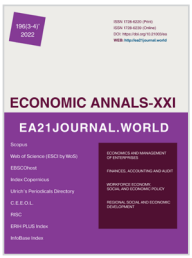

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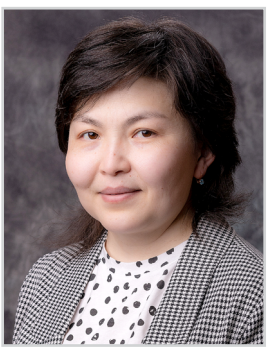

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Innovative activity of industrial enterprises of Kazakhstan: research of factors and key indicators

Abstract. In Kazakhstan, there is an intensification of innovation activity which is particularly important in modern conditions. The aim of the research is to determine the degree of influence of several indicators on the innovation activity of industrial enterprises of Kazakhstan, as well as to conduct a qualitative analysis of the invention activity of industrial enterprises in the country. Within the framework of the research tasks, a scientometric analysis was carried out which made it possible to identify the main global trends in scientific publications dealing with the research of innovative activities of industrial companies. The research of the innovative capacity of industrial enterprises was carried out with the help of correlation and regression analyses. The timeframe of research data is 2009-2019.

It was demonstrated that the share of GVA of industry in the country's GDP, labor productivity in manufacturing and the number of enterprises that have innovations for all types of innovations are the most significant factors influencing the «volume of innovative products shipped by companies». In addition, we analyzed 78 issues of the Industrial Bulletins of the National Institute of Intellectual Property of the Republic of Kazakhstan for the years 2011 and 2021, which made it possible to study the characteristics of the innovative activity of the country's industrial enterprises quantitatively and qualitatively. In this regard, the main findings are the following: an analysis of industrial bulletins showed that in 2011 the leaders in terms of the effectiveness of the implementation of innovative developments were the city of Almaty, Karaganda and East Kazakhstan regions; in 2021, Almaty and Karaganda region retained their positions, in addition, the city of Astana was added to them; in 2011, the main share of innovative developments accounted for inventions, while in 2021 - for utility models.

Keywords: Industry; Innovations; Innovation Activity; Industrial Enterprises; Industry of Kazakhstan; Scientometric Analysis; Commercialization of Innovations; GVA
JEL Classification: O01; O14; O3; O31; O36
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Инновационная деятельность промышленных предприятий Казахстана: исследование факторов развития и ключевых индикаторов

Аннотация
В Республике Казахстан отмечается активизация инновационной деятельности в отраслях промышленности, что особенно актуально в современных условиях. Целью исследования является определение степени влияния ряда показателей на инновационную деятельность промышленных предприятий Республики Казахстан, а также проведение качественного анализа изобретательской деятельности промышленных предприятий страны. В рамках поставленных исследовательских вопросов, был проведен наукометрический анализ, позволивший выделить ключевые мировые тенденции в части научных публикаций, посвященных исследованию инновационной деятельности промышленных предприятий. Исследование инновационных возможностей промышленных предприятий осуществлялось при помощи корреляционно-регрессионного анализа; период проведения: 2009–2019 годы.
По итогам проведенного анализа доказано, что доля валовой добавленной стоимости промышленности в ВВП страны, производительность труда в обрабатывающей промышленности и количество предприятий, имеющих инновации по всем типам инноваций, являются более значимыми факторами влияния на итоговый показатель, тогда как количество промышленных предприятий и производств, а также выданных охранных документов на промышленные образцы в наименьшей степени влияют на объем отгруженной инновационной продукции.
Также в работе было проанализировано 78 выпусков Промышленных бюллетеней Национального института интеллектуальной собственности Республики Казахстан за 2011 и 2021 годы, что дало возможность количественно и качественно изучить особенности инновационной деятельности промышленных предприятий страны. Анализ промышленных бюллетеней показал, что в 2011 году лидерами по эффективности внедрений инновационных разработок были город Алматы, Карагандинская и Восточно-Казахстанская области; в 2021 году свои позиции сохранили Алматы и Карагандинская область, помимо этого, к ним добавился город Астана; в 2011 году основная доля инновационных разработок приходилась на изобретения, тогда как в 2021 году – на полезные модели.
Ключевые слова: промышленность; инновации; инновационная деятельность; промышленные предприятия; промышленность Казахстана; инновационная активность предприятий Республики Казахстан; наукометрический анализ; коммерциализация инноваций.

1. Introduction

The innovative activity of industrial enterprises of the Republic of Kazakhstan is based on the accelerated technological development of all areas of the real sector of the economy. In the structure of Kazakhstan's economy, industry occupies almost one third. The mining and quarrying sector in 2021 accounts to 47.9% in the industrial sector of the country (Statistical Yearbook of the Republic of Kazakhstan, 2022). Modern market conditions require the intensification of innovative activities of enterprises as the most productive way to increase the competitiveness of the country and its further development.

The Republic of Kazakhstan positions itself as a state with a developing, stable, innovation-oriented economy. According to the «Global Innovation Index 2021», Kazakhstan is ranked 79th out of 131 (2020 - 76th). The country has the highest score in «institutions» (45th place), which reflects the state of the political environment, the degree and level of business development, and the regulatory framework.

To strengthen the process of introducing innovations by enterprises, it is necessary to use the programme method to perform the full range of work. Thus, on 31 December 2019, the State Programme for Industrial and Innovative Development for 2020-2025 (SPIID) was adopted by government decree in the Republic of Kazakhstan, which is a logical continuation of the State Programme

for Industrial and Innovative Development of the Republic of Kazakhstan for 2015-2019. Currently, the programme is invalid, according to the Decree of the Government of the Republic of Kazakhstan dated 20 July 2022 No. 508. The main objective of this programme was to increase the competitiveness of the manufacturing industry of the Republic of Kazakhstan in domestic and foreign markets, including through technological development and digital transformation of this sector of the national economy.

In accordance with the Law of the Republic of Kazakhstan «On Commercialization of Results of Scientific and (or) Scientific-Technical Activities», an analysis of the implementation of programmes to promote the commercialization of results of scientific and (or) scientific-technical activities is presented, within the framework of which an analysis of the cost-effectiveness of the implementation of the Programme is carried out, taking into account the achievement of its target indicators and key indicators. At the same time, within the objectives of the development of the Programme, it is important to consider the socio-economic impact of its implementation.

To date, the following state programmes, and projects in the field of commercialization of innovations have been successfully implemented:

1) «Stimulation of productive innovations»;
2) «Grant funding of the most promising projects for commercialization of the results of scientific and (or) scientific and technological activities»;
3) Provision of innovative grants to subjects of industrial and innovative activities by co-financing the implementation of industrial and innovative projects;
4) «Digital Kazakhstan» state programme, which includes 5 key areas: «Digitalization of economic sectors» (including the industrial sector); «Transition to a digital state», «Implementation of the digital Silk Road»; «Development of human capital» and «Creation of an innovative ecosystem», which will enable the implementation of the tasks of more active and efficient introduction of innovations into production through sustainable technological development.

An analysis of the implementation of these programmes was carried out and it was found that they all aim to promote the conduct of high-quality research relevant to the country and the commercialization of technologies. The programme managers are the «QazInnovations» National Agency for Innovation Development JSC, «QazTech Ventures» JSC (subsidiary of Baiterek National Managing Holding JSC), «Science Fund» JSC, the Ministry of Science and Higher Education of the Republic of Kazakhstan, the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan, and the Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan.

Projects are funded in 44 priority areas, which are defined in the SPIID, National Development Plan of the Republic of Kazakhstan until 2025. At the same time, the issue of attracting venture capital and creating demand for innovation remains relevant.

It should be noted that the economy of the Republic of Kazakhstan is not favorable enough for the introduction of scientific and technological innovations due to the lack of adequate financial resources, relatively low production base, and unstable tax and economic legislation. One of the main reasons limiting the scope of innovation activity of industrial enterprises in the republic is the low share of investment. However, the experience of developed countries shows that the development of innovative mechanisms for financing innovation largely solves the problem of lack of funds.

Thus, the share of domestic expenditure on research and development in the country's GDP in 2019-2020 was 0.12-0.13% in each year. It is important to increase this indicator as commercialization is an important contribution of science to the real sector of the economy by creating high-tech products with high added value. So far, the share of commercialization of scientific developments does not exceed 8% of budgetary spending on science.

Since the innovation activity of enterprises, including the industrial sector, is influenced by many factors, we selected criteria and indicators that were then used to build a regression model. A dependent variable was defined, represented by the volume of innovative products shipped, and a group of independent variables consisting of quantitative indicators. At the same time, for a more objective and complete view of the research related to the topics studied, a bibliometric analysis of the publications was carried out, which made it possible to identify the most relevant works reflecting aspects of the commercialization of innovations in relation to industrial companies. It should also be noted that we analyzed industrial bulletins (for the years of 2011 and 2021) published on the territory of the Republic of Kazakhstan by the National Institute of Intellectual Property. This

allowed for a qualitative analysis of the type of inventions, industrial designs and utility models created by industrial enterprises, as this information is not included in the materials of the Office of National Statistics of the Agency for Strategic Planning and Reforms of the Re-public of Kazakhstan, and it is not possible to track it in any other way.

The aim of the research is to determine the degree of influence of several indicators on the innovation activity of industrial enterprises of the Republic of Kazakhstan, as well as to conduct a qualitative analysis of the invention activity of industrial enterprises in the country. The article sets the following tasks:

1) conducting a scientometric analysis of publications and highlighting the areas of scientific research related to the study of factors and characteristics of the development of innovative activities of industrial enterprises, as well as determining the trends in the commercialization of innovations at the current stage;
2) highlighting the factors influencing the innovative activity of the subjects of the industrial sector of the Republic of Kazakhstan;
3) conducting a qualitative assessment of innovative products developed by industrial enterprises of Kazakhstan.

The following are identified as key research questions (RQ) to be answered:

RQ1: How much clusters that reflect the specifics of scientific research related to the study of factors and characteristics of the development of innovative activities of industrial enterprises, as well as determine the main trends in the commercialization of the results of intellectual work in the form of innovations the scientometric analysis will allow us to highlight?

RQ2: Can the volume of innovative products shipped by industrial enterprises depend on factors such as the number of workers employed in industry and engaged in research and development, labor productivity, the volume of industrial production, the profitability of industrial enterprises, the level of research and development costs, etc.?

RQ3: What type of innovative products (inventions, industrial designs, utility models) is most widespread in the activities of industrial enterprises in Kazakhstan, as shown by the analysis of the official bulletins «Industrial Property» of the National Institute of Intellectual Property of the Republic of Kazakhstan for 2011 and 2021?

In general, our paper comprises six main sections: *the first* - «Introduction», which presents the relevance of the aspect considered by the authors; it also includes the purpose, objectives and research questions; *the second* - «Literature review» is devoted to the analysis of scientific papers dealing with the scientific problems studied by the authors; *the third* - «Materials and methods» shows the data sources, algorithms and the main stages of the research, revealing the nature of the «reproducibility» of the research results; *the fourth part* - «Results» - is devoted to the main findings of the analysis; *the fifth part* - «Discussion» - allows to identify general tendencies in the framework of the studied topic and compare the results with previous studies of this kind and highlighting the limitations of the research; *the sixth part* - «Conclusion» - aims to briefly present the main findings and indicating future directions for the authors' research.

2. Data Collection and Methods

In describing the materials and methods, the authors of the research relied on three central research questions posed in this scientific article.

1. Study of the specifics of scientific research related to the study of factors and characteristics of the development of innovative activities of industrial enterprises, as well as the determination of key trends in the field of commercialisation of the results of intellectual labor represented by innovations, based on scientometric analysis (RQ1).

To conduct the scientometric analysis, the materials of the Web of Knowledge plat-form (Clarivate Analytics) were used as a basic data source - articles published in the database through a search query within the entire «depth» of the existing array; for visualization and subsequent processing, the VOSviewer software was used, which made it possible to form cluster «bubbles», thereby highlighting the main trends and directions of ongoing scientific research on the study of the specifics of innovative activity of industrial enterprises (including by highlighting the factors that significantly influence it).

The general methodology for conducting the scientometric analysis developed by the authors is shown in Figure 1:

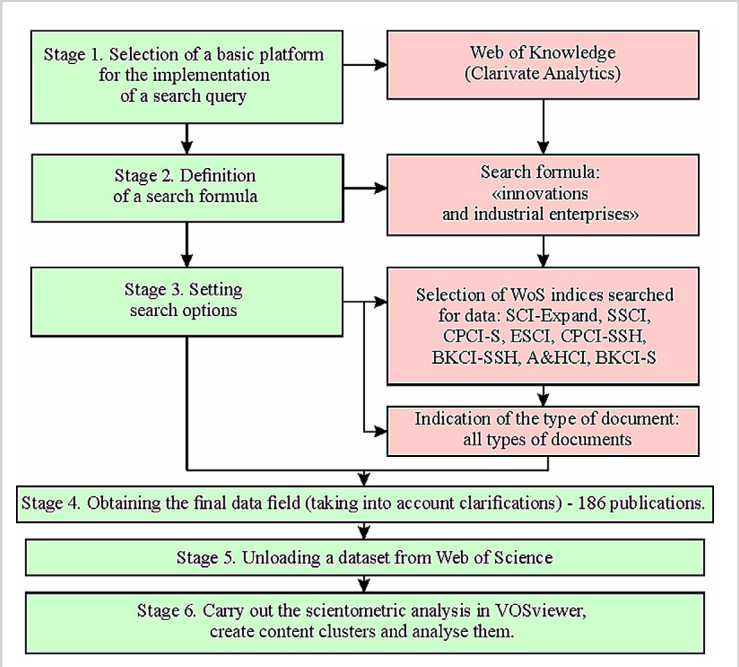

Figure 1:
Methodology for performing a scientometric analysis
Source: Compiled by the authors

Stage 1. Selection of the basic platform for implementing the search query; in our case - Web of Knowledge (Clarivate Analytics).
Stage 2. Definition of the search formula: «innovations and industrial companies».
Stage 3. Setting the search parameters:
- Selection of WoS indicators used to search for data: SCI -Expand, SSCI, CPCI-S, ESCI, CPCI-SSH, BKCI-SSH, A&HCI, BKCI-S;
- Clarification of the type of documents: all types of documents were considered.

Stage 4. Obtaining the final data set (considering the clarifications) - 186 publications.
Stage 5. Unloading the data field from the Web of Science («text file»: complete data set and referenced bibliography).
Stage 6. Performing scientometric analysis in VOSviewer (by keywords), creating content clusters and analyzing them.

In general, the method developed by the author is adaptable and can be applied when working with any scientific database (Scopus, EconLit and many others) as well as with a software product (e.g., with CiteSpace) that allows the bibliographic analysis of the information fields of scientific articles, monographs, conference proceedings, etc.

2. Identification of the factors influencing the innovation activity of the subjects of the industrial sector of the Republic of Kazakhstan based on the correlation and regression analysis (RQ2).

«The volume of innovative products shipped by the enterprises (in thousands of tenge)» was chosen as the dependent variable characterizing the level of development of the industrial enterprises.

Statistical analysis was carried out using the software package MS Excel and applying the methods and techniques of logical, systemic, and comparative analysis to deter-mine the parameters characterizing the innovative activity of industrial enterprises of the Republic of Kazakhstan.

Figure 2 shows an algorithm describing the main stages of the study step by step.

The method of generalization was used, which made it possible to establish the existing relationships between the economic phenomena considered; economic and mathematical methods, represented by correlation and regression analysis, methods of testing the constructed model based on the Fisher criterion, the coefficient of determination and the Durbin-Watson criterion.

3. Qualitative analysis of inventive activity of industrial enterprises of the Republic of Kazakhstan based on the analysis of industrial bulletins of the National Institute of Intellectual Property (RQ3) for 2011 and 2021.

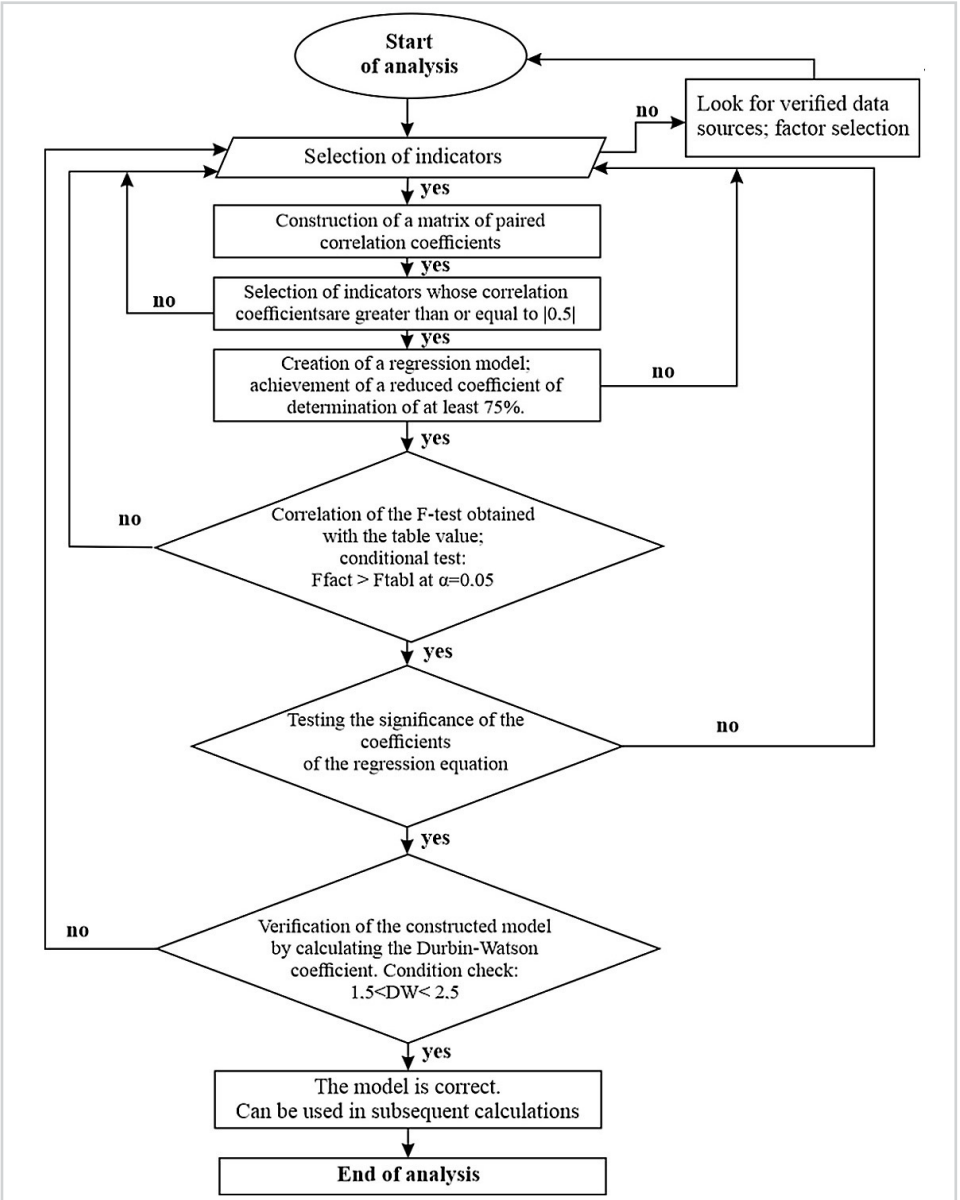

Figure 2:
Algorithm for performing correlation and regression analyses
Source: Compiled by the authors

To conduct this type of analysis, the industrial bulletins of the National Institute of Intellectual Property of the Republic of Kazakhstan were used:

- in 2011 - a series of 24 issues;
- in 2021 - a series of 54 issues.

It should be especially noted that it is only possible to track the innovation activity of industrial enterprises, the types of innovations they create and commercialize by analyzing each issue of the Industrial Bulletin, as this information is not available in the materials of the Office of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. The main steps of such an analysis are the following:

1) determining the time intervals in which the polls are selected for analysis; in the context of this article, all bulletins published in 2011 and 2021 (78 issues);
2) page-by-page search for industrial enterprises that have officially registered the result of their intellectual work with the National Institute of Intellectual Property of the Republic of Kazakhstan: invention, industrial design, or utility model;
3) registration of each object in a table with a description according to the following criteria: name of the industrial enterprise that created the development; region; name of the development; section(s) of the International Patent Classification (hereinafter - IPC) to which the object is

assigned; determination of the type of development - an invention, a utility model or a industrial design;

4) compilation of a summary feature by year (2011 and 2021), by region, by number of innovative objects, and a brief qualitative description of the developments.

The work with the bulletins was conducted online from 10 January to 25 July 2022, as all bulletins are freely available on the official website of the National Institute of Intellectual Property of the Republic of Kazakhstan. The long duration of the work with the bulletins is justified by the conscientious work with the sources.

3. Brief Literature Review

In recent years, there has been a significant increase in the number of publications by authors particularly concerned with the theory of the efficiency of firms' innovative activity, which can be explained to some extent by the increasing role of innovation in the economic activity of firms and in the economy.

A large part of the work deals with general issues of the development of innovation activity in firms, including in the industrial sector.

Thus, N. O. Mogharbel (2015) in his work states that to increase the competitiveness of goods produced by industrial enterprises and to ensure a high level of their productivity, the problem of increasing the level of innovative activity of economic entities is important. Considering the trends of development of the industries in which the enterprise operates, it is advisable to study the factors of its internal and external environment, i.e., the reserves of resources necessary for the implementation of innovative activities, their purpose; the analysis of the competitive environment with the possibility for the enterprise to pay timely attention to the innovative solutions of competitors, etc.

Furthermore, D. M. Morris (2018) notes that innovation and the application of new ideas can promote the formation of new sectors (structural change) as well as the transformation of production structures, specialization, and the gradual expansion of knowledge-intensive industries. At the same time, the impact of innovation on the level of labor productivity is evident. The author believes that ongoing innovation policies should be individually tailored to the industrial and service sectors.

The results of the analysis and evaluation of changes in the company's activities (its innovation activity) are presented in the publications by M. Berdar, O. Yevtushevska (2020), Spitsyn et al. (2018), Ya. Gorączkowska (2018). The authors propose a mechanism for the self-development of a company's innovative activity, which makes it possible to analyze the innovative activity and determine the most effective directions for the innovative development of a company to further increase the efficiency of its functioning. The importance of applying measures such as the stimulation of innovation processes by business and entrepreneurship support organizations, the use of innovation at the level of medium-sized innovative and non-innovative enterprises, and increasing the intensity of innovation processes, e.g. the creation of product innovations by the largest innovative enterprises, is pointed out.

To determine the effectiveness of innovative activities of industrial enterprises, statistical studies are conducted, especially correlation analysis, which is one of the most effective tools in economics that allows to group output data according to the influence of external factors. A group of local scientists - Nurpeisova et al. (2020) - state in their research that it is possible to create a statistical model in which the variability of all parameters is explained by the identified factors. The weight or importance of a particular factor can be estimated by the value of its share in the total variance of the variables, and the close relationship of each task parameter to a particular factor can in turn be estimated by the correlation coefficient.

Similar conclusions are drawn by European scholars. For example, Bashnyanin et al. (2019) point out in their research that innovation and productivity are linked: Research and development (R&D) correlate positively with the volume of innovative products, which in turn correlate with performance. At the same time, in the current phase of economic development, there is a general trend towards a reduction in the number of industrial enterprises that create, use, or disseminate scientific developments.

A. Jakimowicz and D. Rzeczkowski (2019) find that the innovative activity of industrial enterprises depends on the form of ownership and the type of enterprise. There is a certain kind of dynamic equilibrium between these variables, which changes depending on the phase of the economic

cycle. Considering that the scope of activity of industrial enterprises is considered from the point of view of Kondratiev waves, the implementation of the objectives of innovation activity has a great impact on the further development of the innovative capacity of these enterprises.

According to Yu. S. Golikova (2015), the quantitative indicators used (economic effect, profitability) are characterized by a high degree of uncertainty, it is difficult to apply in the evaluation of innovative processes, since the innovative activity can produce an economic effect only if the object of intellectual capital created in the process is moved. After studying the problems of evaluating the effectiveness of innovative activity, it was concluded that quantitative indicators cannot provide a comprehensive assessment of the effectiveness of the innovative activity of industrial enterprises.

The works of V. F. Savchenko, D. V. Pustovoyt (2017), V. V. Govdya, D. V. Pustovoyt (2018), are generated the interest among the scientists. In their scientific research, they analyzed the innovation activity of industrial enterprises, highlighting the role of the state and the government in promoting innovation activity as the most productive way to improve the competitiveness of enterprises. Among the main reasons limiting innovation activity in enterprises is the lack of investment, i.e. the actual development of innovative mechanisms to finance innovation. The authors note that commercialization of the results of scientific research is a necessary condition for entering the market of new goods and services, which will increase the level of innovation activity of industrial enterprises and strengthen their competitiveness.

Mukhtarova et al. (2018) considered and analyzed the problems of education, development of industry and innovative component of the economy of Kazakhstan. It is noted that the countries that apply long-term innovative development strategies that meet the needs of a diverse market have competitive advantages in the market. Therefore, the state should play a leading role both in promoting R&D results in the innovation market and in creating a national innovation system.

At the same time, the implementation of state programs contributes to the realization of the principle of balance between supply and demand for innovation, as noted by Rumyantsev A. A. (2018), which is achieved through the participation of both scientific institutions and innovation-producing companies focused on identifying markets for new products.

Evaluation of the effectiveness of state programs to promote the commercialization of scientific research and development in the Republic of Kazakhstan in the work of Alibekova et al. (2018) presented an analysis of the implementation of programs of the International Bank for Reconstruction and Development, the Ministry of Education and Science of the Republic of Kazakhstan, the Science Foundation, etc. The study found that it is necessary to develop a scientific and systematic approach to create comprehensive indicators for the evaluation of programs to promote the commercialization of scientific developments using the resource base.

I. Kreiydych et al. (2019) believe that the inefficient use of innovative ideas in enterprises leads to the need to strengthen the economic development of industrial enterprises, the introduction of innovative ideas and projects and the development of an innovative development model of the appropriate type. In accordance with the new modern conditions for the development of the economy of each country and its orientation towards the world economic space, the activation of the innovative activity of enterprises is becoming increasingly important, as it is impossible to effectively ensure the socio-economic development of the industrial economy and the state as a whole without progressive structural changes. As a solution to the problem, the need for clustering of modern manufacturing enterprises is identified; the identification of their dimensions with delimitation and grouping of specific functions related to the implementation of effective technology for the innovative development of the industrial sector.

According to Yu. S. Valeeva and N. S. Sharafutdinova (2015), innovations as a factor of intensification are reflected in the growth of labour productivity, capital intensity, increase in cost recovery and working capital. Consequently, these indicators can point to the innovation activity of enterprises. The assessment of enterprises' innovation activity should be based on indicators of intensive development, which, according to the theory of economic growth, include labour productivity, capital productivity, return on capital, working capital turnover and cash flow return.

Veselovsky et al. (2015) have noted in their work a special role in assessing the innovation potential of intellectual property. At the same time, the human and intellectual potential, the use of modern IT technologies, according to the authors, are also important for the development of innovative activities (2020).

K. Kozioł-Nadolna and Yu. Wiśniewska (2020) in their scientific article point out the complex nature of innovative activities, which in turn are associated with a high degree of risk and uncertainty. When making management decisions related to the development of innovative activities of the organization, it is necessary to apply multi-criteria methods. These methods allow to rank the objects under consideration or identify groups of preferences in the existing set of alternatives (options). Each organization has its own innovation potential, which determines the type and scope of innovations implemented, including the innovation strategy.

A. Naizabekov and L. Bozhko (2018) argue that the sustainable functioning and even more the expansion of the activities of enterprises implementing innovative projects presuppose the availability of an infrastructure for their quick start and a massive demand for their services. To enable industrial enterprises to make a technological «breakthrough», a science-based mechanism for the effective use of the existing scientific and technical potential, mineral resources and production infrastructure is needed, considering the priorities of regional development that form the industrial and innovative environment.

The scientific works of several Kazakh scientists are devoted to the problems of innovative development of the economy, innovative activity of industrial enterprises, and the introduction of innovations. L. V. Tashenova and A. V. Babkin (2020) found that the use of correlation-regression analysis is one of the best methods to comprehensively describe the innovative activities of enterprises in Kazakhstan and predict the basic indicator (dependent variable) analyzed. At the same time, it is advisable to select the factors for assessing the innovative activity of enterprises using economic and statistical methods, considering the calculated correlation coefficients of the pairs and multicollinearity, and excluding the factors that have no influence on the dependent variable.

The role of innovation in the development of business activities is shown in scientific research by Mamrayeva et al. (2018) It was found that an indicator such as the innovation activity of companies by industry plays an important role in the activities of the world's leading companies that are actively involved in innovation processes. For many companies, it is becoming increasingly important to ensure the protection and further commercialisation of new ideas (Mamrayeva et al., 2018) and to improve innovation activity by promoting the innovation activity of companies (Mamrayeva, 2017).

The emergence of innovation-active industrial enterprises is usually associated with the evolutionary development of integrated industrial structures that can actively create, implement and market innovative products and take advantage of all the benefits of industrial automation. The methodology developed by Kazakh-Russian scientists to assess the digital potential of backbone innovative-active industrial clusters has been successfully tested on the example of the cluster «Development of Information Technologies, Radioelectronics, Instruments, Communications and Information and Telecommunication Devices in St. Petersburg» (Tashenova et al., 2020).

It should also be noted that in modern scientific literature much attention is paid to issues related to the research of the role of innovation, including in industry, and aspects of the sustainable development of a country, region, and a single sector of the economy. Thus, Alyahya et. al. (2022) and Li et. al. (2021) as part of their works consider the role of green innovation on the example of Saudi Arabia and China; S. Yigit (2021) reveals the multidimensional relationship of innovation with the foundations of sustainable development using data from 35 OECD countries; J. Zhao (2021) as part of the research, gives practical examples of dual innovations and features of their implementation in Chinese enterprises; Mai et. al. (2021) pay special attention to the introduction of innovative business models to achieve sustainable development goals for enterprises.

In addition, a certain pool of publications is devoted to issues that reflect the prospective conditions for the development of single-industry towns, taking into account the context of their functioning, including the innovation aspect (Mitroshina & Skufina, 2021), assessing innovation potential based on the existing GCI methodology, modified to identify differences and trends in the innovative development of individual sectors of the economy, including the industrial sector (Shvindina et. al., 2022), as well as the classification of the factors of innovative development of the industry by the nature of the demand for innovation, the peculiarities of the influence of market environment factors, the type of competition, etc. (Hushtan & Kolodiychuk, 2021).

In general, the relevance of developing innovative activities in industry has been proven according to the results of scientific research. As the analysis of scientific literature has shown, the study of the innovative efficiency of an industrial enterprise is based on the evaluation of quantitative and qualitative indicators using the methods of economic and statistical analysis.

4. Results and Discussions

4.1. Results of the scientometric analysis

To answer the research question 1 (RQ1), a scientometric analysis was conducted, the methodology of which is presented in the «Materials and Methods» section.

The population of works uploaded from the Web of Knowledge platform (Clarivate Analytics) amounted to 186 units, which were later used for uploading into the VOSviewer programme. The graphical interpretation of the results is shown in Figure 3.

As can be seen from the figure, a total of 15 clusters were formed as part of the analysis. The characteristics of the first ten and one of the largest clusters are shown in Table 1.

Clusters 11 to 15 are represented in their composition by 8, 8, 7, 5 and 5 keywords, respectively, and are mostly related to the choice of types of analysis, mainly strategic, to evaluate the effectiveness of business processes, to obtain a number of competitive advantages for industrial enterprises, including by increasing their innovation activity through the creation of intellectual property objects, as well as through scientific research aimed at creating an innovative product and its subsequent commercialisation.

It should also be noted that the majority of publications directly related to innovation and innovation activity fall on the period 2016-2018; in 2020-2022, mainly papers reflecting aspects of the innovation activity of industrial enterprises, the characteristics of the functioning of organizational and economic mechanisms for managing the innovation potential of industrial enterprises, as well as the formation and development of a new type of corporate structures, the emergence of which is due to the digital transformation of industry, the transition to Industry 4.0 and 5.0.

In general, the results of the analysis allow for a clear understanding and highlighting of the specifics of scientific research related to the study of factors and characteristics of the development of innovative activities of industrial enterprises, as well as the identification of key trends in the commercialisation of the results of intellectual labor represented by innovations.

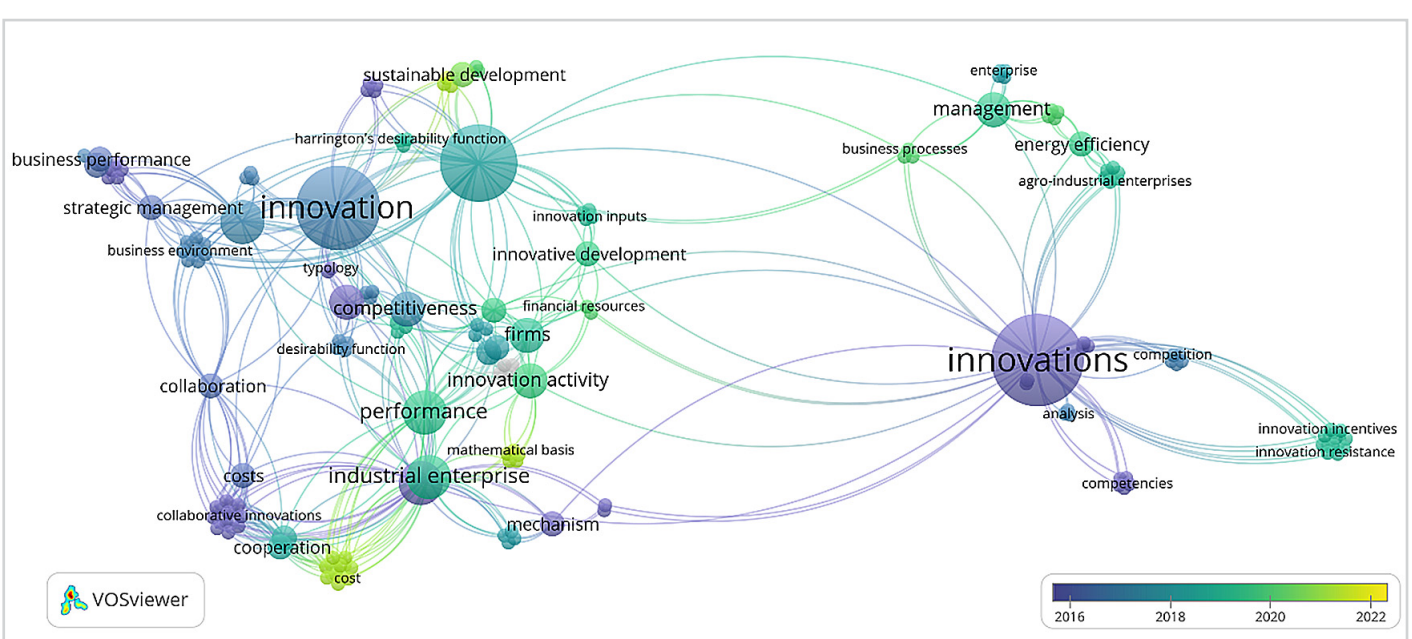

Figure 3:
Graphical result of the scientometric analysis carried out (by keywords)
Source: The figure was created by the authors based on a scientometric analysis in 2022

Table 1:
Characteristics of the clusters obtained (TOP-10)

Cluster number and composition (keywords)	Short description
Cluster 1 (19 items): agro-industrial enterprises, basic forms of business, business process, energy audit, energy efficiency, energy management, energy policy, energy saving, energy-saving technologies, enterprise, green innovations, management, management principles, problems of development, renewable energy sources, risk factors, sector, sustainable development, threats.	The cluster includes 19 keywords that can be conditionally combined within the framework of a scientific direction – «Management of energy resources. Sustainable development». It should also be noted that there are terms within this cluster that relate to the assessment of threats and risks to sustainable development.
Cluster 2 (15 items): environmental insurance, financial mechanism, greening, Harrington's desirability, industrial enterprises, innovation, innovation capacity, innovation activities, integral assessment, knowledge economy, knowledge management, knowledge strategy, legal culture, organizational culture, sustainable development.	The cluster brings together 15 terms linked by aspects of «assessing the innovation activity of industrial enterprises», including the use of the Harrington scale and based on the specific characteristics of knowledge management.
Cluster 3 (14 items): business network, collaboration, collaborative innovation, commitment, cooperation, costs, furniture industry, fuzzy trust evaluation, governance, logistics outsourcing relationships, partners, selection, trust estimation, United States.	Cluster 3 defines 14 keywords linked using joint innovations (between partner companies in industry, logistics, business environment, etc.) and aspects to assess the degree of reliability of such cooperation.
Cluster 4 (13 items): balanced scorecard, business performance, cluster structures, controlling, financial performance, impact, industry, information system, measurement system, performance management, strategic management, technological development, universities.	In this cluster, systems for evaluating the technological development of industrial enterprises and clusters and for assessing the degree of their influence on the strategic planning system can be distinguished as a scientific guiding principle; universities are also assigned their own role here as one of the most important sources of intellectual capital.
Cluster 5 (11 items): company, effects, financial resources, innovation inputs, innovation outputs, innovation strategy, innovation development, innovative products, integrated analysis, strategy, technologies.	Cluster 5 includes 11 key words that can be combined with innovative development and resource assessment issues for their successful implementation.
Cluster 6 (11 items): determinants, enterprise interaction, firms, growth, investments, ownership, performance, policy, potential of the enterprise, SMEs, technology.	The concepts in this cluster are linked through aspects of development in the context of interaction between enterprises, as well as through issues of assessing the potential of enterprises, including those in the field of small and medium-sized enterprises.
Cluster 7 (11 items): administrative decisions, competitiveness, desirability function, eco-innovations, eco-oriented project, efficiency, influence mechanism, innovative activities, controlling, innovative project, organizational and information system of management, typology.	Cluster 7 brings together 11 terms related to the implementation of innovative projects (including in the green economy), as well as aspects of ensuring a certain level of competitiveness through the implementation and use of effective organizational and information management systems.
Cluster 8 (10 items): innovation incentives, innovation resistance, innovation risks, innovation activity, innovation level, openness to innovations, regional agri-food industry, stakeholders, subjective factor, support.	The eighth cluster links key words within the direction, the main core of which is to assess the parameters of the level of innovation activity, the possibilities of using open innovation, and issues of joint work with stakeholders.
Cluster 9 (9 item): choice, cost, holding group, integration, natural resources, open innovation, proximity, rigid form of cooperation, specific assets.	The ninth cluster characterizes the aspects of mutual integration, the specifics of the distribution of resources under the conditions of such cooperation.
Cluster 10 (9 item): analysis, corporate management, development, industrial, innovations, innovative profit, modern technologies, reproduction return rate, technological factor of profitability.	The keywords of the tenth cluster can be grouped into the term «industrial economics», which characterizes another important area of research in the context of the questions dealt with here, related to the determination of the parameters of efficiency of an industrial enterprise (including the technological factor of profitability, reproduction rates, innovation activity, efficiency of management, etc.).

Source: Compiled by the authors based on the results of own analysis

4.2. The results of the correlation-regression analysis of the factors influencing the innovation activity of the subjects of the industrial sector of the Republic of Kazakhstan (RQ2)

The article analyses the data presented for the years 2009-2019 in Table 2. The information base of the study consists of materials from scientific and technical databases, materials from journals, legislative and regulatory documents, statistical and analytical materials of the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, as well as the National Institute of Intellectual Property.

The constructed matrix of paired correlation coefficients is in Table 3.

From Table 3 it can be seen that the analyzed y - «the volume of innovative products shipped by companies, thousand tenge» is indeed influenced by factors, for 8 of them (x_2-x_3, x_7-x_9, x_{14}, x_{16}-x_{17}) the correlation coefficient is more than 50%. In the initial stages of building the model, the authors decided to include factors in the model whose correlation coefficient according to the Chaddock scale is not lower than 0.5 (which corresponds at least to the presence of a noticeable strength of connection).

At the same time, it is important to note that multicollinearity was found between the above factors, which is why only 3 factors were selected to build the model:
x_2 («Labor productivity in the manufacturing sector, thousand US dollars / person»),
x_3 («Share of GVA of the sector in the GDP of the republic, in percent») and
x_{17} («Number of enterprises with innovations for all types of innovations»).

With the «Data Analysis» add-on, we will perform calculations to compute the indicators of the future regression model (Table 4 and Table 5).

Table 2:
Initial data for 2009-2019 within the framework of the analysed parameters

Years	y	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}
2009	8158455000	710.2	36.4	30.6	11329	9121525	4	31.1	80.7	302	236	1.0	31034.8	2248899	15.8	338	49028.6	-*
2010	10832607000	710.5	40.4	32.9	11252	12105526	5.2	43.2	93.8	239	260	1.2	219571.2	2586800	17.0	562	46079.6	572
2011	14210900000	726.8	52.7	31.6	11441	15929052	7.1	48.6	108.4	415	270	1.5	170174.3	2653463	18.0	713	58715.9	762
2012	10918035000	731.2	61.8	30.8	11807	16851775	7.6	39.6	123.4	218	274	2.3	168477.1	2864313	20.4	664	68460.4	1622
2013	5147905169	734.2	57.0	27.8	11843	17833994	8	35.1	138.1	499	280	2.89	219263.2	3069814	23.7	681	73949.9	1774
2014	266667327	726.0	42.6	27.3	11296	18529225	8.1	32.6	158.4	566	282	2.61	248473.6	3508871	25.8	865	73555.6	1940
2015	2705140409	677.5	34.3	24.7	11619	14931378	8.1	5.3	176.3	580	282	1.80	503400.8	3863090	24.7	735	86572.9	2585
2016	3611781672	653.7	27.4	26.1	11884	19026781	9.3	22.5	197.3	611	182	1.81	1390492.1	4320396	23.0	704	89509.8	2879
2017	4164122289	643.5	32.4	26.8	12385	22790209	9.6	28.3	216.0	632	129	3.18	718690.2	4769588	22.1	748	92732.4	2974
2018	5335444267	651.7	35.3	28.2	12486	27218063	10.6	35.9	236.1	751	219	3.41	700206.2	6567368	22.4	839	99706.6	3230
2019	6360905870	656.9	33.3	27.5	13237	29380342	11.3	44.1	261.7	878	229	3.26	354044.7	7786272	21.8	208	118070.7	3206

Notes: Dependent variable:
y - the volume of innovative products shipped by enterprises, thousand tenge;
Independent variables:
x_1 - the number of employees in industry, thousand persons;
x_2 - labour productivity in manufacturing industry, thousand US dollars/person;
x_3 - the share of GVA of industry in the GDP of the Republic, percent;
x_4 - the number of industrial enterprises and industries, units;
x_5 - the volume of industrial production, million tenge;
x_6 - the level of activity of enterprises in innovation, percent;
x_7 - the profitability of industrial enterprises, percent;
x_8 - the average monthly salary of the staff of the main activity of industry, thousand tenge;
x_9 - the number of registered contracts for the alienation of exclusive rights to intellectual property objects, units;
x_{10} - the number of issued titles of protection for industrial designs, units;
x_{11} - the share of innovative products (goods, services) of industrial enterprises in the total volume of industrial production, percent;
x_{12} - expenditure on technological innovation in industry, millions of tenge;
x_{13} - investment in fixed capital in the industry sector, million. tenge;
x_{14} - the number of employees who carried out research and development, thousand persons;
x_{15} - the number of organisations that created and use new technologies and equipment, units;
x_{16} - internal and external costs of research and development (R&D), billion tenge;
x_{17} - the number of enterprises with innovations for all types of innovations.
* - Data is not available.

Source: Compiled by the authors based on statistical reports conducted by the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan which characterise activities in the fields of industry, science and innovation in Kazakhstan (2009-2019)

Table 3:
Calculated matrix of the pair correlation coefficients

Indicator	y	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}
y	1																	
x_1	0.408	1.000																
x_2	0.505	0.835	1.000															
x_3	0.864	0.565	0.495	1.000														
x_4	-0.187	-0.690	-0.318	-0.392	1.000													
x_5	-0.318	-0.628	-0.270	-0.441	0.906	1.000												
x_6	-0.442	-0.660	-0.295	-0.635	0.843	0.952	1.000											
x_7	0.671	0.357	0.466	0.755	0.124	0.165	-0.069	1.000										
x_8	-0.541	-0.821	-0.543	-0.693	0.871	0.924	0.952	-0.193	1.000									
x_9	-0.585	-0.731	-0.569	-0.718	0.783	0.860	0.878	-0.186	0.936	1.000								
x_{10}	0.218	0.789	0.631	0.288	-0.490	-0.410	-0.395	0.129	-0.518	-0.402	1.000							
x_{11}	-0.450	-0.419	-0.041	-0.481	0.777	0.893	0.853	0.085	0.794	0.724	-0.305	1.000						
x_{12}	-0.458	-0.748	-0.627	-0.596	0.332	0.398	0.558	-0.454	0.599	0.502	-0.659	0.225	1.000					
x_{13}	-0.356	-0.765	-0.510	-0.482	0.924	0.932	0.879	0.023	0.945	0.902	-0.423	0.747	0.418	1.000				
x_{14}	-0.826	-0.249	-0.131	-0.846	0.274	0.489	0.665	-0.508	0.603	0.606	0.012	0.624	0.421	0.392	1.000			
x_{15}	-0.312	0.054	0.158	-0.258	-0.312	0.023	0.168	-0.289	0.036	-0.006	0.026	0.194	0.317	-0.189	0.520	1.000		
x_{16}	-0.522	-0.754	-0.454	-0.725	0.892	0.908	0.954	-0.213	0.981	0.925	-0.429	0.792	0.540	0.929	0.627	-0.032	1.000	
x_{17}	-0.614	-0.761	-0.448	-0.782	0.768	0.854	0.951	-0.340	0.959	0.856	-0.463	0.787	0.681	0.832	0.744	0.235	0.950	1.000

Source: Calculated by the authors

Table 4:
Regression statistics

Indicator	Value
Multiple R	0.88
R-square	0.77
Normalized R-square	0.67
Standard error	2386632088
Observations	11

Source: Compiled by the authors

Table 5:
Results of analysis of variance

Analysis of variance	Indicators							
	df	SS	MS	F	F significance			
Regression	3	1.3088E+20	4.4E+19	7.7	0.012954614			
Residue	7	3.98721E+19	5.7E+18					
Total	10	1.70752E+20						
Indicators	Coefficients	Standard error	*t*-statistics	*P*-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Y-intersection	-40403261015	15313174881	-2.638	0.033	-76613165707	-4.2E+09	-7.7E+10	-4.2E+09
Variable X1	42892744.09	78367617.28	0.547	0.601	-142417224.3	2.28E+08	-1.4E+08	2.28E+08
Variable X2	1535817050	493036571.5	3.115	0.017	369970816.2	2.7E+09	3.7E+08	2.7E+09
Variable X3	649108.226	1077621.92	0.602	0.566	-1899062.701	3197279	-1899063	3197279

Source: Calculated by the authors

Table 3 shows that the coefficient of determination exceeds 75%, indicating that the model is consistent with the data; such a model is considered tractable. Importantly, the normalized R-squared (reduced coefficient of determination) is also quite high, which also confirms the significance of the constructed regression.

Next, we will use the actual value of the F-test = 7.66. Considering the fact that we are working with a three-factor model, as well as the fact that we have 11 observations, we use the table with the already calculated values of the F-test at α = 0.05. As a result, we get: Ffact = 7.66 > Ftabl = 4.35, which indicates the significance of the equation.

The calculations carried out have made it possible to obtain tcr = 2.2 (taking into account the confidence probability = 0.05); thus, in our case: ta > tcr, tb > tcr and tc > tcr, the coefficients a, b and c are significant.

The final view of the model is as follows (1):

$$y = -40403261015 + 42892744.09x_1 + 1535817050x_2 + 549108.226x_3. \quad (1)$$

The calculated Durbin-Watson statistic in our case is 2.42.

It is generally accepted that if the resulting coefficient is in the range of 1.5 < DW < 2.5, there is no autocorrelation. Therefore, the econometric model constructed is effective and can be used in further research. During the analysis, it was found that the correlation coefficients obtained show a linear relationship between the selected indicators.

The resulting model can subsequently be used to predict the indicator «the volume of innovative products shipped by companies», which the authors believe is one of the most important in analyzing the effectiveness of innovative activities of industrial firms.

Labor productivity in the manufacturing sector, the share of gross value added of industry in the GDP of the Republic of Kazakhstan, and the number of enterprises with innovations have a great influence on the volume of innovative products shipped. Factors such as the number of industrial enterprises and sectors, as well as the number of industrial design titles granted, were less significant in the constructed model. The description of the results of the regression analysis, which refers to the analysis of the factors of innovation activity, allows the following conclusion: 95% of the variation in the volume of products shipped can be explained by these factors.

4.3. Results of quantitative and qualitative analysis of innovative products created by industrial enterprises of the Republic of Kazakhstan (RQ3)

In general, the analysis of bulletins showed that in 2011 the leading regions in terms of the number of innovative developments by industrial enterprises were: the city of Almaty (52 units of inventions, utility models and industrial designs), Karaganda and East Kazakhstan regions (19 units each), Akmola and Almaty (6 units each), North Kazakhstan (5 inventions and designs)

and Kostanay region (4 units of innovative products). 10 years later, in 2022, the capital of the republic, Astana city, was leading, Almaty city was on the second place and Karaganda region on the third place; at the same time on the fourth place - Akmola region and Shymkent city; on the fifth place - Almaty, Pavlodar and Aktobe regions (Table 6). It is important to note that the cities of Astana, Almaty and Shymkent are cities of republican importance and are therefore analyzed separately in this article. Table 6 also provides examples of commercial ownership of properties in a regional context.

Table 6:
TOP-5 leading regions in terms of the number of innovative developments by industrial companies in 2011 and 2021

Region	Number of innovative products created by industrial companies, including:						Total
	inventions	example	utility models	example	industrial designs	example	
2011							
Almaty city	31	A process for the continuous profiling (shaping) of sheet material, a roller for carrying it out and sheet material obtained by this process; multilayer pipe of polypropylene; process for removing palladium catalyst residues from hydrogenated butadiene - nitrile rubber, etc.	5	flexible locking and sealing device «universal-1m»; resistance transformer; directional coupler, etc.	16	packing for sweets (5 options); packing list «Alatau» (5 options); packing list «Altyn Orda» (13 options), etc.	52
Karaganda region	18	power plant muffler; process for making the wort for the beer «Karaganda», etc.	1	subscriber access cabinet	-	-	19
East Kazakhstan region	19	steel tube boiler; a process for obtaining a biologically active lactic acid product, etc.	-	-	-	-	19
Akmola region	5	a method of purifying furnace gases resulting from the thermal decomposition of uranium concentrates; a method of selective flotation of molybdenum, etc.	-		1	-	6
Almaty region	1	method for continuously profiling (shaping) sheet material, roller for carrying out the method and sheet material obtained by the method	2	modular design with a rigid connection between beam and post	3	packaging for adhesive (2 options); box for packaging frozen semi-finished products (7 options), etc.	6
North-Kazakhstan region	1	method for rinsing household gas cylinders of heavy residues	-	-	4	packaging for pasta; glass bottle, etc.	5
Kostanai region	2	method for restoring worn tapered augers; automatic control device for borehole water lift pumps	1	heating water boiler	1	-	4
2021							
Astana city	8	ripper-fertilizer; facade screen, etc.	30	monitoring and control system for oil heating systems; interactive devices with touch interface; automated lighting control system, etc.	2	student furniture set (product as a whole) (2 options), single desk (stand-alone part), double desk (stand-alone part), student chair (stand-alone part); metal folding pedestals, etc.	40
Almaty city	4	mobile sound measuring complex; locking and sealing device, etc.	26	driver's cab, etc.	3	LED Lamp «AILIN LED for housing and community services»; AILIN Premium LED art board, etc.	33
Karaganda region	-	-	14	a method of restoring worn parts of the flow section of pumping equipment; brake shoe frames of rail vehicles, etc.	-	-	14
Shymkent city	1	method for the preparation of a highly concentrated leaching solution	11	apparatus for coring fruit; apparatus for mechanical activation; method for drying grapes; process for the preparation of activated carbon, etc.	1	school desk	13
Akmola region	4	hot water boiler with two rotating screens in the combustion chamber, with post-combustion of the pyrolysis gases and purification of the flue gases from ash carry-over within the boiler, etc.	9	boiler room of block construction; universal water heating boiler for stratified combustion, etc.	-	-	13
Aktobe region	3	method of interval completion of a vertical well; method of interval completion of a horizontal borehole, etc.	6	device to protect against unscrewing of the suction rod; gas-tight screw connection of pump-compressor pipes, etc.	-	-	9
Almaty region	2	mobile module; automatic system for the manufacture of products from thermoplastic material	7	LED Recessed luminaire of the oval type; oval type LED ceiling luminaire; LED street lamp; LED surface mounted luminaire; LED recessed ceiling luminaire	-	-	9
North-Kazakhstan region	-	-	9	hot water boiler manual with automatic programme control; pipe clamp, etc.	-	-	9

Source: Compiled by the authors based on data from the Industry Bulletins of the Republic of Kazakhstan for 2011 and 2021

It is important to note that the relatively large concentration of inventions and other objects of industrial property in the cities of Astana and Almaty is partly due to the fact that the legal address of many industrial enterprises is located in these cities, whereas in reality they may be located in the regions. It should also be noted that many regions of the country are specialized in industry (manufacturing, mining, etc.), which explains the large number of innovations in these sectors. For example, the share of industry in the GDP of the Republic of Kazakhstan in 2020 was 27.1%.

A general description of the results of innovation activity of industrial enterprises of the Republic of Kazakhstan in 2011 and 2021 is presented in Table 7.

Table 6:
Summary of the performance of innovative activities of industrial enterprises in Kazakhstan in 2011 and 2021

Year	Number of industrial enterprises, according to the Industry Bulletins	Number of innovative products created by industrial companies, including:			Sections of the IPC most frequently found in bulletins analyzing the innovative activities of industrial companies
		inventions	utility models	industrial designs	
2011	61	84	9	25	A. HUMAN NECESSITIES B. PERFORMING OPERATIONS; TRANSPORTING C. CHEMISTRY; METALLURGY E. FIXED CONSTRUCTIONS F. MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING G. PHYSICS H. ELECTRICITY
2021	116	31	140	12	

Source: Compiled by the authors based on data from the Industry Bulletins of the Republic of Kazakhstan for 2011 and 2021

Table 7 shows that the total number of innovative products created by industrial enterprises in 2011 was 118 units, 36% less than in 2021; at the same time, the number of products created directly by industrial enterprises themselves has increased by 48%, as shown in the 2021 bulletins. Among the IPC departments most frequently found in the bulletins in the analysis of the innovative activities of industrial enterprises, we can single out: C. Chemistry; metallurgy; E. Fixed constructions; F. Mechanical engineering; lighting; heating; weapons; blasting; G. Physics, which is logically related to the industrial specialization of the Republic of Kazakhstan.

5. Discussion

The main results obtained during the research made it possible to answer the re-search questions posed by the authors at the beginning of the article.

RQ1: *The scientometric analysis identifies at least 7 clusters that reflect the specifics of scientific research related to the study of factors and characteristics of the development of innovative activities of industrial enterprises, as well as determine the main trends in the commercialisation of the results of intellectual work in the form of innovations.*

The scientometric analysis carried out in the work enabled the identification of 15 clusters summarizing work within the framework of the scientific issues considered in this article; it enabled the concretization of current trends and key areas of scientific work related to aspects of the innovative activity of industrial enterprises in the world, the commercialisation of the results of intellectual labor, the effective management of innovative activity and the potential for innovation; and, based on the results obtained, the identification of promising areas for future research. It should be noted that in the scientific works of the authors repeatedly considered the nature and content of regional innovation systems, developed an effective mechanism for commercialisation of IP objects, and studied the quantitative aspects of innovation activity of enterprises in Kazakhstan from the regional aspect. This study made it possible to narrow down and concretize the work - to single out industrial enterprises as an object and to understand the factors that can significantly influence their innovative activity, including through the prism of scientometric, correlation and regression analyses, as well as based on the study of industrial bulletins.

RQ2: *Can the volume of innovative products shipped by industrial enterprises depend on factors such as the number of workers employed in industry and engaged in research and development, labor productivity, the volume of industrial production, the profitability of industrial enterprises, the level of research and development costs, etc.?*

The results of the study have shown that the variable that allows to a large extent to evaluate the activity of enterprises in the field of innovation can be «The volume of innovative products shipped by the enterprises «, which is significantly influenced by factors such as «labor productivity in

manufacturing», «the share of GVA of industry in the GDP of the Republic of Kazakhstan» and «the number of enterprises with innovations for all types of innovations». Thanks to the selection of these factors, a model was created that can be used in the future in the analysis and prediction of the analyzed dependent variable.

RQ3: *What type of innovative products (inventions, industrial designs, utility models) is most widespread in the activities of industrial enterprises in Kazakhstan, as shown by the analysis of the official bulletins «Industrial Property» of the National Institute of Intellectual Property of the Republic of Kazakhstan for 2011 and 2021?*

By analyzing the official industry bulletins for 2011 and 2021, it was possible to identify the leading regions in terms of the effectiveness of their activities in the implementation of innovation policy by industrial companies. Thus, if in 2011 the leading positions were taken by the city of Almaty, Karaganda region and East-Kazakhstan region, then after 10 years - in 2021 - among the first three will be: the cities of Astana, Almaty as well as Karaganda region. It should also be noted that the main share of innovation activity in 2011 is invention, and in 2021 - utility models, which is primarily due to the technological needs of enterprises, and secondly, due to the complexity of registration and subsequent maintenance of inventions. In terms of the qualitative characteristics of innovative products, according to the IPC, innovations predominate in the chemical and metallurgical, construction and mining, mechanical engineering, lighting, heating, motors and pumps, and physics sectors, which is of course related to the industrial specialization of the country's regions and the Republic as a whole.

This study is unique in its kind, as there is no work of this kind to date that allows the innovation activity of industrial enterprises to be assessed not only quantitatively, but also qualitatively.

It is important to highlight the limitations of the research:

RQ1: In conducting a scientometric analysis, materials from the Web of Knowledge database (Clarivate Analytics) were used as a basic source of information, while we can also draw on materials from other platforms for an assessment of this kind: Scopus, Econ-lit, etc. At the same time, we believe that this limitation does not diminish the theoretical and practical significance of the results obtained, since the WoS database is one of the best known and contains a range up to 1975 in depth, which makes it possible to cover a considerable number of publications on the problem analyzed;

RQ2: In the correlation-regression analysis, the authors limited themselves to the official statistical data of the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (next - Bureau) and to individual indicators of sectoral services and ministries, which could to some extent limit the set of considered factors that have a real impact on the innovation activity of industrial enterprises; this limitation could be removed in the future by expanding the set of indicators officially presented on the website of the Office, as the statistical activities of the Bureau are constantly improved and refined;

RQ3: All industrial enterprises were taken into account when working with the bulletins; at the same time, some of them indicate their legal address when registering an IP object, while in reality they may carry out their activities in another region; consequently, the statistical coverage of their innovative products is based on the legal registration and not on the actual location; It should also be noted that the analysis of the bulletins makes it possible to evaluate the effectiveness of the innovative activity of industrial enterprises only on the basis of the registered objects, whereas enterprises create developments but cannot officially register them and it is therefore impossible to take such innovations into account.

6. Conclusion

In general, the research enabled the identification of promising research in the field of innovation activity of industrial companies around the world, which allowed the team of authors to identify directions for future scientific research. In addition, the conducted correlation-regression analysis allowed identifying the factors of development of innovative activity of industrial enterprises of the Republic of Kazakhstan, creating a model that can be used in the future in predicting the volume of shipped innovative products - an indicator of the effectiveness of innovative activity of enterprises. The analysis of industrial bulletins made it possible to conduct a quantitative and qualitative assessment of the innovative activity of the country's industrial enterprises, to study the indicators of the creation of innovative products (inventions, utility models and industrial designs) in 2011 and 2021 (with a difference of 10 years).

The results obtained are of theoretical importance, as they contribute to the expansion of knowledge in the field of industrial economics, in terms of understanding the main global trends in the field of innovative activities of industrial enterprises and the commercialisation of the results of intellectual work; In addition, the practical significance of the research is high, as the obtained results can be useful for JSC National Agency for Development of Innovations «QazInnovations», JSC «QazTech Ventures», JSC «Fund of Science», the Ministry of Science and Higher Education of the Republic of Kazakhstan, the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan, and the Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan in the development of regional and republican programmes for innovative development and the industrial sector, identification of factors / groups of factors influencing the effectiveness of innovation, as well as the formation of key objectives in the field of policy for the commercialisation of the results of intellectual work. In addition, the results of the analysis of industrial bulletins can form the basis for the expansion of statistical data and the inclusion of a section on the analysis of innovative activities of industrial enterprises in the official publications of the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, which is very important, as the industrial sector in Kazakhstan accounts for about 27% of the country's GDP. Moreover, the results of the work can be useful for all scientists conducting research in the framework of this scientific issue.

Future research directions of the author team refer to a component analysis of the current organizational and economic mechanism and factors of commercialisation of innovations in the industrial enterprises of the Republic of Kazakhstan, development of recommendations for improvement of the organizational and economic mechanism of commercialisation of innovations in the industrial enterprises of Kazakhstan based on a systematic approach, highlighting promising areas of activity in commercialisation of innovative products by the industrial enterprises of Kazakhstan based on a matrix approach.

The results obtained show that in the new, modern conditions of economic development of any country, intensification of innovative activity of industrial enterprises be-comes increasingly important, as without significant and fundamentally progressive structural changes it is impossible to effectively ensure socio-economic development of an economic entity and the state.

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