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COMPARATIVE ANALYSIS OF SOCIAL AND ECONOMIC EFFICIENCY IN MANAGING PRODUCT INNOVATIONS IN THE PHARMACEUTIC INDUSTRY

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Abstract. Despite the variety of studies of modern innovative projects within the global pharmaceutical industry, the study of the management system for innovative projects in the pharmaceutical industry is relevant. The pharmaceutical business has a high social role in the country's economy, meeting the needs of the population in providing the necessary products. This is what determines the significant influence of the state on this sphere of economic activity, which is expressed in the mandatory fulfillment of a number of rigidly and clearly established requirements, due to which the observance of the rights of citizens in the possibility of obtaining high-quality pharmaceutical products will be ensured.The aim of the study is to consider the socio-economic characteristics of managing product innovations in pharmaceuticals (leading pharmaceutical markets) based on assessing the level of innovative activity of pharmaceutical companies, which addresses the problems of managing their role and importance in the healthcare system of Kazakhstan.

Keywords:pharmaceutical industry; product innovation; innovative development; innovation activity; management; development strategy

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JEL Classifications:M21, O11

1. Introduction

A comparative analysis of the strategic goals of various economic systems allows us to talk about an objective increase in the role of innovative development in the general management system. Large-scale identification of new knowledge in various fields, as well as their combination, entails the emergence of new products and technologies. If an economic system of any scale and type of activity ceases to pay attention to innovation processes, then sooner or later this will lead, if not to the termination of its functioning as an economic system,

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then to a decrease in the efficiency of activity. Innovation management is becoming a necessary element of economic development, since it allows us to differentiate in advance and identify the usefulness or hopelessness of an innovation, eliminate contradictions between innovations and existing old technologies, equipment, products, etc., as well as take into account the state policy in the field of innovation and scientific research.

The pharmaceutical market is an important sector of the economy of any country and is a criterion for its economic and social development, the level of well-being of the population. With the beginning of a large-scale diversification of the economy in Kazakhstan, industries that are fundamentally new for the country have appeared. The implementation of the state program for industrial and innovative development has borne fruit: machine building, petrochemistry, food production and a host of other new industries are developing in the country. One of the key, and without exaggeration, vital for every citizen of Kazakhstan, has become the pharmaceutical industry. The development of the pharmaceutical industry in Kazakhstan provides for a complex of organizational, economic, technological, managerial measures aimed at the design, construction and commissioning of pharmaceutical industries, the introduction of production technologies, research and development work for the development and development of the production of new competitive drugs , the creation of raw material bases in the regions from domestic medicinal plant materials, training of personnel for pharmaceutical production in accordance with GMP, which should ultimately contribute to an increase in the volume of domestically produced products, subject to state support for local pharmaceutical production, sustainable growth of the pharmaceutical market in recent years, and overall positive macroeconomic climate, Kazakhstan is becoming an attractive destination for pharmaceutical companies as a target market and region of the global center.

2. Research background

Most scientists who have studied the dynamics of the development of pharmaceuticals and the innovation processes characteristic of it indicated that in recent decades the industry has undergone continuous intensive changes both in business models and in production and research activities, while the cost of innovative medicines has risen. So, Rozhnova S.A., Tsypkina A.V. (2017) show the extremely important role of the stages of development of pharmaceutical products, which require detailed study, since they require more time and economic costs.We would also like to note that the strategic development of the pharmaceutical industry is subject to the influence of demographic trends: characteristic diseases corresponding to aging determine the focus of R&D and the directions of global investment activity in the industry. In this process, multinational corporations play a predominant role, locking in innovation processes and investing huge amounts of money in R&D.

In his scientific research, Scannell J. W. (2017) describes the profitability of drugs entering the market that are entirely dependent on their innovation and special status, supported by a patent mechanism. In the past two decades, the effective duration of the patent period has dropped significantly. This is due to the lengthening of the period of clinical trials and the timing of the review by regulators of the results of these trials in order to make a decision on the admission of innovative medicines to the market.

As a result, companies seek to recover costs in a shorter sales period and inflate the price of medicines. To this end, companies strive to release drugs at the same time with a high price and a potentially large sales market. That is, choose those therapeutic categories where, for example, the country's medical insurance system is ready to purchase a large number of expensive medicines (in accordance with the existing priorities in the country) (Philippidis, 2017).

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Many scientists, including A. Bachman, J. Cantwell (2017), focused on the role of small companies in the innovative development of knowledge-intensive industries, including pharmaceuticals. As they pointed out, the development of information technologies leads to the convergence of technological competencies and knowledge among the largest high-tech companies - knowledge becomes more accessible for transfer, and globalization and internationalization of TNCs accelerate the exchange of knowledge between companies from different regions of the world and, more importantly, from different industries.

For example, if in the past industrial enterprises simply transferred knowledge about methods and processes from one production to another, then information technology has created an environment in which the interpenetration of various competencies takes place, which gives wider opportunities for innovative development. All this opens up prospects for a further global innovation leap, caused not so much by a specific technology (including technologies of widespread use), but by the emergence of a fundamentally new sectoral structure of the world economy. In such a situation, the sources (points of origin) of innovations and the mechanisms of interaction between them and established companies (in pharmaceuticals, mainly TNCs) change. In particular, many researchers highlight the growing role of pharmaceutical alliances and joint ventures, as well as independent researchers. That is, the innovation process ceases to be linear and goes beyond TNCs, opening up opportunities for small businesses and innovative start-ups.

According to the studies of Cantwell J. A., Bachmann A. (2017), an important role is also played by competition between developed and developing countries, as well as intra-industry competition between generic manufacturers and leading TNCs focusing on patented drugs.

Many scientists analyze the innovative indicators of the development of the world economy over the past ten years, which shows that in search of competitive advantages and effective technological solutions, the world's largest corporations have begun to increase investments in R&D (Ivanova, N., Mamadyarov, Z., 2019).

In their studies, Zervas G., Proserpio D., Byers J.W. (2017) highlight the development of the phenomenon of the shared economy (sharingeconomy), the intensification of the use of outsourcing, the changing role of small and medium-sized enterprises in a number of industrial and high-tech sectors of the economy, among which pharmaceuticals occupy an important place.

Most scientists, such as, for example, KoganL. (2017), who studied the dynamics of the development of pharmaceuticals and the innovation processes characteristic of it, indicated that in the past decade the industry has undergone continuous intensive changes both in business models and in production and research activities.Globalization played a key role in the intensive growth of the pharmaceutical industry, stimulated an increase in product sales and growth in the capitalization of leading TNCs. At the same time, globalization has led to increased competition in the pharmaceutical market, the emergence of a powerful generics market and the erosion of the share of leading TNCs in it. The largest pharmaceutical companies have already intensified their search for new opportunities for cooperation, have begun to develop new business models, trying to maintain their positions against the background of growing competition, and have tried to launch the process of transforming the industry from within, using the advanced capabilities of information technology (Schweitzer, S., Lu, Z., 2018).

The international activities of pharmaceutical TNCs are concluded in three main geographic regions of the planet: North America (up to 50% of the world market), Europe and Asia - primarily the USA, EU and Japan. China also plays a role - in addition to the potential of a huge domestic market, China is of key importance in supplying the world market with the primary substances necessary for the creation of drugs. It should be noted that for a long

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time China remained relatively inaccessible to world TNCs, and only in recent years there have been tendencies for the activation of foreign TNCs in the Chinese market, strengthening of patent legislation and serious shifts in the mechanisms of pricing and R&D support (Hu, J., Mossialos, E., 2016).
Further development of the industry will depend on innovative success in pharmaceuticals and the reaction of leading TNCs to the ongoing changes (Kruger, H., 2018).Therefore, one of the main tasks of the state in the pharmaceutical industry is to achieve 50% of the domestic market supply with domestic pharmaceuticals.

Progress in the pharmaceutical industry does not stand still. The companies, together with scientific organizations, are actively working to find advanced approaches to pharmacotherapy. Pharmaceutical manufacturers spend about $ 150 billion annually on research and development. As a rule, out of thousands of compounds, only a small number of molecules receive approval for subsequent introduction into clinical practice. In general, in recent years, the largest number of new molecules at different stages of development or clinical trials fell on the segment of drugs for the treatment of cancer. The attention of pharmaceutical companies is also focused on such therapeutic areas as infectious diseases, neurology, hematology, endocrinology, allergy and immunology, cardiovascular and respiratory diseases, etc. (Bervelt, P., Dooren, V., 2019).

According to the forecast of IQVIA experts, by 2023 the global market for oncological drugs will grow to $ 140-150 billion, retaining its leading position among other therapeutic areas in terms of costs. Significant growth by 2023 should also be expected in the segment of drugs for the treatment of diabetes mellitus, the capacity of which will amount to 115-125 billion dollars. At the same time, the volume of the pharmaceutical market as a whole by 2023 will reach about 1.5 trillion dollars (IQWIA, 2019).

In her scientific research, Y. Prozherina (2019)analyzes the dynamics of the development of the global pharmaceutical market, which provides a forecast by 2023 with an emphasis on the growth of cancer drugs, which will grow to $ 140-150 billion, while maintaining a leading position among other therapeutic areas in terms of costs. Significant growth by 2023 should also be expected in the segment of drugs for the treatment of diabetes mellitus, the capacity of which will be 115-125 billion dollars. At the same time, the volume of the pharmaceutical market as a whole by 2023 will reach about 1.5 trillion dollars.

Analysis of the factors that determine the state and development of the global pharmaceutical industry, according to the research of T.A.Bizunok (2019), also indicates a high level of development of the pharmaceutical industry in economically developed countries, which is facilitated by the pharmaceutical transnational corporations created by them.

The growth of the global pharmaceutical industry is mainly due to the growth of the pharmaceutical markets of the BRICS countries, which include Brazil, Russia, India, China and South Africa (Kostin, K., Adams, R., Samli, C., 2015).
One of the key tasks facing the pharmaceutical industry of the BRICS countries today is to achieve a balance: on the one hand, it is required to provide citizens with vital, latest and most effective medicines, and on the other, to comply with the commercial interests of Big Pharma (Maksimtsev, I., Karlik, A., Yakovleva, E., 2016).

It should be noted that China stands out significantly against the background of other BRICS countries in terms of R&D expenditures. Moreover, at the beginning of the XXI century. countries started off with roughly the same indicators. However, it was China, developing its economy that stimulated the development of research and development and, in particular, the pharmaceutical sector (Plotnikov, V., Kuznetsova, V., 2018).

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Currently, there is a need to solve a whole range of problems that impede the introduction of innovative drugs to the market, which requires an institutional approach, i.e. taking measures of a political, legal, social, organizational, scientific, technical and economic nature. In his research, A.A.Semin (2017) examines the institutional mechanisms for increasing the productivity of scientific research in the development of innovative medicines, consisting in improving institutions: public procurement, state registration of medicines, state support for small and medium-sized businesses, state scientific and technical policy, science and education, international relations.

Focusing on the Russian experience, C.Rudisill, S. Vandoros, J. Antoun (2014.) based on the current political and regulatory environment, it was proposed the possibility of switching to cost-based pricing, and in the short term - to introduce direct price negotiations and drug pricing in accordance with reference countries using the assessment of medical technologies.

The leading approach to the study of this issue, in accordance with the position of S.I.Ashmarina, A.V. Streltsov, A.M. Izmailov, E.M.Dorozhkin, M.Vochozka (2016) is an analytical approach that allows to determine the main directions of restoring the competitiveness of the pharmaceutical industry.

In the management of product innovations in the pharmaceutical industry, the marketing aspects of product innovations, pricing and stock options of the brand, as well as exclusivity options available through government regulators (Ding, Eliashberg, Stremersch, 2014).

Pharmaceutical policy in countries with a developing healthcare system has its own characteristics, which depend on the level of socio-economic status, as described in their research by W. Kaplan, N. Boskovic, D. Flanagan, S. Lalany, Ch. Ying Lin, Z. Ud Din Babar (2017.).

Thus, pharmaceutic are the most high technology industry in the world economy with research and development in the total sales of more than 14%, which in monetary terms in 2022 is expected to grow to $ 182 billion (Lin, Goncharov, Ivichev, 2016.).

3. Researchquestions

The dynamic development of the pharmaceutical market, the high organizational dynamics of its subjects and the increased competition impose new requirements on the organization of management of pharmaceutical enterprises. In these conditions, it is strategically important to determine the main directions for increasing competitiveness, based on the characteristics of a specific production of medicines, which is largely determined by the efficiency of organizing production processes, the use of limited resources, responsiveness to market conditions and flexibility in production management

For effective management of product innovations in the pharmaceutical industry, it is necessary to systematize the factors of innovative development of the industry, to identify problems in the market of innovative medicines, as well as opportunities for managing innovative activities of pharmaceutical enterprises. Therefore, in order to analyze the effectiveness of the management system for innovative projects in the pharmaceutical industry of the Republic of Kazakhstan, the author considered the main indicators of health care development and it's financing, which affect the further development of product innovations in the pharmaceutical industry. As a result, the dependence of the number of medical personnel in the pharmaceutical industry on the number of medical institutions and the amount of funding was revealed (Figure 1).

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The pharmaceutical business has a high social role in the country's economy, meeting the needs of the population in providing the necessary products. This is what determines the significant influence of the state on this sphere of economic activity, which is expressed in the mandatory fulfillment of a number of rigidly and clearly established requirements, in particular, the effective management of product innovations in the pharmaceutical industry.

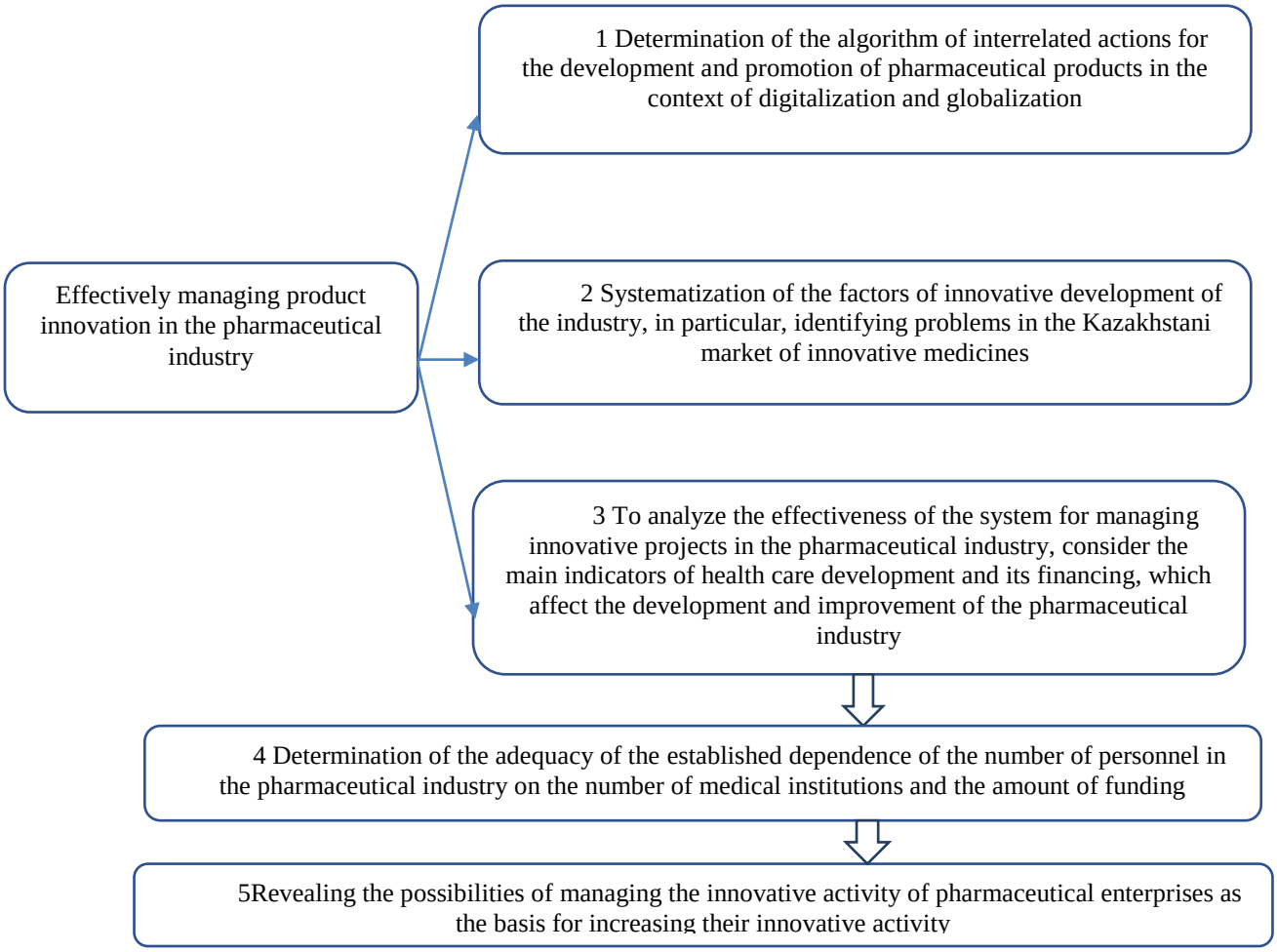

Figure 1. Research questions
Source: compiled by authors

Scientific novelty consists in a comprehensive study of innovative processes in the pharmaceutical industry, which will reveal the specifics and prospects for the development of the industry.

4. Methodologic approach and data analysis

The pharmaceutical industry is also one of the most socially significant segments of the economy. The results of the work of pharmaceutical companies have a significant impact on the health of the population and constitute an

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important part of the healthcare systems of the countries of the world. The latest drugs, including vaccines, are critical to the stability of the global health system and are therefore strictly controlled by national regulators as well as international organizations such as the World Health Organization. All this determines the strategic nature of the industry both for the economic development of countries and their research potential. With all its scale and global character, the functioning of the pharmaceutical industry in each specific country depends both on the decisions and policies of local regulators and industry institutions, and on the level of participation of local companies in the global pharmaceutical market (Mamedyarov, Z., 2019).

In this regard, the decisive tasks of the state in the formation of the pharmaceutical market in Kazakhstan are:
- modernization of existing production facilities and construction of new pharmaceutical enterprises as part of the implementation of investment projects;
- implementation of international quality standards; i.e. Good Manufacturing Practice (GMP) at pharmaceutical industry enterprises;
- creation of conditions for import substitution of pharmaceutical and medical products based on modern technologies in accordance with international GMP standards;
- providing the industry with qualified personnel.

The development of the pharmaceutical industry in Kazakhstan provides for a complex of organizational, economic, technological, managerial measures aimed at the design, construction and commissioning of pharmaceutical industries, the introduction of production technologies, research and development work for the development and development of production of new competitive drugs, the creation of raw material bases in the regions from domestic medicinal plant materials, training of personnel for pharmaceutical production in accordance with GMP, which should ultimately contribute to an increase in the volume of domestically produced products.
Today, the domestic pharmaceutical industry is engaged in the research, development, mass production and distribution of medicines, medical products and medical equipment. At the moment, more than 200 pharmaceutical enterprises operate in the Kazakhstan market. 12 production sites of 8 domestic pharmaceutical companies received GMP (Good Manufacturing Practice) certificates (Table 1).

Table 1. InternationalGMPstandardsatdomesticpharmaceuticalcompaniesin Kazakhstan

№	Enterprise	Production area
1	JSC «Nobel AFF»	Solid Medicines Workshop
		Workshop for liquid and soft medicines
2	JSC «Khimfarm»	Aseptic powdering workshop
		Workshop for the production of injection solutions in ampoules, syringe filling
		Production lines of injection solutions of the workshop of injection solutions and infusion
3	LLP «VIVA Pharm»	Solid Medicines Manufacturing Site
4	LLP «FitOleum»	Production area for oil extracts
		Suppository production site
5	LLP «EikosPharm»	Solid Medicines Manufacturing Site
6	LLP «Kelun-KazPharm»	Production area for infusion solutions
7	LLP «PFK «Eleas»	Sterile Medicines Dispensing Workshop
8	LLP «DOSPHARM»	Conducting preclinical and clinical studies, introducing drugs into the production

Source: compiled by authors according to Data of the Ministry of Health and Social Development of the Republic of Kazakhstan

It should be noted that most of them are enterprises with foreign participation. The presence of GMP certificates for certain industries should help to increase the output of manufactured products and contribute to a more free

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promotion of domestic drugs to foreign markets. Of course, the state has a significant impact on the formation of the pharmaceutical market - this is:
- provision of a guaranteed volume of free medical care (guaranteed volume of medical care);
- support for domestic manufacturers within the framework of existing programs.
In fact, in order to develop the market, it was necessary to radically reform the entire system - production, import, registration and certification of medicines. Today, the country has streamlined activities for registration, certification, and quality control of medicines, medical devices and medical equipment, as well as their advertising. The National Medicines Information Center was created; state regulation of prices for medicines purchased from the budget was introduced. Also in Kazakhstan, a unified distribution system for medicines and medical products was created in the person of LLP SK-Pharmacia, which made it possible to ensure transparency of the public procurement of medicines market, bring it closer to the existing international standards of logistics, storage and distribution. All these measures brought their results.

In many respects, the current success of Kazakhstan producers is facilitated by the support they receive from the state, in particular, in public procurement (long-term contracts).

Within the framework of the State Program of Industrial and Innovative Development for 2015-2019, there are various tools to support business, including for pharmaceutical companies. Programs such as:
- "Business Roadmap 2020" (Official site of the Government of the RK, Business Roadmap 2020);
- "Exporter 2020" (Official site of the Government of the RK, Exporter 2020);
- "Employment 2020" (Official site of the Government of the RK, Employment program 2020);
- "Map of the industrialization of Kazakhstan for 2015-2019" (Official site of the Government of the RK, State program, 2015-2019);
- the program "Productivity 2020" and are aimed specifically at increasing the competitiveness of domestic enterprises by stimulating the production, export, personnel and technological potential of enterprises (Official site of the Government of the RK, Business Roadmap 2020).

And although, in general, according to the results of the first half of 2019, the volume of purchases of pharmaceutical products for guaranteed medical care in value and physical terms decreased, the share of Kazakhstani manufacturers increased - in physical terms from 59% in the first half of 2018 to 66.3% in the first half of 2019. year, in value terms - from 19% to 23.2%, respectively. But Kazakhstani producers are not only increasing their presence in the public procurement sector. They are systematically increasing sales in the retail segment, which is very important, since its volume is several times higher than the procurement segment for guaranteed volume of medical care, both in value and in kind. It is clear that they have to work in this segment without any support. on a par with other market participants, in a highly competitive environment for doctors' recognition and consumer preferences.As already noted, long-term contracts are a significant incentive for the construction of new or modernization of existing production sites in accordance with international GMP standards. After all, this is the main condition for their conclusion. So, since the beginning of the application of this support measure, 24 production sites have appeared in the republic, operating according to GMP rules.

The results for the first half of 2019 show that the Kazakh pharmaceutical market is going through difficult times. This is mainly due to the economic situation, the policy of the regulator aimed at rationalizing the costs of medicines purchased for the guaranteed volume of medical care. The high volatility of the national currency rate, the decrease in the purchasing power of the population and the related change in the structure of demand in favor of cheaper synonymous drugs make their contribution.

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Only local producers are increasing their market share. Especially in the procurement segment for guaranteed volume of medical care. According to the Pharmacy Committee of the Ministry of Health of the Republic of Kazakhstan and LLP SK-Pharmacy, for 2019, the Single Distributor has already purchased 536 names of drugs and medical devices in the amount of 50.4 billion tenge for the provision of guaranteed medical care (Table 2).

Table 2. TOP-8 domestic manufacturers of medicines (A) and medical devices (B) in terms of the purchase amount for the guaranteed volume of medical care (tender, contract, agreement) for 2019

(in mln tenge)

Domestic manufacturers	medicines (A)		Domestic manufacturers	medicines (B)	
	mln tenge	share among OTP, %		mln tenge	share among OTP, %
Santo (JSC «KhimFarm»)	12664	25,1	JSC «Dolce»	2652	5,3
JSC «Nobel AFF»	12622	25	JSC «Aksel and A»	2122	4,2
JSC «Abdi International»	7193	14,3	JSC «Super Pharm»		3
JSC «Nur May Pharmacia»	1913	3,8	JSC«KazMedProm»	1395	2,8
JSC«EcoPharmInternational»	1895	3,8	JSC «Almerek»	740	1,5
JSC «VIVA Pharm»	1483	2,9	Wellness center of Masimov	680	1,3
JSC «Kelun-Kazpharm»	1337	2,7	JSC «Juldyz Kenan»	271	0,5
Others	1610	3,2	JSC «Sultan»	123	0,2
			Others	215	0,4

Source: compiled by authors according to Data of the Ministry of Health and Social Development of the Republic of Kazakhstan

At the end of the first half of 2019, Kazakhstan took the first position in the ranking of producer countries in terms of market share. Only time will tell whether domestic producers will be able to retain their leading position in the future. But, certain prerequisites for this already exist.

Based on the available data on the sales volume of SANTO in the Kazakhstani pharmaceutical market, we will build a trend model with the help of which we will calculate the forecast value of the indicator under consideration for 2020.

Analytical methods for identifying trends in a time series are implemented within the framework of regression models, in which the variable acts as a dependent variable y_t, in our case, the sales volume, and in the role of the only explanatory variable time t.

The trend parameters are estimated using the least squares method, i.e. are selected in such a way that the graph of the function is located at a minimum distance from the points of the original data. According to OLS, when estimating model parameters, all observations are assigned equal weights, i.e. their information value is recognized as equal, and the development trend throughout the entire observation area is unchanged. Let's build a graph of the dynamics of sales for 2013-2018 (Figure 2).

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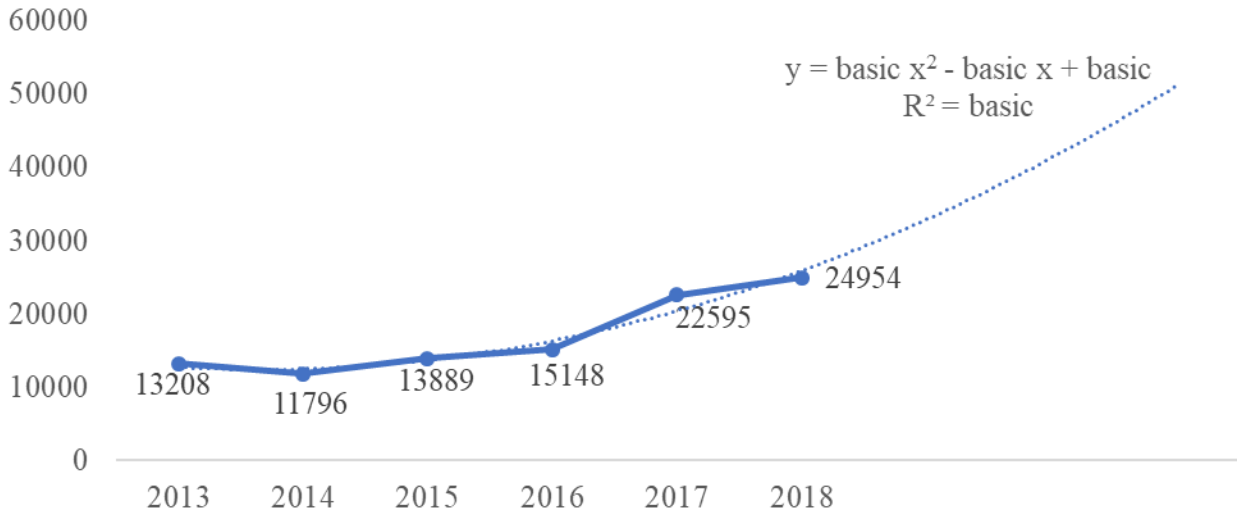

Figure 2. Dynamics of sales volume, in million tenge
Source: compiled by authors

Graphical analysis indicates the closeness of the development of the considered indicator to the parabolic shape. Using the "Data Analysis" Excel setting, we will build a parabolic trend. The regression analysis protocol is shown in Figure 3.

CONCLUSION OF THE RESULTS

Regression statistics	
Multiple R	0,973240196
R-square	0,947196479
Normalized R-square	0,911994131
Standard error	1620,040941
Observations	6

Analysis of variance

	df	*SS*
Regression	2	141237631,4
Remainder	3	7873597,95
Total	5	149111229,3

	Coefficients	*Standard error*
Y- intersection	14404,9	2898,017336
t	-2394,275	1895,96213
t^2	719,125	265,1414372

Figure 3. Protocol for performing regression analysis
Source: compiled by authors

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Thus, the parabolic trend equation will take the form:

$$y_t = 14404,9 - 2394,275t + 719,125t^2.$$

To determine the predicted values of the sales volume, it is necessary to substitute the corresponding value of the time parameter into the resulting model ($t = 7 и t = 8$):

$$y_7 = 14404,9 - 2394,275 \cdot 7 + 719,125 \cdot 7^2 = 32882,1 \text{ mln.tenge;}$$

$$y_8 = 14404,9 - 2394,275 \cdot 8 + 719,125 \cdot 8^2 = 41274,7 \text{ mln.tenge.}$$

Thus, the forecasted values of the sales volume for 2019 amounted to 32882.1 million tenge, and in 2020, respectively, will amount to 41,274.7 million tenge.
According to the Pharmacy Committee of the Ministry of Health of the Republic of Kazakhstan and LLP SK-Pharmacy, in 2019, the range of domestic pharmaceutical products purchased under long-term contracts will increase to 493 drugs and medical devices (231 drugs, 262 medical supplies), and by 2021 it will be replenished another 112 drugs and 32 medical devices. At the same time, domestic companies demonstrated the highest sales growth rates, which significantly outstrip the growth of the pharmacy segment as a whole (Figure 4).

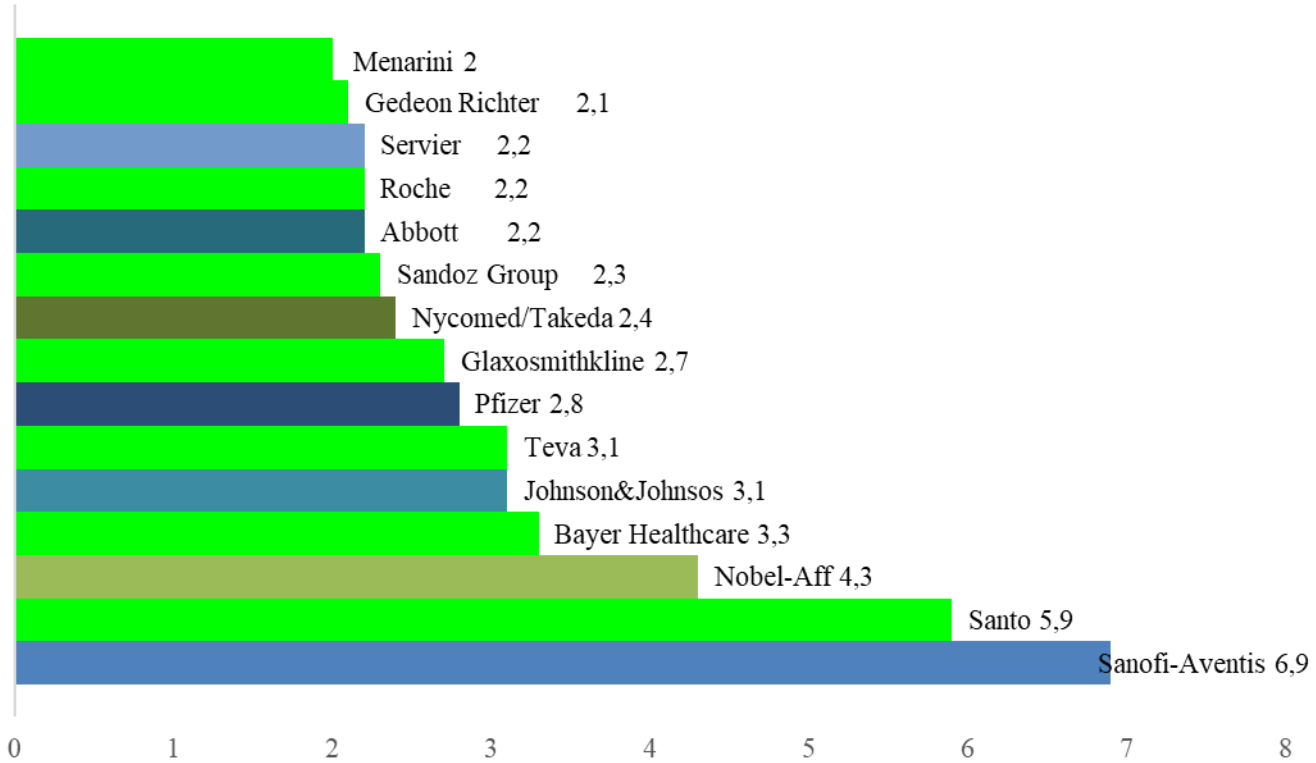

Figure 4. TOP-15 companies in the Kazakhstan market for 2019, (%)
Source: compiled by authors according to resource of www.pharm.reviews

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In this regard, an increase in the purchase volume of the Single Distributor of domestic pharmaceutical products in monetary terms from 30 billion tenge to 73 billion tenge in 2024 is forecasted. This will help to increase the share in the budget segment, and if Kazakhstan pharmaceutical manufacturers continue to develop as actively in retail, they will have every chance to remain number 1 on the market.

Today, drug provision of the population is one of the most acute social problems in the system of state interests. It is no secret that at this stage, the country's drug supply is not effective enough and the costs are growing, a significant part of the population does not receive the necessary drugs.

Focusing on innovation, it is necessary to understand that innovation in the pharmaceutical sector is costly and unpredictable in terms of results, since it requires significant R&D expenditures in order to invent and test new drugs. Pharmaceutical companies can spend up to 10-15 years developing new drugs until they enter the market. During this time, companies incur significant costs with the high risks that new drugs may not pass clinical trials. Hence, the retail price for drugs that have successfully passed clinical trials and brought to the market is usually high, since the manufacturer must compensate for its costs. As a consequence, innovation in the pharmaceutical industry offers more patent protection than any other industry. Patent protection allows pharmaceutical companies to recover the substantial costs of inventing, testing new drugs, and obtaining regulatory approval for placing them on the market. However, determining the optimal balance between the level of innovation and the optimal timing and scope of intellectual property protection is an extremely difficult task, and each state solves this task in its own way.

By analyzing customer preferences and applying the latest technologies, it is possible to promote products in a more targeted manner, taking into account the characteristics of each target group, which increases the efficiency of promotion costs. For this you need to learn new tools and master them. In this regard, we propose a certain algorithm of interrelated actions for the development and promotion of pharmaceutical products in the context of digitalization and globalization (Figure 5).

Pharmaceutical companies need to use new channels of promotion, not limited to the activities of medical representatives, to introduce omnichannel models. This requires systematic targeted work, which includes the following components:
1) setting goals for the effectiveness of new product development;
2) creating partnerships with other companies, medical institutions, scientific institutions, as well as regularly analyzing trends and best practices to obtain new ideas from external sources and develop new dosage forms (including through the acquisition of biotech startups);
3) development of new competencies in a number of areas:
- the use of digital technologies, for example, for working with large amounts of data and using artificial intelligence;
- portfolio management of innovative ideas;
- building partnerships, including searching for and buying promising startups or shares in them;
- development of export markets;
4) the use of new approaches to work with portfolios of innovations in the field of products, processes and business models, in particular, mastering the methods used in the field of venture capital;
5) improving the efficiency of the research and development process:
- using digital technologies, rapid prototyping based on the Agile model, involving a large number of participants in the process;

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6) the development of the function of fast time-to-market for new products, including the use of RWE's practical evidence base and innovative pricing methods (risk sharing concept).

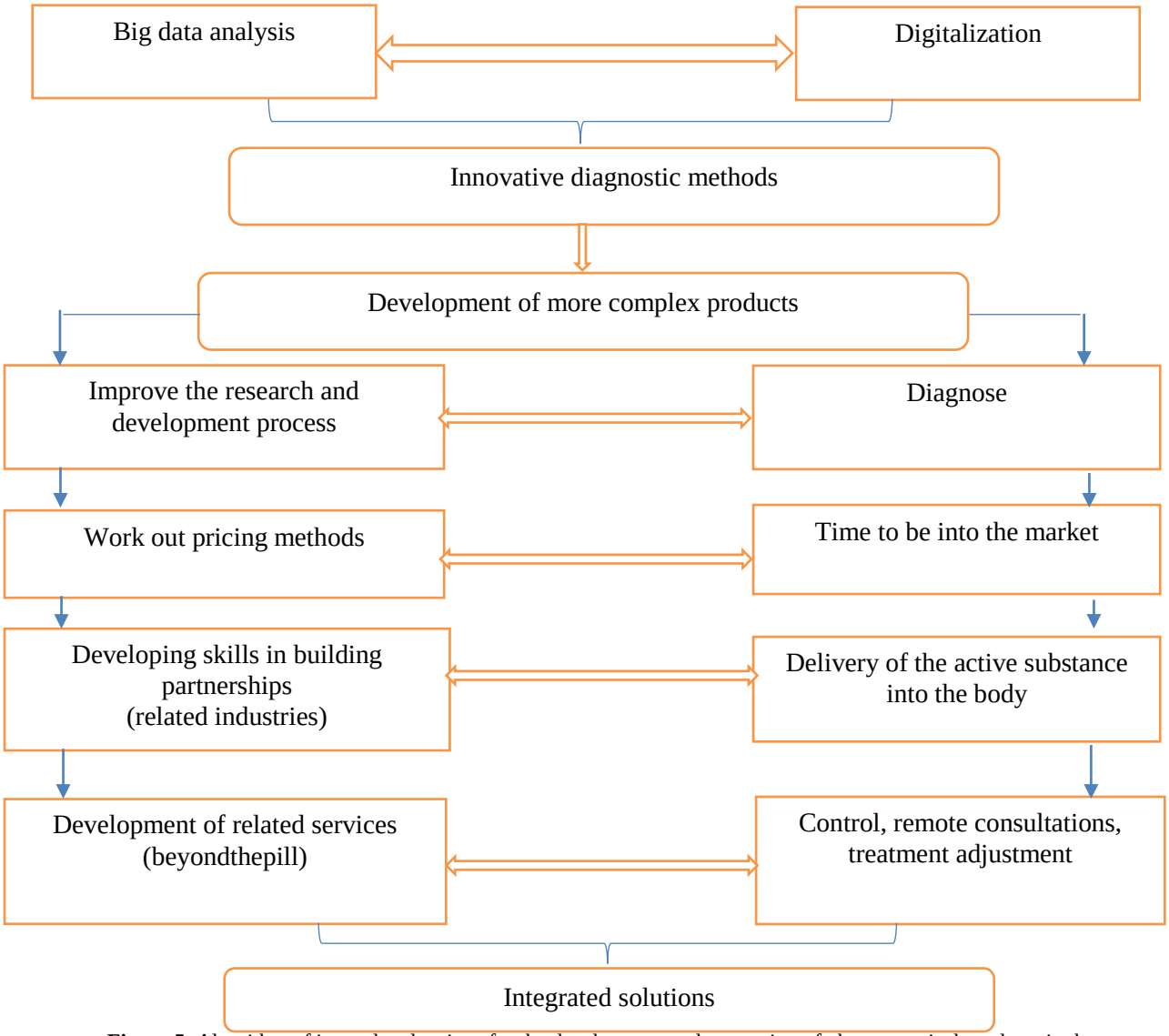

Figure 5. Algorithm of interrelated actions for the development and promotion of pharmaceutical products in the context of digitalization and globalization
Source: compiled by authors

The introduction of innovations is becoming one of the priority instruments for ensuring the growth of the state economy. Innovation is an effective tool in the competition, as it definitely leads to a company of welfare, to attract inevitable investments, as well as to the formation of new effective demand.

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In today's environment, only pharmaceutical companies that have sufficient sales volume, have an optimized structure for working with clients and possess the necessary new concepts for successful operation can be able to conduct a profitable business. In this regard, the role of the pharmaceutical industry in healthcare, in particular, for the Republic of Kazakhstan is obvious and huge.

The author uses a project approach to innovation and investment activity, which is based on the principle of cash flows, a feature of which is its predictive and long-term nature, where the analysis takes into account the time factor and the risk factor. At the same time, the effectiveness is determined on the basis of Methodological Recommendations for assessing the effectiveness of innovative projects and their selection for financing.

Therefore, to analyze the effectiveness of the management system for innovative projects in the pharmaceutical industry, we will consider the main indicators of health care development and its financing, which affect the development and improvement of the pharmaceutical industry (Table 3, 4).

Table 3. Key indicators of health care development in Kazakhstan

Indicators	2015	2016	2017	2018	2019	Growth in 2019 compared to 2015, in %
The number of doctors of all specialties in the pharmaceutical industry, in thousands of people	54,6	54,8	55,5	57,3	59,4	108,8
per 10 000 population	36,5	36,3	36,5	37,6	38,4	105,2
Number of nursing staff in the pharmaceutical industry, in thousands of people	115	117	119,6	125,2	130	113,0
per 10 000 population	76,9	77,6	78,6	81,8	84	109,2
Number of hospitals (using pharmaceutical products)	1029	1042	1063	1086	1055	102,5
Number of medical institutions	3463	3462	3434	3609	3896	112,5

Source: compiled by authors according to Data of JSC Kazakhstan Industry Development Institute (KIDI)

Table 4. Amount of healthcare financing in Kazakhstan

Indicator	2015	2016	2017	2018	2019	Growth in 2019 compared to 2015, in %
Amount of financing, total billion tenge	131,2	187,1	231,1	309,5	403,5	307,5
per capita (total), in tenge	8 740	12 298	15 184	20 105	25932	296,7
per 1 inhabitant (local level), in tenge	7 097	9 946	12 304	17 344	22542	317,6
Financing volume of guaranteed volume of medical care, total billion tenge	90,5	118,5	139,6	195,1	225,6	249,3
per capita (total), in tenge	6 025	7 785	9 172	12 673	14488	240,4
per 1 inhabitant (local level), in tenge	5 433	7 405	8 728	11 969	14745	271,4
share of guaranteed volume	68,9	63,3	60,4	63,0	55,8	80,9

Source: compiled by authors

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5. Mathematical approach

Having considered the main indicators of health care development, as well as the amount of financing of health care in Kazakhstan for the period from 2015-2019, which were analyzed in Tables 3 and 4, their average values were identified and the forecast of expenditures for priority areas of the health care system is shown using regression analysis (Table 5).

For the analysis of costs, as a resultant attribute, such an indicator as the total expenditure of healthcare financing, which affects the further development of the pharmaceutical industry, was taken as a basis, and the factors affecting the resulting attribute:

x1 - inpatient care;
x2 - PHC;
x3 - construction and reconstruction of healthcare facilities;
x4 - medical education and science;
x5 - other expenses, including SES;
x6 - priority areas.

Table 5. Forecast of expenditures for priority areas of the health care system of the Republic of Kazakhstan

Indicator	Sign	Average value in 5 years	Calculation formula	Credibility	Forecast	
					2020	2021
Total consumption	У	319,36	У=76,1Х+90,9	R^2 = 0,98	547,5	623,6
Inpatient assistance	x1	86,54	У=9,29Х1+58,6	R^2 = 0,98	114,3	123,6
PHC	x2	65,76	У= 34,802exp(0,19 x^2)	R^2 = 0,99	108,43	131,04
Construction and reconstruction of healthcare facilities	x3	66,26	У=16,81Х3+15,8	R^2 = 0,97	116,6	133,47
Medical education and science	x4	10,3	У=2,55Х4+2,65	R^2 = 0,99	17,95	20,5
Other expenses	x5	15,88	У=5,9Х5-1,82	R^2 = 0,97	33,58	39,48
Priority directions	x6	74,62	У=28,5Х6-11,03	R^2 = 0,97	159,97	188,47

Source: compiled by authors according to Data of JSC Kazakhstan Industry Development Institute (KIDI)

Analyzing the data in Table 5, the following should be noted:

1) if the expenditure on inpatient care is increased by 1 unit, the total expenditure will increase by 0.29 units.
2) if the consumption for PHC is increased by 1 unit, the total consumption will increase exp (0.19) times.
3) if the expenditure on the construction and reconstruction of healthcare facilities is increased by 1 unit, the total expenditure will increase by 16.81 units.
4) if the expenditure on medical education and science is increased by 1 unit, the total expenditure will increase by 2.55 units.
5) if other expenses, including SES, are increased by 1 unit, the total consumption will increase by 5.9 units.
6) if the consumption for priority areas is increased by 1 unit, the total consumption will increase by 28.5 units.

Elasticity coefficient:

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1) if the expenditure on inpatient care is increased by 1%, the total expenditure will increase on average by 0.93%.
2) if the expenditure on PHC is increased by 1%, the total expenditure will increase on average by 12.49%.
3) if the expenditure on the construction and reconstruction of healthcare facilities is increased by 1%, the total expenditure will increase on average by 0.99%.
4) if the expenditure on medical education and science is increased by 1%, the total expenditure will increase on average by 0.91%.
5) if other expenses, including SES, are increased by 1%., The total expense will increase on average by 1.02% units.
6) if the expenditure on priority areas is increased by 1%, the total expenditure will increase by 1.01% on average.
Thus, the total expenditure is more influenced by other expenditures, including SES (1.02%) and expenditures on priority areas (1.01%), to a lesser extent, expenditures on construction and reconstruction of healthcare facilities (0.99%) and the least influence have expenses for inpatient care (0.93%) and for medical education and science (0.91%).
on the number of honey. staff in the pharmaceutical industry is more influenced by the number of clinics than by funding.
Let us establish the dependence of the number of honey. personnel in the pharmaceutical industry from the number of medical institutions and the amount of financing of the guaranteed volume of medical care.
Let be:
y - number of medical personnel (doctors and paramedical personnel in the pharmaceutical industry) - thousand people;
x_1 - number of medical institutions - thousand units;
x_2 - volume of financing guaranteed by the guaranteed volume of medical care - billion tenge.
We will look for a two-factor regression equation in the following form:

$$y = a + b_1 x_1 + b_2 x_2, \qquad (1)$$

The system of normal equations for determining the coefficients of the regression equation is:

$$\begin{cases} na + b_1 \sum x_1 + b_2 \sum x_2 = \sum y \\ a \sum x_1 + b_1 \sum x_1^2 + b_2 \sum x_1 \cdot x_2 = \sum y \cdot x_1 \\ a \sum x_2 + b_1 \sum x_1 \cdot x_2 + b_2 \sum x_2^2 = \sum y \cdot x_2 \end{cases} \qquad (2)$$

To determine the required values of the amounts, we will draw up a calculation Table 6.

Table 6. Estimated indicators

№	y	x_1	x_2	x_1^2	x_2^2	$y \cdot x_1$	$y \cdot x_2$	$x_1 \cdot x_2$
1	169,6	3,463	90,5	11,9924	8190,2500	587,3248	15348,8000	313,4015
2	171,8	3,462	118,5	11,9854	14042,2500	594,7716	20358,3000	410,2470
3	175,1	3,434	139,6	11,7924	19488,1600	601,2934	24443,9600	479,3864
4	182,5	3,609	195,1	13,0249	38064,0100	658,6425	35605,7500	704,1159
5	189,4	3,896	225,6	15,1788	50895,3600	737,9024	42728,6400	878,9376
Σ	888,4	17,864	769,3	63,9739	130680,0300	3179,9347	138485,4500	2786,0884

Source: compiled by authors

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Thus, we obtain the following system of normal equations:

$$\begin{cases} 5a + 17{,}864b_1 + 769{,}3b_2 = 888{,}4 \\ 17{,}864a + 63{,}9739b_1 + 2786{,}0884b_2 = 3179{,}9347 \\ 769{,}3a + 2786{,}0884b_1 + 130680{,}03b_2 = 138485{,}45 \end{cases}$$

Let's solve the system of equations using Cramer's method:

$$\Delta = \begin{vmatrix} 5 & 17{,}864 & 769{,}3 \\ 17{,}864 & 63{,}9739 & 2786{,}0884 \\ 769{,}3 & 2786{,}0884 & 130680{,}03 \end{vmatrix} = 2153{,}8925,$$

$$\Delta_1 = \begin{vmatrix} 888{,}4 & 17{,}864 & 769{,}3 \\ 3179{,}9347 & 63{,}9739 & 2786{,}0884 \\ 138485{,}45 & 2786{,}0884 & 130680{,}03 \end{vmatrix} = 260798{,}801$$

$$\Delta_2 = \begin{vmatrix} 5 & 888{,}4 & 769{,}3 \\ 17{,}864 & 31799347 & 2786{,}0884 \\ 769{,}3 & 138485{,}45 & 130680{,}03 \end{vmatrix} = 23702{,}6084,$$

$$\Delta = \begin{vmatrix} 5 & 17{,}864 & 888{,}4 \\ 17{,}864 & 63{,}9739 & 3179{,}9347 \\ 769{,}3 & 2786{,}0884 & 138485{,}45 \end{vmatrix} = 241{,}9091.$$

So,

$$a = \frac{\Delta_1}{\Delta} = \frac{260798{,}801}{2153{,}8925} = 121{,}0826,$$

$$b_1 = \frac{\Delta_2}{\Delta} = \frac{23702{,}6084}{2153{,}8925} = 11{,}0045,$$

$$b_2 = \frac{\Delta_3}{\Delta} = \frac{241{,}9091}{2153{,}8925} = 0{,}1123.$$

We get the following two-factor regression equation:

$$y = 121{,}0826 + 11{,}0045\,x_1 + 0{,}1123\,x_2$$

To check the adequacy of the established dependence of the number of honey. personnel in the pharmaceutical industry on the number of medical institutions and the amount of funding, we use the correlation index. To calculate it, we will compose the following calculation Table 7.

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Table 7. Estimated indicators

№	y	x_1	x_2	$\tilde{y}$	$(y-\tilde{y})^2$	$(y-\bar{y})^2$
1	169,6	3,463	90,5	169,3556	0,0597	65,2864
2	171,8	3,462	118,5	172,4893	0,4752	34,5744
3	175,1	3,434	139,6	174,5510	0,3014	6,6564
4	182,5	3,609	195,1	182,7101	0,0442	23,2324
5	189,4	3,896	225,6	189,2940	0,0112	137,3584
Σ	888,4	17,864	769,3		0,8917	267,1080

Source: compiled by authors

where $\bar{y} = \frac{\sum_{i=1}^{n} y_i}{n} = \frac{888,4}{5} = 177,68$

The correlation index is equal to:

$R = \sqrt{1 - \frac{\sum_{i=1}^{n}(y-\tilde{y})^2}{\sum_{i=1}^{n}(y-\bar{y})^2}} = \sqrt{1 - \frac{0,8917}{267,1080}} = 0,9983$ indicates a very close relationship between the effective trait and factor variables.

Let's analyze the resulting equation: an increase in the number of medical institutions by 1 unit leads to an increase in the number of honey. There are 11 personnel in the pharmaceutical industry, an increase in the volume of financing of the guaranteed volume of medical care by 1 billion tenge leads to an increase in the number of honey. personnel in the pharmaceutical industry 112 people.

Let's calculate the coefficients of elasticity:

$Э_1 = b_1 \cdot \frac{\overline{x_1}}{\bar{y}} = 11,0045 \cdot \frac{3,5728}{177,68} = 0,2213$, where $\overline{x_1} = \frac{\sum_{i=1}^{n} x_{1i}}{n} = \frac{17,867}{5} = 3,5728$

- an increase in the number of medical institutions by 1% leads to an increase in the number of honey. personnel in the pharmaceutical industry by 0.22%;

$Э_2 = b_2 \cdot \frac{\overline{x_2}}{\bar{y}} = 0,1123 \cdot \frac{153,86}{177,68} = 0,0973$, where $\overline{x_2} = \frac{\sum_{i=1}^{n} x_{2i}}{n} = \frac{769,3}{5} = 153,86$:

- an increase in funding by 1% leads to an increase in the number of honey. personnel in the pharmaceutical industry by 0.0973%.

Thus, the number of medical institutions has a greater influence on the number of medical personnel in the pharmaceutical industry than the amount of financing of the guaranteed volume of medical care. Comparing the two obtained regression equations, it can be noted that the volume of financing of guaranteed volume of medical care has a greater impact on the number of honey. personnel in the pharmaceutical industry than the total funding.

Speaking about innovation in the pharmaceutical industry, we understand that we are talking, first of all, about modern biotechnologies used in medicine, where methods of influencing the pathological process at the level of molecules and genes are used. It has two main goals: analysis of the pathogenesis of a disease at the molecular

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level and the production of drugs based on genetic modifications of microorganisms and body cells. Few biotech companies have managed to maintain their autonomy. Among them: Gilead, Amgen, Celgene (Table 8).

Table 8. Leaders among biotech companies that have retained independence

	Company	Country	Market value in million dollars	Turnover in 2018 in million dollars	Turnover in 2019 in million dollars	Growth in %
1.	GileadScience	USA	85 320	30 390	26 107	-14,09%
2.	Amgen	USA	111 580	22 991	25 434	10,63%
3.	Shire	Ireland	45 400	10 885	14 449	32,74%
4.	Celgene	USA	62 120	11 185	12 973	15,99%
5.	Biogen	USA	57 140	11 449	12 274	7,21%
6.	Alexion	USA	25 110	3 018	3 551	17,65%
7.	Vertex	USA	37 760	1 685	2 173	28,96%
8.	JazzPharmaceuticals	Ireland	8 840	1 488	1 619	8,80%
9.	Incyte	USA	13 190	994	1 360	36,82%
10.	Regeneron	USA	30 690	896	1 198	33,71%

Source: compiled by authors

In general, everything has led to the fact that today the biotechnological sector has come under the control of the leaders of the global pharmaceutical market. This trend is quite logical and logical, since the number of new drugs that are produced by biotechnology is increasing every year. And, of course, large companies, instead of funding expensive in-house developments, buy out the rights to biologics from small businesses as soon as they show the first promising results in clinical trials. At the same time, a 50-80% markup on the current exchange quotation is already becoming a normal phenomenon. From the above facts, we can conclude that there is an intensive consolidation process in this area, and the number of main players is decreasing.
The biotechnology market in Kazakhstan is going through a real revolution, Kazakhstani pharmaceutical manufacturers offering modern high-quality drugs pose serious competition for the players of the international large pharma. In this situation, it is extremely important to create and strengthen in the minds of representatives of target audiences a strong and reliable image of Kazakhstan pharmaceutical manufacturer.

6. Conclusion

An analysis of the volume of financing in the health care system contributes to the modernization of public medical institutions, an improvement in the quality of medical services to the population, the successful implementation of large infrastructure projects, both in the health sector and in the further development of the pharmaceutical industry.

For effective management of product innovations in the pharmaceutical industry, it is necessary to systematize the factors of innovative development of the industry, to identify problems in the market of innovative medicines, as well as opportunities for managing innovative activities of pharmaceutical enterprises. Therefore, in order to analyze the effectiveness of the management system for innovative projects in the pharmaceutical industry of the Republic of Kazakhstan, authors considered the main indicators of health care development and its financing, which affect the further development of product innovations in the pharmaceutical industry. As a result, the dependence of the number of medical personnel in the pharmaceutical industry on the number of medical institutions and the amount of funding was revealed.

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By analyzing customer preferences and applying the latest technologies, it is possible to promote products in a more targeted manner, taking into account the characteristics of each target group, which increases the efficiency of promotion costs. To do this, we need to learn new tools and master them. In this regard, authors had developed an algorithm for interrelated actions for the development and promotion of pharmaceutical products in the context of digitalization and globalization.

Thus, the growing volumes of pharmaceutical markets, high growth rates of drug prices, a shortage of certain types of drugs, the need for effective spending of budget funds and the social significance of drug markets make it necessary to conduct a thorough study and identify problems in the Kazakhstani market of innovative drugs and the reasons for their low effectiveness.

The introduction of innovations is becoming one of the priority instruments for ensuring the growth of the state economy. Innovation is an effective tool in the competition, as it definitely leads to a company of welfare, to attract inevitable investments, as well as to the formation of new effective demand.

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