scientific, technical and moral progress in general.

**LITERATURE REVIEW**

The theme for studying models for high-tech innovation creation and protection of their intellectual property was chosen for research because of the increased global popularity of cooperative strategies, including competitive cooperative strategies, developed in the context of open innovation strategies and economy networking. In this format, it seems necessary for confirming the working hypothesis of the article to identify the innovation network model features in the field of high-tech technologies embodied in the equipment of civilian use (computers, household appliances, etc.) in the context of intellectual property protection, regarding the economic theory provisions and the OI strategy peculiarities based on the analysis of real "acting" projects implemented within the framework of this strategy in the high-tech sphere abroad.
This research was conducted using expert data in the works of domestic and foreign researchers on a selected range of issues. The problems raised in this article are considered in numerous publications. Barancheev (2007), Zemlickienė (2011), Allen (2003), Yu et al. (2020) studied it from the standpoint of analyzing models for the high-tech products development and market launch. Hwang (2020), Duysters and Hagedoorn (1998), and Gomes-Casseres (1997) made their investigations from the perspective of the influence of co-innovations on technological convergence and the role of strategic technology alliances and technological competencies, and patent analysis, including joint patents. Fraga-Lamas and Fernández-Caramés (2020) studied blockchain use in the practice of open innovation strategies. Chesbrough (2003) considered the open innovation practice itself, including on the part of small and medium-sized enterprises (2021), Benkler Yochai (2006) studied implications of network effects in the economy and James M. Crick and Dave Crick (2016), Krupić et al. (2016) discussed cooperative strategies.

In general, the current state of research is characterized by the studies that emphasize the different facets of the study of the results of the “intersection”, the simultaneous study of cooperative strategies, including the strategy of open innovation, and the network economy, usually through the prism of patent analysis. From this viewpoint, the article is an attempt to give a comprehensive analysis of open models for high-tech innovation creation and protection of their intellectual property from the standpoint of confirming the working hypothesis that the selection and use of open models of innovative interactions of interested parties when creating high-tech innovations of civilian use are based on different cooperation strategies in the intellectual property development and protection, but always gives advantages over working alone.

MATERIALS AND METHODS
The studied materials and data were obtained from open information sources and from paid access resources:

- Laws and other normative acts and documents, cooperation agreements, etc.;
- Scientific publications (articles, monographs chapters, etc.);
- Judicial acts;
- Data posted by Xerox, Fuji Xerox, Cisco, Siemens, and other companies on their publicly available official websites.
- The following methods were applied to solve the tasks set in the article, proceeding from analytical reflections on information gleaned from the referenced sources and literature. These methods are based on materialistic dialectics and consist of data collection through the analysis of legal acts and documents, judicial acts, cooperation agreements, and descriptive approach to legal norms and documents in the studied area, and reflective practice. Thus,
  - Method of systematic and informational analysis and conceptualization of the ideas presented in the articles mentioned above, book chapters, etc., along with operations such as induction and deduction, is used during the consideration of the provisions of Xerox, Fuji Xerox, Cisco, Siemens companies’ operational strategies, etc.;
  - Methods of formal and dialectical logic help in understanding the relationship between the companies’ networked cooperation and their open innovation strategies to obtain benefits that are absent when working alone;
  - A materialistic insight into the processes and phenomena of the external world as a whole makes us proceed from the fact that both companies’ network cooperation and integration of open innovation strategies into their operating business strategies are an objective need of the present time.

RESULTS
The results obtained during the study and the undertaken analysis show and make clear the following:
Firstly, it has been established that the application of open innovation strategies to the high-tech sphere, the end products of which are considered as high technologies, and which in themselves are the first market innovative products and the beginning of the innovation market, and their applications in the form of a radical innovation product/service, forming the basis of the innovation market and requiring radical innovation management and marketing in the form of high-tech management and high-tech marketing, respectively (for example, personal computers, mobile phones, foundries, etc.), is justified by several features inherent in these products, such as (BARIČEV, 2007; BARRETT et al, 2021):

- short product life cycles, for example, according to one of the founders of Intel, Gordon E. Moore, each next generation of computers runs 2.5 times faster than the previous one (KRUPIC et al, 2016);

- complex pricing with the simultaneous blurring of the competitive market environment due to the difficulty of establishing the boundaries of the product market. For example, in the decision upon Microsoft’s motion to acquire Skype (2011) the European Commission assessed market share as a factor influencing the regulator’s decision to apply for the competitors’ merger. The decision stated, inter alia, that “... the communications services sector for non-industrial users is a recent and fast-growing sector, characterized by a short innovation cycle, in which large market shares may suddenly turn out to be ephemeral. In such a dynamic context, a large market share does not always correspond to market power and, therefore, is not a signal of the presence of competition restrictions, which should be terminated in compliance with the Regulation 139/2004;

- connection with the creative approach to the application and the accompanying problems of implementation and adaptation in the market. For example, the turning point in the history of digital photography in 1995 was retained in the market memory with the appearance of such consumer cameras as Apple QuickTake 150, Kodak DC40, Casio QV100 with a resolution of 640x480, and in 1996 Olympus entered the market, marking its appearance with interesting models having high resolution and expensive memory cards, which required, firstly, money, and secondly, changes in the thinking and behavior of consumers who were accustomed to film what is seen through the lens rather than look before taking a picture in a small screen of a new digital camera; carry films to a photography workshop for development or develop films at home by themselves instead of sending them to print on a printer in a film developing workshop, etc. (LEWIS, 2020);

- introduction of new knowledge into the organization, which increases the requirements for the level of professionalism (new competencies, etc.) of personnel. Thus, for example, PC usage skills of different levels are one of the requirements for workers in many sectors of the economy now;

- need for new knowledge for the consumers to use the new product. For example, in the final judgment in Meyer v. Kalanick case (2015-2020) (LEWIS, 2020) concerning Uber’s accusations of using a price algorithm, which the plaintiff Spencer Meyer disputed, saying that while using Uber’s services he knew nothing about their Uber Mobile Application Terms of Service, the court ruled that the phrase “By creating an Uber account, you agree to TERMS OF SERVICE AND PRIVACY POLICY, was written in bright blue capital letters and underlined, that is, it has a hyperlink to a third screen containing a button that, when clicked, displayed the current version of the Uber Terms of Service and Privacy Policy. The text, including hyperlinks to the terms, conditions,
and privacy policy, appears directly below the registration buttons. "The entire screen, the court noted, including the Terms of Service notice, was clearly visible without the need to scroll." The court pointed out that "although the font of this text was small, the dark font contrasts with the bright white background, and the hyperlinks are highlighted in blue and underlined". The court also clarified that "a prudent, reasonable smartphone user understands that conspicuous underlined text in blue is a hyperlink to another web page with the Uber Terms of Service". The court held that "such a hyperlink gives the user a constructive notification of the terms of service" and that "a prudent, reasonable smartphone user must understand that these conditions were associated with account creation by the user." (LEWIS, 2020).

Secondly, it was established that the open innovation policy pursued by states (for example, the USA, the countries of the European Union, South Korea, Japan) in the form of institutional cooperation, aimed at enhancing co-innovations in the "firm-university, firm-government, research institute" format, within the state (as exemplified by South Korea; HWANG, 2020) for a long time served as a tool for supporting innovative resources in the form of technological convergence, mainly for firms that were unable to cover the innovation costs or did not have the technologies or workforce necessary for innovations, along with universities that also played a definite role in supporting innovation resources for firms with insufficient innovation capacity.

However, the difference is that in this system, universities have relatively low autonomy in choosing innovative disciplines (courses) compared to other subjects, and they are not as sensitive to changes in technological demand as firms. In contrast, firms themselves have relatively a high level of co-innovations aimed at producing converged technologies through a combination of heterogeneous technologies. Because, on the one hand, firms are very sensitive to changes in the demand for technologies in the market to survive. On the other hand, firms, especially large ones with high financial capabilities, can and often finance most of the research from their internal budgets. Since the innovation process takes time, firms prefer to stay ahead of technology relatively quickly through co-innovations with other firms with different technologies, rather than develop all technologies as internal innovations or innovations with universities.

At the same time, technological convergence is characterized by the fact that the firms’ participation in it as co-innovation partners is always determined by the economic market expediency rather than the goal of creating co-innovations and patents (BELIKOVA, 2019; DUYSTERS, G.; HAGEDOORN, 1998).

The form of participation in OI used by Siemens along with traditional contractual research (BELIKOVA, 2019), is a classic example of technological convergence. It is based on bilateral partnership agreements with universities (for example, Tsinghua University, Beijing, China; Georgia Institute of Technology (GeorgiaTech), USA; UC Berkeley, USA, and others) and research institutes worldwide in the framework of government-funded research and innovation projects in the format of programs of the strategic partner university, which are adapted to the needs of Siemens and the academic community. The dialogue with students includes idea contests and hackathons, Siemens-sponsored doctoral degrees for alumni, and university teaching positions for Siemens employees. Siemens is also a member of various academic organizations that strive to better match industry and academic requirements. Research “co-locations” and “living labs” allow professors, Siemens experts, and students to interact and learn about Siemens’ products and technologies at close hand. An interdisciplinary approach, especially in the digital technology domain, assumes ever greater importance. Siemens shares its industry experience and knowledge of industry needs in developing new training programs on advanced technologies of artificial intelligence, cybersecurity, and the Internet of things. Siemens is actively promoting new partnerships with academic incubators. And Siemens’
flagship scientific collaboration program, “Center of Knowledge Interchange” (CKI), gives the company access to cutting-edge research and highly qualified university staff.\(^3\)

Thirdly, it was revealed that the network form of open innovation currently enjoys the greatest popularity; this form includes a wide range of participants in their current development strategies. For example:

- **the network form of operating companies’ participation in OI** is used by Xerox to improve their products, starting from an increasing number of suppliers (including technology brokers), for cost reduction, to partners in the field of new technologies (major platform extensions and new platforms). For example, since 2006, Xerox often works with its joint venture partner in Japan, Fuji Xerox (based on the 2006 Technology Agreement by and between Xerox Corporation and Fuji Xerox Co., Ltd)\(^4\); together, they did what their competitor Canon Ltd does alone (GOMES-CASSERES, 1997). Thus, in 2011 Fuji Xerox Co. Ltd received 588 patents in the United States, and taken together, these companies received 1,618 patents in the United States, which put Xerox in the eighth place in the list of IFI Patent Intelligence worldwide (XETX BUSINESS SOLUTIONS, 2021). In the new markets, Xerox enters into consortia with other large companies such as Kodak, Motorola, etc. in the context of the stepping stone options strategy;

- **a network form of companies created to participate in OI** was created by Cisco, which strategically located these companies in cities around the world (Barcelona, Berlin, Dubai, Rio de Janeiro, Singapore, Paris, etc.) in the form of co-innovation centers (Cisco Global Co-Innovation Centers); they work with regional and global partners to create new technology solutions that solve sector problems and positively impact business, society and the planet.

Their projects include, for example, the work with a Cisco innovation partner - the largest research agency in the Commonwealth of Nations - The Commonwealth Scientific and Industrial Research Organization (hereinafter - CSIRO), which worked with Cisco’s Australian Co-Innovation Center to collect previously unavailable data and launch the Global Initiative for Honey Bee Health.\(^5\); Also, an OI network consisting of 20 R&D centers was created by Siemens in China in 2016, where more than 4,500 researchers and engineers worked in the R&D field; they applied for and received more than 11 thousand active patents. For example, by September 2016, Siemens Signaling Co. Ltd., Xi’an (SSCX) was the copyright holder of 30 utility model patents and four invention patents granted by the China Intellectual Property Office (CIPO). Signal copies S700 K-C electric point machine, S 21 Balise system, and AŽS 350 U axle counting system, implemented and adaptively developed by SSCX, are widely used on China’s high-speed lines, passenger lines, and metro lines (SIEMENS, 2017).

Fourth, speaking about the protection of intellectual property rights for the results of such innovations, today the traditional approach is still applicable, in which such interaction is most often built on the conclusion of appropriate agreements, based, in turn, on bilateral agreements between countries or companies from different countries in the areas which clearly define the questions of ownership of intellectual property rights (copyright, patent law) for each of the parties to scientific and technical interaction (MASHDUROHATUN et al, 2021).

\(^3\)COLLABORATIONS AND OPEN INNOVATION. Available at: https://new.siemens.com/global/en/company/innovation/collaborations-partnerships.html. Access: Apr. 03, 2021.

\(^4\)TECHNOLOGY AGREEMENT BY AND BETWEEN XEROX CORPORATION AND FUJI XEROX CO., LTD, 2006. (terminated due to expiration on 31.03.2021) Available at: https://www.sec.gov/Archives/edgar/data/108772/000119312518026297/d530502dex994.htm. Access: Apr. 04, 2021.

\(^5\) CISCO GLOBAL CO-INNOVATION CENTERS. AVAILABLE at: https://www.cisco.com/c/en/us/solutions/innovation-centers.html#~our-centers. Access: Apr. 03, 2021.
Thus, cross-licensing intellectual property rights should be assigned to the fourth form of OI. For example, in March 2015, Fuji Xerox Co. Ltd and Microsoft Technology Licensing LLC announced major patent cross-licensing agreements (in such agreements, each party grants the other party its intellectual property rights), ensuring that Microsoft and Fuji Xerox would continue to benefit from the access to each other's significant and valuable patent portfolios and accelerate research and development. The agreement covered a wide range of products and services offered by Microsoft and Fuji Xerox, including digital imaging, document management, and mobile consumer products. The agreement was otherwise undisclosed; however, as it was noted in connection with its conclusion, this agreement demonstrated the power of patent licensing to stimulate involvement in innovation and increased opportunities for cooperation between mutual technologies and intellectual property assets of both companies, it encouraged greater interoperability and provided valuable consumer protection. Overall, more than 1,100 licensing agreements have been entered into since Microsoft launched its Intellectual Property Licensing Program in December 2003 (MICROSOFT NEWS CENTER, 2015).

Fifth, the very relations between enterprises participating in a consortium (pool, etc.) to create a joint technology portfolio that combines research results and/or the finances of one (several) of the partners within cooperation agreements are still built according to traditional schemes (Figure 1).

**Figure 1.** The mechanism for creating a joint technology portfolio

![Figure 1](image)

Source: Adapted on the basis of Lebedeva (2016)

Sixthly, from the viewpoint of joint patenting, which becomes the result of such interactions, it is reported (as exemplified by the United States): 1) an increase in the number of such patents (for American companies based on the results of their joint research and other works conducted with their foreign partners (except for those with scientific centers and representative offices of Siemens, Sony, Nokia, etc.) from 6% in 1982 to 14% in 2004); 2) joint patents tend to be strong innovation equal to and sometimes greater than the power of innovative work done by the same firm using groups of inventors located exclusively in the United States, overpassing even the patents developed by firms abroad exclusively by foreign teams of inventors. Joint patents are more successful than others because more applications are filed, back-citations are made within and outside of such inventors’ teams, applications are more original, they list more subclasses. They are characterized by new combinations of technologies (KERR & KERR, 2015).

Seventh, proceeding from the fact that OI adherents emphasize the need to benefit from the use of one’s intellectual property by others, and the inventor, in turn, acquires the intellectual property of other companies at a stage when innovation has acquired the quality of the protected intellectual property, rather than controls it, so that competitors cannot take advantage of the inventor’s results. It was established that one of the opportunities for creating a field of legal certainty and security in the conditions of open innovation strategies provided by networking is based on the use of blockchain distributed ledger technology (IVANOV et al,
By linking the principle of cooperation with open innovation, blockchain creates a new paradigm, making open innovation more efficient, productive and ethical in the process of cooperation between science, politics, industry, and community to achieve greater goals. How? Blockchain is able to bring quality and sustainability benefits in four main dimensions: cybersecurity, accountability, transparency, and traceability. Thus,

- cybersecurity of an application is provided by a reliable cyber-resistant digital infrastructure based on the implementation by designing in such basic technologies as the Internet of Things (IoT), artificial intelligence (AI), etc.,
- accountability is associated with the recognition by an organization or an individual of the consequences of their actions, taking responsibility for them (for example, in the form of corporate social responsibility, etc.), which implies a quantitative assessment of the internal and external consequences of actions and the presentation of reports thereon to all interested parties. Such reporting should be understandable, relevant, reliable, and comparable across different organizations and over time;
- transparency means that the external impact can be derived and understood from the reporting of all external interested parties;
- traceability is understood as the ability to identify and trace assets (for example, products, parts, processes, events, data, and materials) from the moment they arise until the production and distribution processes are implemented and, ultimately, until the end of their life cycles. It can be internal (within its own organization) and external (striving to receive a flow of information about the asset movement between various logistics systems and processes of several organizations) (FRAGA-LAMAS & FERNÁNDEZ-CARAMÉS, 2020).

Eighth, it was established that other mechanisms for implementing cooperation in the OI format include its modeling between the interested parties using smart contracts that can deal with the timestamp of any disclosure or creating IP objects and automate corrective actions in the event of unauthorized use of IP, IP infringement and information disclosure, acting as signed NDAs (non-disclosure agreements) (RIMSAN & MAHMOOD, 2020). In addition, stimulating and rewarding mechanisms can be created (for example, in pre-negotiated cryptocurrencies by analogy with GlucoCoins (FERNÁNDEZ-CARAMÉS et al, 2019) concerning diabetes) to promote global knowledge about a particular subject or object. Thus, this could be done as applicable for The Dow Chemical Company and Fuji Xerox Co., Ltd, which joined Eco-Patent Commons in October 2010, a first-of-its-kind business coordinated by the World Business Council for Sustainable Development (WBCSD) to help the environment by promising to grant environmentally beneficial patents to the public domain (MCCAFREY, 2009). This approach provides benefits while meeting requirements such as compliance with statutory regulations, including regulatory office processes, and data transparency for the parties involved in the cooperation and participants with simultaneous confidentiality provided by the sovereignty of data ownership and protection.

DISCUSSION

It is pointed out (ALLEN, 2003) that companies use various concepts of high-tech product development (Table 2); according to experts, more than 60% of developments of all new high-tech products are discontinued before their commercialization, and the remaining 40% are withdrawn from the market after their commercialization. In the polls, the companies list marketing problems (55% of respondents), product defects (16%), too high costs for the development of new products (10%), production problems (6%), other reasons (13%) among the reasons for the failures of new high-tech products.
Table 2. Concepts of high-tech product development used by the companies

| Concepts Used                                | Author (Year)                                                                 |
|---------------------------------------------|-------------------------------------------------------------------------------|
| High-technology products                    | K.R. Allen (2003), J. Strebel, T. Erdem, J. Swait (2004), C. Easingwood, S. Moxey, H. Capleton (2006), A. Sharma, G. Iyer, H. Evanschitzky (2008) |
| Technology innovation products              | V. Zurylo, N. Iazvinsk (2007)                                                 |
| Product innovation                          | K. Tollin (2008), J. Zhang, C.A. Di Benedetto, S. Hoenig (2009)               |
| Product innovation and technology           | R.G. Cooper, S.J. Edgeett (2010)                                              |
| High-tech products and innovations          | J. Mühr, S. Sengupta, S. Slater (2010)                                         |

Source: Zemlickienė (2011)

In this regard, it seems understandable to apply open innovation strategies suggested by Chesbrough (CHESBROUGH, 2003; CHESBROUGH, 2006a; CHESBROUGH, 2006b) to the high-tech sphere, based on a number of the following concepts, justifying great profitability, expediency, and other collaborations compared to working alone:

1) the failure of the above strategies and the search for new ones (YU et al, 2020);

2) the fact that there are many innovative ideas in the market that can bring profit; however, for a company to get part of this profit or to profit from discoveries for business, it is not necessary to find an idea by oneself and make a discovery (for example, after technologies developed by Xerox Corporation in cooperation with the Palo Alto Research Center were rejected by the former as unsuitable for further innovations, later they were effectively applied by the latter (TRIFILOVA, 2008),

3) the vision about the need to develop and bring the idea to the market by oneself, because the company that first creates innovation and brings it to the market will no longer become a leader, since leadership is determined rather by the optimality of the business models than by the primacy of entering the market (this is, for example, in a significant part of the Cisco’s corporate strategy of recent times (KRUPIĆ et al, 2016);

4) the opinion that one should optimally work with the leading specialists of one’s own company and leading outsourced specialists, use internal and external innovations based on partnership agreements or crowdsourcing, involving a wide range of people in solving various problems of innovative (production) activities to use their creativity, knowledge, and experience in the form of subcontracting work voluntarily applying information technologies, organized by various platform companies or marketplace companies that provide a place where the proper specialists are selected for the project;

5) in cases where innovations acquire the quality of intellectual property protected by law, it should not be controlled in terms of being used by competitors but profit from the fact that others use one’s intellectual property, and the person, in turn, acquires the intellectual property of other companies.

In this regard, our opinion is that over time, due to the increasing development of distributed ledger technology, the very need to issue patents in various clusters (areas of activity, subsectors of the economy) will disappear and will be replaced by blockchain technology, in the medium and long term even without obtaining patents. Since even if there is an unlimited number of anonymous users in the public blockchain, technologies will soon become so complex that even experts (specialists) alone, not to mention ordinary people, will not have an actual opportunity (material, production, resource, and other bases) to embody the results of intellectual creativity of scientific teams and their members into materialized objects of the world (for example, in the form of products printed on a 3D printer).

However, there are also adherents of a different opinion (FRAGA-LAMAS & FERNÁNDEZ-CARAMÉS, 2020), who believe that open innovation, being uncertain in the result and

---

6 See in more detail at. https://www.cisco.com/c/cru_ru/index.html. Access: Apr. 03, 2021.
associated with high risk, in the absence of trust or problems therewith that impede cooperation and involvement of the interested parties in open innovation processes, especially for small and medium-sized enterprises, fit perfectly into the idea and practical implementation of distributed ledgers, they need to strengthen the protection of intellectual property rights, which includes responsible open source licensing, application processes for ideas (QUINN, 2018), the creation of more qualified and reliable ledgers of intellectual property objects (know-how, patents, trademarks), keeping better records, licensing and concluding non-disclosure agreements (NDAs), automatic payment of patent royalties and income from creative activities in accordance with the amounts predetermined by agreements.

Nevertheless, the issue of open innovation development based on the introduced advanced technologies is a future that needs to be closely monitored.

In addition, it should be noted that the effectiveness of companies’ open innovation strategies depends on the type of cooperation; therefore, before using an open innovation strategy, companies should carefully study the partner’s type and check which partner best suits the goals they hope to achieve through joint open innovation. Thus, if we talk about the companies’ cooperation with universities, it should be remembered that such cooperation will exert a relatively small impact on technological convergence. This conclusion can be exemplified by developing basic technologies that are not developed in the market but have large external effects (ARROW, 1962; NELSON & WINTER, 1982).

CONCLUSION
The research confirmed the working hypothesis that the selection and use of open models of interested parties’ innovative interactions when creating high-tech innovations of civilian use is based on different cooperation strategies in the development and protection of intellectual property but always gives advantages over working alone. It is shown that the main feature of the general-purpose high-tech technology implementation is associated with the need for the simultaneous formation of psychology and skills of using a new product among consumers and manufacturers.

It is revealed that when using the open innovation concept, the strategies of enterprises have either the form of institutional cooperation in the form of technological convergence or networking interaction of participants in the innovation process. At the same time, there is a wide range of attraction of the latter: from students and university professors to other enterprises and their employees, including foreign centers created by the interested parties. The profit-making schemes employed by the participants of innovative network cooperation are given. It is shown that the effectiveness of cross-licensing agreements in the field of intellectual property is associated with the involvement of foreign and interdisciplinary specialists in such innovative cooperation, which significantly increases their productivity, the level of inventiveness, and the quality of new products.

The main features of networking of high-tech technologies obtained in the open innovation process are formulated – the presence of numerous agreements, contracts, and smart contracts (including cross-border ones) between the participants in the process; provision of mutual access for all participants to databases, including intellectual property; application of blockchain technology for ensuring the security, transparency, accountability, and controllability of the use of rights to joint inventions and patents.

FUNDING
The reported study was funded by RFBR according to the research project no. 20-011-00154 A.

REFERENCES
ALLEN, K. R. Bringing New Technology to Market. New Jersey: Pearson, 2003.

ARROW, K. Economic Welfare and the allocation of resources for invention. In NELSON, R. The rate and Direction of Incentive Activity: Economic and Social Factors. Princeton: Princeton university press, 1962, p. 609–626.
AVDASHEVA, S.; GOLOVANOVA, S.; KATSOULACOS, Y. The role of judicial review in developing evidentiary standards: The example of market analysis in Russian competition law enforcement. International Review of Law and Economics, 2019, 58, p. 101-114. Available at: https://doi.org/10.1016/j.irel.2019.03.003 Access: Apr. 16, 2021

BARANCHEEV, V. P. High-tech marketing of radical innovations (radical and “disruptive” innovations - high-tech marketing). Textbook. Moscow: LLC Blagovest-V, 2007, p. 11-12.

BARRETT, G.; DOOLEY, L.; BOGUE, J. Open innovation within high-tech SMEs: A study of the entrepreneurial founder’s influence on open innovation practices. Technovation, 2021, 103. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0166497221000134#abs0015 Access: Apr. 17, 2021

BELIKOVA, K. M. Evolution of basic doctrines and principles of contract law in Europe. Amazonia Investiga, 2019, 8(22), p. 173-182. Available at: http://www.udla.edu.co/revistas/index.php/amazonia-investiga/article/view/1637/2183 Access: 17/09/2019

BELIKOVA, K. M. Legal aspects of the Brazilian government in stimulating the generation and implementation of scientific information as innovations. Amazonia Investiga, 2019, 8(20), p. 91-97. Available at: https://www.amazoniainvestiga.info/index.php/amazonia/article/view/67/45 Access: May 31, 2020

BENKLER, Y. The wealth of networks: how social production transforms markets and freedom (NEVEROV, 2019st ed.). New Haven: Yale University Press, 2006.

BOGERS, M.; CHESBROUGH, H.; MOEDAS, C. Open innovation: research, practices, and policies. California Management Review, 2018, 60(2), p. 5-16.

BOGERS, M.; CHESBROUGH, H.; STRAND, R. Sustainable open innovation to address a grand challenge: Lessons from Carlsberg and the Green Fiber Bottle, British Food Journal, 2020, 122(5), p. 1505-1517. Available at: https://doi.org/10.1108/BFJ-07-2019-0534 Access: Apr. 16, 2021

BOGERS, M.; ZOBEL, A.-K.; AFUAH, A.; ALMIRALL, E.; BRUNSWICKER, S.; DAHLANDER, L.; FREDERIKSEN, L.; GAWER, A.; GRUBER, M.; HAEFLIGER, S.; HAGEDOORN, J.; HILGERS, D.; LAURSEN, K.; MAGNUSSON, M. G.; MAJCHRZAK, A.; MCCARTHY, I. P.; MOESLEIN, K. M.; NAMBIAN, S.; PILIER, F. T.; RADZIWON, A.; ROSSI-LAMASTRA, C.; SIMS, J.; TER WAL, A. L. J. The open innovation research landscape: established perspectives and emerging themes across different levels of analysis. Industry and Innovation, 2017, 24(1), 8-40. Available at: https://www.tandfonline.com/doi/full/10.1080/13662716.2016.1240068 Access: Apr. 16, 2021

CHESBROUGH, H. Open business models. How to thrive in the new innovation landscape. Harvard: Harvard Business School Press, 2006.

CHESBROUGH, H. Open Innovation: The New Imperative for Creating and Profiting from Technology. Boston: Harvard Business School Press, 2003.

CHESBROUGH, H.; VANHAVERBEKE, W.; WEST, J. Open innovation. researching a new paradigm. Oxford: Oxford University Press, 2006.
DEMSETZ, H.; VILLALONGA, B. Ownership Structure and Corporate Performance. *Journal of Corporate Finance*, 2001, 7, p. 209-233. Available at: https://pdfs.semanticscholar.org/a98d/4335bb33071972cd32a4e89de0fc8371ed57.pdf Access: Aug 10, 2019

DUYSTERS, G.; HAGEDOORN, J. Technological convergence in the IT industry: The role of strategic technology alliances and technological competencies, *International Journal of the Economics of Business*, 1998, 5(3): 355-368.

FERNÁNDEZ-CARAMÉS, T. M.; FROIZ-MÍGUEZ, I.; BLANCO-NOVOA, O.; FRAGA-LAMAS, P. Enabling the Internet of Mobile Crowdsourcing Health Things: A Mobile Fog Computing, Blockchain and IoT Based Continuous Glucose Monitoring System for Diabetes Mellitus Research and Care. *Sensors (Basel)*, 2019, 19(15). Available at: https://pubmed.ncbi.nlm.nih.gov/31357725/ Access: Apr. 04, 2021

FRAGA-LAMAS, P.; FERNÁNDEZ-CARAMÉS, T. M. Leveraging Blockchain for Sustainability and Open Innovation: A Cyber-Resilient Approach toward EU Green Deal and UN Sustainable Development Goals. In THOMAS C.; FRAGA-LAMAS P.; FERNÁNDEZ-CARAMÉS T. M. *Computer Security Threats*. London: IntechOpen, 2020. Available at: https://www.intechopen.com/books/computer-security-threats/leveraging-blockchain-for-sustainability-and-open-innovation-a-cyber-resilient-approach-toward-eu-gr Access: Apr. 04, 2021

GASSMANN, O. Opening up the innovation process: Towards an agenda. *R&D Management*, 2006, 36(3), p. 223-228.

GOMES-CASSERES, B. Competing in Constellations: The Case of Fuji Xerox. *World View*, 1997, 6. Available at: https://www.strategy-business.com/article/8969?gko=f1e95 Access: Apr. 04, 2021

HEREDIA PÉREZ, J. A.; KUNC, M. H.; DURST, S.; FLORES, A.; GELDES, C. Impact of competition from unregistered firms on R&D investment by industrial sectors in emerging economies. *Technological Forecasting and Social Change*, 2018, 133, p. 179-189. Available at: https://doi.org/10.1016/j.techfore.2018.03.028 Access: Apr. 16, 2021

HSUA, G. J. Y.; LIN, Y.-H.; WEIC, Z.-Y. Competition policy for technological innovation in an era of knowledge-based economy. *Knowledge-Based Systems*, 2008, 21(8), p. 826-832. Available at: https://doi.org/10.1016/j.knosys.2008.03.043 Access: Apr. 16, 2021

HWANG, I. The effect of collaborative innovation on ICT-based technological convergence: A patent-based analysis. *PLoS ONE*, 2020, 15(2). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0228616 Access: 03.04.2021

IVANOV, A. Yu.; BASHKATOV, M. L.; GALKOVA, E. V.; TYULAEV, G. S.; PIVNENKO, A. S. *Blockchain at the peak of the hype: legal risks and opportunities*. Moscow: Higher School of Economics Press, 2017.

JAMES, M.; CRICK, D. C. The dark-side of coopetition: Influences on the paradoxical forces of cooperativeness and competitiveness across product-market strategies. *Journal of Business Research*, 2021, 122, p. 226-240. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0148296320305750. Access: Apr. 16, 2021
Types of open models for high-tech innovation creation and intellectual property protection

KERR, S. P.; KERR, W. R. Global Collaborative Patents. of Harvard Business School, 2015, 16-059. Available at: https://www.hbs.edu/ris/Publication%20Files/16-059_d8b35c46-be68-4d2d-9ef2-7b0903481982.pdf Access: 03.04.2021

KRUPIĆ, D.; GRAČANIN, A.; CORRC, P. J. The evolution of the Behavioural Approach System (BAS): Cooperative and competitive resource acquisition strategies. Personality and Individual Differences, 2016, 94, p. 223-227. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0191886916300459. Access: Apr. 16, 2021.

LEBEDEVA, Ya. O. Mechanisms of management intellectual property of high technology companies in the conditions open innovation. Moscow State University of Management Bulletin, 2016, 4, p. 182-186.

LEWIS, J. B. Arbitrator’s Joke Not Sufficient to Vacate Award in Putative Antitrust Class Action. Lexology, 2020. Available at: https://www.lexology.com/library/detail.aspx?g=350e57e0-e8b9-8de4e4f3e1e#:~:text=In%20December%202015%2C%20Spencer%20Meyer,Uber%20moved%20to%20compel%20arbitration Access: Sept. 20, 2020

MASHDUROHATUN, A.; SUSILO, A. B.; BAWONO, B. T. Copyright Protection towards the Society 5.0. Journal of Southwest Jiaotong University, 2021, 56(2), p. 394-404. Available at: https://doi.org/10.35741/issn.0258-2724.56.2.32 Access: 17.05.2021

MASHDUROHATUN, A.; YULIAWAN, I.; SUSILO, A. B.; LAKSAMANA, A. W.; MANSYUR, M. A. The Effectiveness of Intellectual Property Rights Protection to Improve Creative Economy Realization in Semarang District. Journal of Southwest Jiaotong University, 2021, 56(2), p. 385-393. Available at: https://doi.org/10.35741/issn.0258-2724.56.2.31 Access: 17.05.2021

MCCAFREY, M. Dow and Fuji Xerox Join Eco-Patent Commons. Xerox pledges additional patent to help the planet. IBM News Room, 2009. Available at: https://newsroom.ibm.com/2009-10-20-Dow-and-Fuji-Xerox-Join-Eco-Patent-Commons?InK=hm Access: Apr. 04, 2021

MEDOVNIKOV, D.. Open innovation poker. IQ HSE RU, 2011. Available at: https://iq.hse.ru/news/177672788.html Access: 02.04.2021

MICROSOFT NEWS CENTER. Fuji Xerox and Microsoft announce patent agreement. Microsoft News Center, 2015. Available at: https://news.microsoft.com/2015/03/19/fuji-xerox-and-microsoft-announce-patent-agreement Access: Apr. 04, 2021

MICROSOFT/ SKYPE. Regulation (EC) No 139/2004 merger procedure. Luxembourg: Office for Publications of the European Union, 2004. Available at: https://ec.europa.eu/competition/mergers/cases/decisions/m6281_924_2.pdf Access: Mar. 21, 2020.

MORADI E., JAFARI S. M.; DOORBASH, Z. M.; MIRZAEI, A. Impact of organizational inertia on business model innovation, open innovation and corporate performance. Asia Pacific Management Review, 2021. Available at: https://www.sciencedirect.com/science/article/pii/S1029313221000038 Access: Apr. 16, 2021

NELSON, R.; WINTER, S. G. An evolutionary theory of economic change. Cambridge, Mass: Belknap Press of Harvard University Press, 1982.
NEVEROV, K.A. Applying a competitive cooperative strategy based on blockchain technology to improve manageability efficiency. Eurasian Integration: Economics, Law, Politics, 2019, 2, p. 33-40.

QUINN, G. Protecting an Idea: Can Ideas Be Patented or Protected? IPWatchDog, 2018. Available at: https://www.ipwatchdog.com/2018/11/17/protecting-idea-can-ideas-be-patented/id=103389/ Access: Apr. 04, 2021

RAHAMAWATI, M. I.; SUKOHARsono, E. G.; RAHMAN, A. F.; PRIHATININGTIAS, Y. W. From Blockchain to Accounting Profession: Evidence from Indonesia. Journal of Hunan University Natural Sciences, 2021, 48(2), 10-16. Available at: http://jonuns.com/index.php/journal/article/view/514 Access: 17.05.2021

RIMsan, M.; MAHMOOD, A. K. Application of Blockchain and Smart Contract to Ensure Temper-Proof Data Availability for Energy Supply Chain. Journal of Hunan University Natural Sciences, 2020, 47(10), p. 154-164. Available at: http://jonuns.com/index.php/journal/article/view/460 Access: 17.05.2021

RITAla, P.; HURMELINNA-LAUkkanen, P. What’s in it for Me? Creating and Appropriating Value in Innovation-Related Coopetition. Technovation, 2009, 29(12), p. 819-828.

SIEMENS INDUSTRY SECTOR MOBILITY DIVISION. S 700 K point machine. Setting points reliably. Braunschweig: Siemens AG, 2008. Available at: https://assets.new.siemens.com/siemens/assets/api/uuid:a0351b96-65f9-43c8-b976-45ee5d9d1d5/s-700-k.pdf Access: Apr. 04, 2021

SIEMENS. Build intelligent infrastructure. In Siemens R&D in China. Beijing: Siemens Ltd., China, 2017, p. 6. Available at: https://assets.new.siemens.com/siemens/assets/public.1505713521.6864f996c64c6c5aa55a629bf8117c0516fbb7f8.siemens-r-d-in-china-en.pdf Access: Apr. 04, 2021

SOUTHERN DISTRICT OF NEW YORK. Case 1:15-cv-09796-JSR Document 126. New-York: United States District Court, 2016. Available at: https://cases.justia.com/federal/district-courts/new-york/nysdce/1:2015cv09796/451250/126/0.pdf?ts=1469881571 Access: Sept. 20, 2020

TRIFILOVA, A. A. “Open innovation” - a paradigm of modern innovation management. Innovation, 2008, 1(111), p. 73-77.

VLASOVA, V. V.; KUZNETSOVA, T. E.; RUD V. A. Cooperative strategies in enterprise innovation. The Science. Technologies. Innovation. Moscow: High School of Economics Press, 2016. Available at: https://issek.hse.ru/news/195422159.html Access: Apr. 15, 2021

WEST, J.; BOGERS, M. Leveraging external sources of innovation: a review of research on open innovation. Journal of Product Innovation Management, 2014, 31(4), p. 814-831.

XETX BUSINESS SOLUTIONS. Patent Filings Rank Xerox Among the World’s Top Innovators. XETX Business Solutions, 2021. Available at: https://www.xetx.com/patent-filings-rank-xerox-among-world%E2%80%99s-top-innovators-0 Access: Apr. 04, 2021

YAROSHENKO, S. Digital cameras: yesterday, today, tomorrow. Comprice, 2005. Available at: http://www.comprice.ru/articles/detail.php?ID=42747 Access: Apr. 03, 2021
Resumo
A pesquisa tem como objetivo confirmar a hipótese de trabalho, identificar as características dos produtos de alta tecnologia de uso civil e analisar projetos reais de "atução" implementados dentro da estratégia de OI. A análise foi realizada com base na informação e compreensão sistemática das ideias apresentadas em artigos científicos, capítulos de livros, etc., utilizando indução e dedução (como estudo de caso das empresas Xerox, Fuji Xerox, Cisco e Siemens), métodos de lógica formal e dialética para entender os benefícios da cooperação em rede e da estratégia de OI. Assim, por exemplo, mostra-se o conceito de OI nas estratégias da empresa assume o caráter de cooperação institucional na forma de convergência tecnológica ou networking com o envolvimento de uma ampla gama de participantes neste último: de estudantes e professores universitários a empresas e seus funcionários, incluindo centros estrangeiros estabelecidos pelas partes interessadas etc.

Palavras-chave: Alta tecnologia. Estratégias cooperativas competitivas. Estratégia de inovação aberta. Networking da economia. Propriedade intelectual.

Abstract
The research aims to confirm the working hypothesis, identify the features of high-tech products of civilian use and analyze real "acting" projects implemented within the OI strategy. The analysis was carried out based on the information and systematic understanding of ideas presented in scientific articles, book chapters, etc., using induction and deduction (as a case study of Xerox, Fuji Xerox, Cisco, and Siemens companies), methods of formal and dialectical logic to understand the benefits from network cooperation and OI strategy. Thus, for example, it is shown that the OI concept in company strategies takes on the character of either institutional cooperation in the form of technological convergence or networking with the involvement of a wide range of participants in the latter: from students and university professors to companies and their employees, including foreign centers established by the interested parties, etc.

Keywords: High-tech. Competitive cooperative strategies. Open innovation strategy. Networking of the economy. Intellectual property.

Resumen
La investigación tiene como objetivo confirmar la hipótesis de trabajo, identificar las características de los productos de alta tecnología de uso civil y analizar los proyectos reales de "actuación" implementados dentro de la estrategia OI. El análisis se llevó a cabo en base a la información y comprensión sistemática de las ideas presentadas en artículos científicos, capítulos de libros, etc., utilizando la inducción y deducción (como un estudio de caso de xerox, Fuji Xerox, Cisco y siemens empresas), métodos de lógica formal y dialéctica para comprender los beneficios de la cooperación de red y la estrategia de OI. Así, por ejemplo, se demuestra que el concepto de OI en las estrategias de empresa adquiere el carácter de cooperación institucional en forma de convergencia tecnológica o de trabajo en red con la participación de una amplia gama de participantes en esta última: desde estudiantes y profesores universitarios hasta empresas y sus empleados, incluidos centros extranjeros establecidos por las partes interesadas, etc.

Palabras-clave: Alta tecnología. Estrategias cooperativas competitivas. Estrategia de innovación abierta. Trabajo en red de la economía. Propiedad intelectual.