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Forecasting the Demand for the Economy in Personnel with Higher Education in the Conditions of Digitalization

Abstract. *Providing the economy with qualified personnel is one of the priorities of the state policy implemented for the sustainable development of the country. The complexity and scale of this task requires coordination of the efforts of public authorities, as well as the involvement of employers, educational organizations and the public in the process of timely training of professional personnel. Currently, there is a problem of internal effective interaction of bodies responsible for state regulation and development of the labor market in Kazakhstan. This study is aimed at studying methodological approaches to forecasting the demand in the labor market for specialists with higher and postgraduate education in the conditions of digitalization with the development of specific measures and recommendations to improve the economic indicators of the labor market and universities. The creation of this methodology made it possible to develop an automated program for calculating the needs of the state economy in specialists, dividing them by education levels and branches of the economy. The Ministry of Science and Higher Education, based on the data of the proposed model, will be able to distribute the state order taking into account the relevance of a particular profession.*

Keywords: *higher and postgraduate education, labor market, supply and demand, informatization, digitalization, qualification.*

Introduction

To date, the emergence of new types of production and services requires the workforce to improve their skills constantly. Along with this, an increase in demand for cognitive and behavioral skills is predicted to help adapt to rapidly changing conditions and market needs. At the same time, taking into account the automation of processes, coding and creation of algorithms, the value of a person's ability to make decisions promptly in non-standard situations increases. In 2020, due to the unexpected onset of the COVID-19 pandemic, during which strict quarantine measures were introduced in Kazakhstan, which subsequently led to the transfer of almost all types of activities to a remote format, and as a result had a negative impact on economic development, employment and the quality of education.

Globalization of education can lead to increased competition in the labor market, and a high proportion of NEET (Not in Education, Employment or Training) young people, i.e. the third generation of young people who, due to various economic, social, or political factors, do not work or study in the regions can lead to an even greater "talent drain". The actual non-recognition of the National Qualifications Framework by the EAEU and European countries will lead to low competitiveness of Kazakhstani personnel in international labor markets, and in general, the failure of the NSC (National Qualifications System) will lead to low-skilled labor in the country. It should be noted that globalization and digital technology have changed the forms of employment, which in some cases led to the loss of jobs. It is this factor that influences the formation of the labor market in the conditions of digitalization.

Problems of communication between science, education and production, as well as a low level of education will lead to a decrease in the level of human capital, to a greater increase in unemployment, unproductive and informal employment. It is becoming increasingly obvious that the workforce must be prepared for the fact that they will have to compete with technology. The lack of coordination between the actions of government agencies, educational organizations and the private sector can lead to a slowdown in the development of the labor market in Kazakhstan and the failure to fulfill strategic goals and objectives. Currently, the facts of the distribution of state educational grants of the Ministry of Science and Higher Education and the international educational scholarship "Bolashak" have already been established, without taking into account the forecast data of the Ministry of Labor and Social Protection of the Population, which in the future may lead to an imbalance of labor resources. A similar problem of interaction between the participants of the NQS and the National Labor Forecasting System can lead to a further delay in the implementation of national qualifications and forecasting systems, the lack of interrelation of training with labor market forecasting. As a result, low-skilled labor in the country, which does not meet the challenges of the fourth industrial revolution, will lead to the attraction of foreign labor with higher qualifications.

In this regard, the Ministry of Science and Higher Education is working to optimize private universities in the Republic of Kazakhstan. However, there is currently no information and analytical system in the country that could assist government agencies and the business community in forecasting the demand for specialists with higher and postgraduate education. This information would be useful in teaching students, undergraduates, doctoral students with the necessary competencies in the labor market, as well as for the Ministry of Science and Higher Education, which could revise educational programs and, at the same time, redesign some higher education institutions instead of closing them, and contribute to the development of the country's economy.

Thus, despite extensive research in the field of finding ways to overcome imbalances in the ratio between the demand for personnel and its training, there is still no sufficiently reliable scientific and methodological justification for effective methods of systematic management of these processes that allow higher educational institutions to qualitatively and quantitatively meet the need of the economy for qualified personnel in modern economic conditions.

Kazakhstan-2050 Strategy defines modernization of the employment policy and the key guidelines of the education system as the priority directions. A national project is being implemented to promote the idea of a "Society of Universal Labor" [1]. Within the framework of the state program "Digital Kazakhstan", it is planned to develop and implement social and labor sphere systems, develop an electronic labor exchange, create and implement a system for maintaining employee profiles and accounting for employment contracts [2]. The first two systemic reforms of the medium-term Strategic Development Plan of the Republic of Kazakhstan until 2025 are aimed at the development of new human capital and the use of digital technologies [3].

According to the assessment carried out among representatives of fairly large, leading companies in their sectors, such as PetroKazakhstan, Kazakhstan Temirzholy, KazMunaGaz, Kazakhtelecom, NIS, employment of graduates of the country's universities in 2019-2021, the indicators of the level of employment of university graduates increased from 74% to 77%. The following universities are in the top leaders in terms of employment rate: The Egyptian University of Islamic Culture "Nur-Mubarak", Kazakh National University of Arts, Karaganda Medical University and T. Zhurgenov Kazakh National Academy of Arts. The outsiders of the ranking are Orda University with an employment rate of 55%, Kazakhstan University of Innovative and Telecommunication Systems with 59%, and Kainar Academy with an employment rate of 60%.

In addition, average salaries are also rising. If in 2020 the level of average salaries of graduates was 101 thousand tenge, now it is 127 thousand tenge. That is also good tendency. It is because business is pragmatic and votes with its money for knowledge and competence. After graduation, young people look for work for an average of 89 days. At the same time, 70%

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of health care graduates work in their field, and 19% work in fields other than their specialty. This is the best performance of all education groups. The indicators of employment of university graduates by specialty for 2020- 2022 are shown in Figure 1.
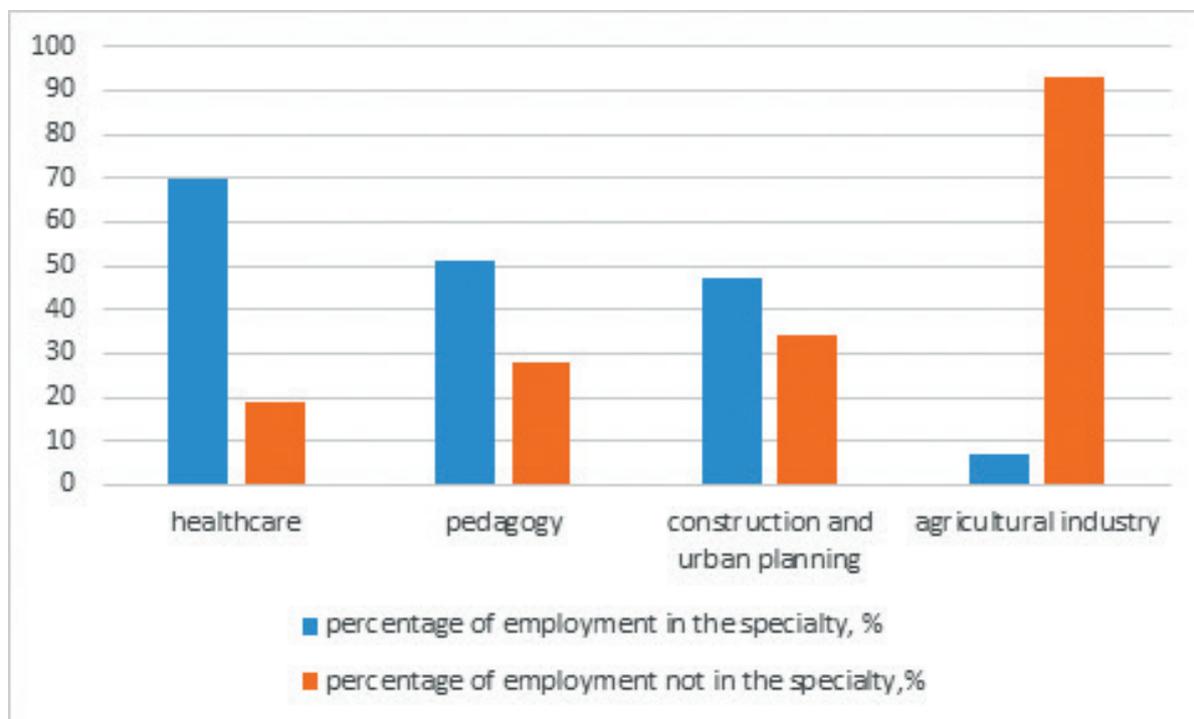

Figure 1 – Indicators of employment of university graduates by specialty for 2020-2022
Note-Compiled by the authors

The employment rate in pedagogy is 51%, when 28% of graduates find work out of specialty, 21% graduates do not find a job within 12 months. 47% of construction and urban planning graduates find work outside of their field of study and only 34% in their field of study. The situation is most dismal in agriculture. Only 7% of graduates find work in their specialty. Moreover, this is along with a large shortage of specialists in the agro-industrial complex and in rural areas. Although the average level of salaries in the sector is quite high. The results of the survey also showed that 55% of employers are satisfied with the quality of educational programmes. Around 35% of respondents say that the educational programmes are satisfactory, but require improvement. After graduation, young people look for work for an average of 89 days. At the same time, 70% of graduates of the "healthcare" direction work in their specialty, 19% do not work in their specialty. This is the best indicator among all groups of educational programs [4].

Currently, there is a problem of internal effective interaction of bodies responsible for state regulation and development of the labor market. At the same time, the labor market itself is not balanced, and labor resources are not competitive enough. The results of the evaluation of international ratings indicate an insufficient level of the system of Kazakhstan's higher and postgraduate education. According to the World Bank, the low level of human capital development in Kazakhstan requires a revision of state policy in this area. It is proposed to improve the development and regulation of the labor market of Kazakhstan in the conditions of digitalization based on the synergy of structural interaction of state bodies, the private sector and universities, with the involvement of personnel policy and professional organizations in the implementation. In our opinion, this strategy, based on the best European practices, echoes the concept of a "Hearing State", the embodiment of which is possible through a constant dialogue

between the authorities and society to build a harmonious state capable of responding promptly and effectively to the needs of the population.

The main idea of this research is to study methodological approaches to forecasting the demand for the labor market for specialists with higher and postgraduate education in the conditions of digitalization with the development of specific measures and recommendations to improve the economic indicators of the labor market and universities.

Methodology

Attempts to study this topic have been indirectly undertaken by foreign scientists and by domestic scientists such as D.A. Morse [5], P. Ester [6], G. Petrova, E. Posadneva, T.Morozova [7], S. Jumambaev [8], S. Baizakov [9], Z.G. Zainasheva [10], D.L. Bakusova [11], L.M. Nizova [12], A. Kurmanbekov, M. Temirkhanov [13], J.A. Kulekeyev [14] and others. In turn, research in the field of digitalization originates from the work of K. Shvaba, which found its continuation in the works of Western and Russian scientists: M. Gobble, M. Rachinger, R. Rauter, S. Muller, V. Worraber, E. Shirgi, E. Senamor, V. Parida, T. Turunen, L. Gorissen, T. Yudina, V. Khalin, G. Chernova, D. Zozulya, etc. These researchers have revealed the concept of "digitalization" in their works, citing its differences from the concept of "digitization". At the same time, there are no specific studies on this topic to date. The main results of the study of the labor market and educational services of higher and postgraduate education can be used in the practice of forecasting the formation of a state order for the training of specialists with higher postgraduate education.

The methodology of economic forecasting is a set of working techniques that form the forecasting technology used by forecast developers in their activities. Currently applied methodological approaches to the development of forecast indicators are mainly based on a system of direct calculations and expert assessments. Only for individual blocks of indicators, model calculations are carried out using production functions of various types and complexity, as well as systems of econometric models of small dimension [15].

A.G. Mokronosov and others note that, at present, there are the following forecasting techniques:

- Quantitative accounting of the contribution to the formation of effective demand for labor;
- Mathematical model of forecasting the needs of regional economies for specialists with professional education;
- The use of a scenario approach in forecasting the development of the labor market.

Thus, the available methods of forecasting the needs of individual sectors of the economy and their enterprises for specialists with higher education can be used only when integrating their positive aspects, taking into account the peculiarities of the functioning of the modern knowledge economy and connecting them to the final model of forecasting the final results, indicators of competitiveness and efficiency of individual industries [16].

Discussion and results

In this study, for the first time, the methodology of forecasting the demand for the labor market in personnel with higher postgraduate education in the conditions of digitalization (hereinafter referred to as the Forecasting Methodology), taking into account the Atlas of New Professions and Competencies in the Republic of Kazakhstan, developed by order of the Ministry of Labor and Social Protection, has been considered. In the course of the research, the authors have studied normative legal acts, orders and resolutions, programs and plans of the Government of the Republic [17-25]. This approach will make it possible to forecast the number of required specialists with higher and postgraduate education under a state grant for economic spheres, and universities will have an idea of the demand for certain professions that they teach. The Ministry of Science and Higher Education based on the proposed data "Methods of forecasting the demand for the labor market in specialists with higher education in the conditions of digitalization" will be able to distribute the state order taking into account the relevance of a

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particular profession. Another beneficiary will be applicants and applicants entering the master's and doctoral studies, who will have the opportunity to receive information about the demand for the labor market in the profession they want to study.

For lifelong learning, it is recommended to use forecasting programs based on Computational General Equilibrium models in accordance with the best world practices. The study identifies the types of need for personnel with higher and postgraduate education in the labor market (frictional, cyclical, seasonal, institutional, structural, hidden), and shows their relationship and interdependence with the corresponding types of unemployment.

The algorithm for calculating the forecasting of personnel needs in the context of economic spheres, specialties (professions) and regions consists of two main stages:

1) The first stage: medium-term forecast of work force needs: this stage involves determining a medium-term forecast of staffing requirements for the republic, taking into account socio-economic development forecasts, as well as determining the forecast labour supply for the republic in terms of professions and main sectors of the economy;

2) The second stage: a questionnaire survey of enterprises and institutions to determine the forecast need for staffing in the medium term: this stage involves conducting a sample questionnaire survey of enterprises and institutions to study their staffing needs by type of economic activity and occupation for the short-term period, followed by disaggregation of the data for the entire number of enterprises and institutions in the republic.

The significance of this study lies in the possibility of providing state bodies and the business community of Kazakhstan with up-to-date information that allows assessing the human resource potential and the labor market for the coming years in order to effectively use labor resources. In this regard, it is expected to work closely with a number of organizations. For the implementation of this research, possible partners may be regional, local executive bodies and other departments that collect and systematize statistical data. Further, this information is accumulated in central state bodies, such as the Ministry of Labor and Social Protection of the Population, the Ministry of National Economy, the Ministry of Trade and Integration, the Agency for Strategic Forecasting and Reforms (Bureau of National Statistics), the Ministry of Education and Science, the Ministry of Defense, etc.

At the same time, the corresponding calculations of the need for specialists are carried out using the methodology. The forecast of the need for specialists is sent to the Ministry of Education and Science, which forms a state educational order based on this information. In order to collect the necessary statistical and analytical reports and data and a more objective assessment of the state of the economy and the labor market, it may be necessary to involve a wide range of experts: specialists of interested organizations, authorized employment authorities, university leaders, scientists, representatives of the public and employers of all forms of ownership (national companies, state and non-state sectors of the economy).

The forecasting process also uses data on the need for personnel for the medium-term period within the framework of ongoing state, sectoral, regional programs and private initiatives to verify further the results of the previous stages. Thus, regional local executive bodies and other agencies that collect and systematize statistical data can act as possible partners.

The authorized body in the field of education, on the basis of a short-term, medium-term forecast of personnel needs submitted by the authorized body on employment issues, forms a draft state educational order for the training of personnel with higher and postgraduate education. The state educational order for the training of personnel with higher education is formed according to the areas of training, with postgraduate education – according to the levels of training. The following figure shows the scheme of formation of the state order for the training of specialists with higher professional education (Fig.2).
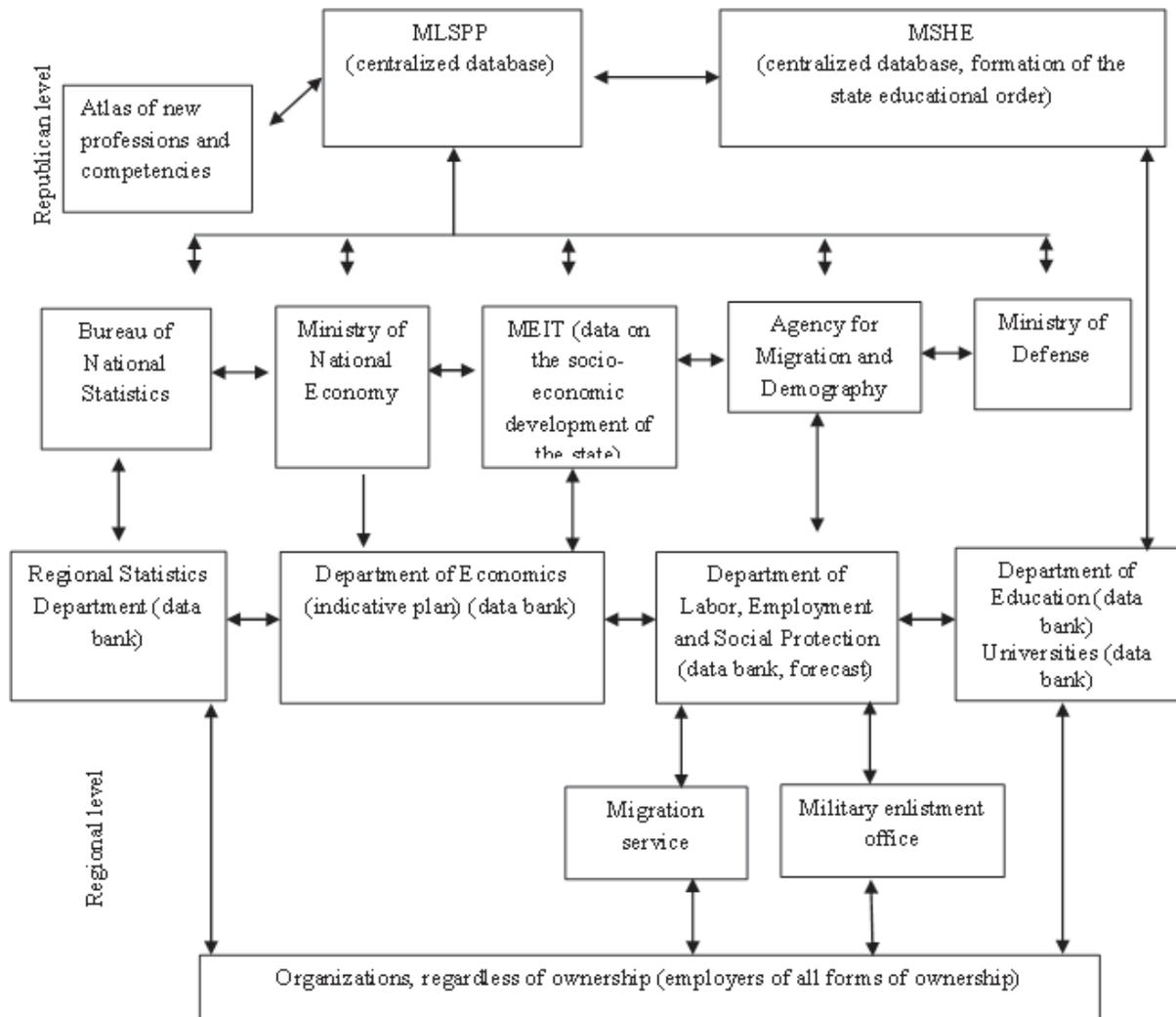
Figure 2 - Scheme of formation of the state order for the training of specialists with higher professional education

Note – Compiled by the authors

In connection with the above, the first step towards increasing the effectiveness of this direction is the use by local executive bodies, employment centers, educational institutions of all available analytical and predictive materials on the demand for personnel in close cooperation with regional employers.

In forecasting, it is necessary to collect baseline information in particular on the professional structure of those employed in the various sectors of the economy and to conduct the study not once every 10 years, but from the results of surveys carried out every three years, which will make it possible to operate with more recent data. It is also difficult to use the methodology for determining skill needs because the forecasting methodology is used for a steady-state economy, where industries in developed countries have a high level of technology and a steady cycle of development.

The information obtained through analysis and forecasting from the list of occupations in which qualified specialists are trained, as presented in the respective education programmes, is used for the calculations. It is of particular value in determining the prospects of graduation of students already admitted with 2 to 5 years of study, as well as those admitted in the current year, whose graduation is planned for the following years. In the latter case, there is a real opportunity

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to influence the composition of the professions in order to really align it with the future market demand for the respective professions and to make decisions on diversification (re-profiling) of higher education institutions' activities.

The calculation is based on a balance model of supply and demand for specialists with higher education in each specialty in the regional market (j-index of the regional unit) for the projected year (t-index of the year). Hereafter, the j and t indices are omitted when writing the model so as not to overload the formulas.

The balance model of demand Si and supply Pi of specialists of the i-th specialty with higher education (HE) in the regional labour market for the projected year is as follows:

$$D_i = S_i \pm X_i$$

where

+X - unsatisfied demand; is formed when Si>Pi;

-X_i -unmet supply; generated when Si<Pi.

The demand for specialists with HE of the i-th specialty Si consists of two components:

$$D = D_{iB} + D_{i3,}$$

Where

D_{iB} - demand for specialists with higher education in vacant positions, (newly created jobs). Forecast for vacancies is set by organizations irrespective of their form of ownership as a result of analysis of perspectives of production development, planned technologies of innovations, improvements of already functioning production processes, improvements of organizational management structures, etc.

D_{i3} - demand for specialists with HE to replace the specialists with HE who are retired for various reasons (total, without detailing by reasons).

This indicator for the forecast perspective is set by a recalculation method, based on the number of employed specialists of the i-th specialty and the coefficient of attrition of specialists:

$$D_i = N_{i3} * I,$$

where

N_{i3} - the number of employed specialists of the i-th specialty

I - Attrition rate of specialists of the i-th speciality. Determined on the basis of economic forecasting or by extrapolation method.

The supply of specialists with HE i-th specialty Si consists of the following set of terms:

$$S = M_i + N_i + F_i + L_i - L'_i + K_i - K'_i + B_{i,}$$

where

M_i - young graduates of higher educational institutions of i-th speciality under the state order, including grants and loans (1st higher education);

N_i - unemployed with HE of i-th speciality;

F_i - specialists with HE of i-th speciality from the category of self-employed persons, but willing to work by their profession;

L_i - mechanical inflow of specialists with HE of i-th speciality;

L'_i - departure of specialists with HE of i-th speciality for various reasons, including dismissals at will;

K_i - discharged from the armed forces of Kazakhstan with HE i-th specialty; K'_i - young specialists drafted into the armed forces of the Republic of Kazakhstan;

B_i -specialists who obtained the 2nd higher education in the i-th specialty.

Note: The indicators L'_i and u K'_i' are not logically related. But subtracting them from the right side of the balance sheet will allow a more reliable accounting of the S_{i3} (right side of the balance sheet) and M_i (left side of the balance sheet) components.

Information sources are represented by the Ministries, departments and services, where data is generated for calculating the balance.

The initial information is pre-processed for the purpose of suitability in the balance formula and then entered into the corresponding tables. Next, summary tables are compiled, reflecting the general situation of supply and demand in the context of specialties in the republic (the number of such tables is equal to the number of specialties) and one summary table reflecting the general situation of the labor market of the Republic of Kazakhstan.

Software Features:

The estimated volume of the software will be about 5,500 lines. The labor intensity is determined in three stages: Determining the nominal volume of labor; Clarifying the amount of labor costs; Drawing up a work schedule.

Modern analytical information systems use the so-called n-level (or n-link) architecture. In this model, processing is divided between the client and the server, and business logic is concentrated at the middle level. The user's workplace is a standard computer – this allows the user to stay in the familiar desktop environment. The architecture of the data warehouse of the developed information and analytical system "Labor Market" (Figure 3).
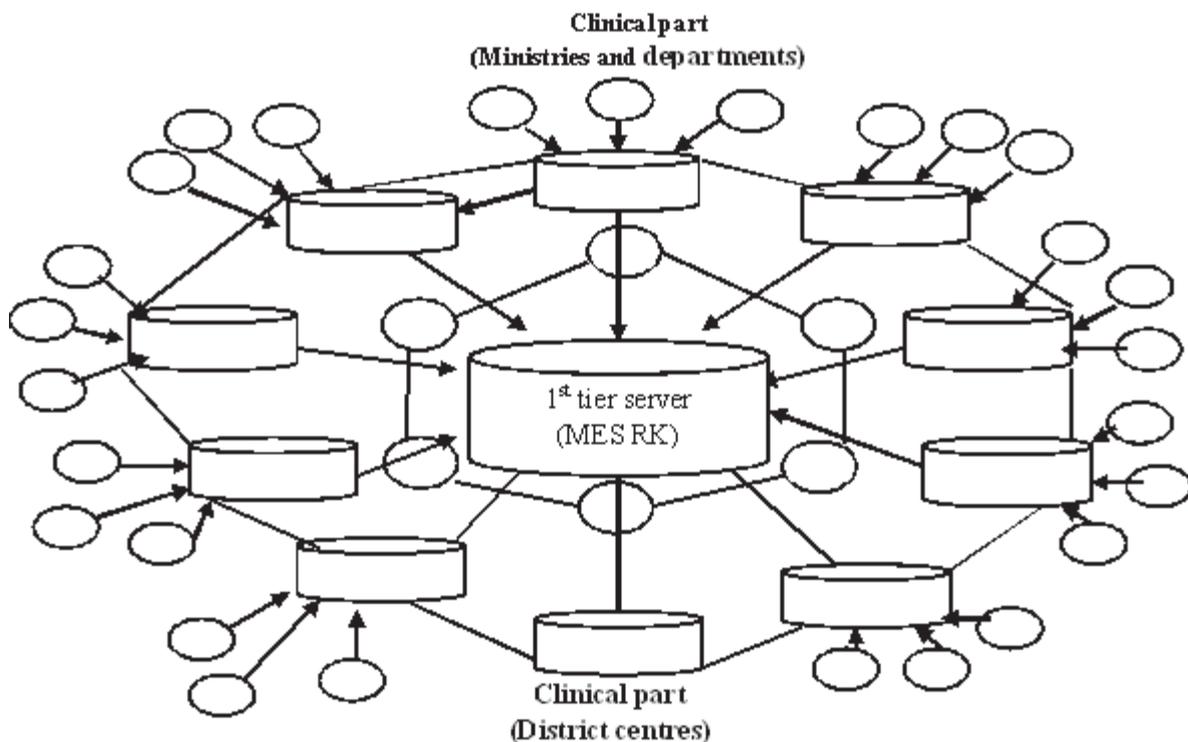

Figure 3. Data warehouse architecture
Note – Compiled by the authors

Improving the development and regulation of the labor market of Kazakhstan in the context of digitalization based on the synergy of structural interaction between government agencies, the

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private sector and educational organizations, with the involvement of trade union organizations in the implementation of personnel policy. The use of new educational technologies in universities: a) online learning and b) technologies affecting teaching, learning and administration. As technologies (Internet of Things, blockchain, 3D printing, adaptive technologies, mobile technologies, etc.) continue to integrate into the real world, changing and transforming it. Higher and postgraduate education should also change over time and integrate educational technologies that contribute to the development of international higher and postgraduate education. There is an increase in demand for specific competencies and skills due to the fact that with the future automation of workplaces there will also be a radical transformation of the labor market and the market of educational services. Accordingly, universities will have to change educational programs in such a way as to guarantee graduates the appropriate competencies and skills. In turn, educational organizations are becoming more and more receptive to the introduction of CT, which play an important role in the system of higher and postgraduate education, allowing students and teachers to interact and take advantage of new learning opportunities. It should be noted that competition is growing in the higher and postgraduate education market not only between public and private universities, but also graduates of foreign universities and the international Bolashak program. In order to attract students and teachers from all over the world, universities have, along with participation in international rankings, to attract business partners, associations and foundations, both to conduct research and to find sources of funding. Thus, it can be concluded that in the present conditions there are many diverse connections and mutual influences between the labor market and the system of higher and postgraduate education. There are contradictions, for example, between the universality of higher and postgraduate education and the "technological" requirements for an employee, there is also mutual support – in matters of flexibility, "intelligence" and the ability of employees to make decisions in a situation of uncertainty. It is obvious that these mutual influences and mutual influences (in the future) will lead to mutual "harmonization" of the requirements of education and the labor market, since there is a close relationship between the labor market and education, even when education is "self-sufficient".

Forecasting the needs of the economy in personnel is a rather complex task that requires the use, along with conducting special research, of a wide range of economic and mathematical models. At the same time, the model system should be at least two-level. The macroeconomic model should describe trends in the development of the economy for the foreseeable future, while taking into account the peculiarities of demographic and migration processes, structural and technological changes in the economy and the social situation of the population. The second-level model is more detailed, however, it should be based on the indicators of the macroeconomic model. At the same time, the model should contain a mechanism for disaggregating macro indicators based on taking into account labor productivity and wages by industry, training by universities, and calculate the balance between the supply and demand of personnel by profession. Statistical data alone is not enough to build such models. Therefore, special surveys are conducted in order to fill in the missing data for the model. This is an expensive and complex undertaking, but without performing such complex work it is impossible to assess the projected needs of the economy, which means that until then the country will not have scientifically sound prerequisites for the effective distribution of state educational grants taking into account the needs of the economy [26]. Thus, the lack of reasonable forecast calculations leads to systemic errors and affects the effectiveness and efficiency of all educational programs funded from both the republican and local budgets.

Conclusion

The scientific significance of the work consists in solving a wide range of scientific and technical problems related to the development of a single data warehouse, they are:

- generalization of theoretical approaches to systematization of factors determining the ratio of supply and demand in the labor markets of various structural levels;

- making a forecast and hypothesis of the study;

- specification of the values of economic, socio-demographic, organizational, technical, institutional and resource factors;

- identification of key factors determining supply and demand in the labor market of the region, and their corresponding indicators (gross regional product growth, population growth in the region, investment in the economy of the region, etc.;

- substantiation of the need to monitor the need for personnel at the level of the republic in order to improve the quality of the obtained forecast estimates, and the development of appropriate methodological developments

- assessment of the impact of the model of forecasting the needs of the economy of Kazakhstan for personnel with higher education on the socio-economic indicators of the economy and the quality of training in educational institutions;

- study of supply and demand in the labor market and educational services and their corresponding indicators;

- monitoring the need for personnel at the level of the republic in order to improve the quality of the forecast estimates received, and the development of appropriate methodological developments;

- forecasting the training (graduation) of specialists taking into account market demand in the territorial, sectoral and professional sections based on the forecast of the development of industries and regions;

- preparation for publication of research results, including obtaining a certificate of entering information into the state register of rights to objects protected by copyright.

Creation of this methodology made it possible to develop an automated program for calculating the needs of the state's economy in specialists, dividing them by levels of education and branches of the economy. This development opens up prospects for full automation of the process of analyzing information coming from line ministries and enterprises, the process of forecasting the economy's need for personnel in the medium term, as well as planning the necessary number of students studying at educational institutions of various levels so that for the period of graduation these specialists could meet the need of the regional economy for personnel of the necessary qualifications.

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Цифрландыру жағдайында жоғары білімі бар кадрларда экономиканың сұранысын болжау

Аңдатпа. Экономиканы білікті кадрлармен қамтамасыз ету елдің тұрақты дамуы мақсатында іске асырылатын мемлекеттік саясаттың басымдықтарының бірі болып табылады. Бұл міндеттің күрделілігі мен ауқымдылығы мемлекеттік органдардың күш-жігерін үйлестіруді, сондай-ақ жұмыс берушілерді, білім беру ұйымдары мен қоғамды кәсіби кадрларды уақтылы даярлау процесіне тартуды талап етеді. Қазіргі уақытта Қазақстанда мемлекеттік реттеу мен еңбек нарығын дамытуға жауапты органдардың ішкі тиімді өзара іс-қимылы мәселесі бар. Бұл зерттеу еңбек нарығы мен университеттердің экономикалық көрсеткіштерін жақсарту бойынша нақты шаралар мен ұсыныстар әзірлей отырып, цифрландыру жағдайында жоғары және жоғары оқу орнынан кейінгі білімі бар мамандарға еңбек нарығындағы сұранысты болжаудың әдіснамалық тәсілдерін зерттеуге бағытталған. Бұл әдістемені құру экономиканың мамандарға деген қажеттіліктерін есептеу үшін автоматтандырылған бағдарламаны әзірлеуге мүмкіндік берді. Ғылым және жоғары білім министрлігі ұсынылған модельдің деректері негізінде белгілі бір кәсіптің өзектілігін ескере отырып, мемлекеттік тапсырысты бөлуге мүмкіндік алады.

Түйін сөздер: жоғары және жоғары оқу орнынан кейінгі білім, еңбек нарығы, сұраныс пен ұсыныс, ақпараттандыру, цифрландыру, біліктілік.

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Прогнозирование востребованности экономики в кадрах с высшим образованием в условиях цифровизации

Аннотация. Обеспечение экономики квалифицированными кадрами является одним из приоритетов государственной политики, реализуемой в целях устойчивого развития страны. Сложность и масштабность этой задачи требует координации усилий органов государственной власти, а также вовлечения работодателей, образовательных организаций и общественности в процесс своевременной подготовки профессиональных кадров. В настоящее время в Казахстане существует проблема внутреннего эффективного взаимодействия органов, ответственных за государственное регулирование и развитие рынка труда. Данное исследование направлено на изучение методологических подходов к прогнозированию спроса на рынке труда на специалистов с высшим и послевузовским образованием в условиях цифровизации с разработкой конкретных мер и рекомендаций по улучшению экономических показателей рынка труда и университетов. Создание данной методики позволило разработать автоматизированную программу для расчета потребностей экономики государства в специалистах, разделив их по уровням образования и отраслям экономики. Министерство науки и высшего образования на основе данных предлагаемой модели будет иметь возможность в распределении государственного заказа с учетом актуальности той или иной профессии.

Ключевые слова: высшее и послевузовское образование, рынок труда, спрос и предложение, информатизация, цифровизация, квалификация.

Экономическая серия Вестника ЕНУ им. Л.Н. Гумилева
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ECONOMIC Series of the Bulletin of L.N. Gumilyov ENU

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