

Information Analytical Management System for the Qualified Personnel Training To Supply the Needs of the Russian Labor Market

E. A. Pitukhin

*Department of Applied Mathematics and Cybernetics
Petrozavodsk State University
Petrozavodsk, Russia
eugene@petsu.ru*

Abstract—The article is devoted to the development of new toolkit aimed at improving the balance of the labor market, increasing the efficiency of the vocational education system, as well as increasing the employment of graduates in their specialty. It is proposed to create a unified end-to-end expert-analytical system connecting from one end the employer with his needs for qualified personnel, and from the other – the student-entrant and his parents. Implementation of the system is expected in the form of Internet portals and mobile applications (services) that interact with the system of modeling and forecasting the needs of the labor market in qualified personnel. The development and implementation of a fundamentally new innovative type of IT-services on the Russian market based on the creation of a set of mobile applications (services) to provide relevant information on the labor market and the education system to high school students and potential entrants should be widely in demand in the future. The system not only collects data and forecasts the staffing needs of the economy in occupations in demand, but also gives users the opportunity to plan their career path - from diagnosing their professional inclinations to choosing an educational organization where they can get an education and jobs at leading enterprises. As a result, the developed service contributes to an increase in the level of employment of graduates in the received specialty. The proposed service will help decide on admission to a university or college not on an intuitive level, but on a rational one, guided by logic and accurate scientifically-based forecasts. In this way, a digital approach to improving the balance of the labor market by increasing the efficiency of managing the formation and use of labor resources will be implemented. Prototypes of the service in the form of career guidance portals “My Career” have been successfully implemented in four regions of the Russian Federation.

Keywords—*information analytical system, labor market, personnel training, digital service, mobile application, Internet portal, employment, graduates, occupations in demand, career guidance, forecasts*

I. INTRODUCTION

The intensive transition of Russia to the digital economy makes it urgent to develop and implement new software tools that would help the system of secondary vocational and higher education to train professionals in demand by the economy. This task still does not have a unified system solution at the Federal level.

Practice shows that, at the regional level of the Russian Federation, the management of the training of professional personnel is carried out by various executive authorities: from regional ministries of education and economics to employment departments. Despite the approved at the federal level methods of calculating the forecast of the balance of labor resources and forecasting the needs of economic sectors for personnel, at the regional level, in most cases, there are no specialists who could correctly carry out the appropriate calculations and take responsibility for the result. Objectively, this is explained by the high knowledge-intensiveness of methods for forecasting needs, their multi-factorial nature and complexity of connections and, as a result, the lack of the necessary qualifications and experience of the staff of relevant departments.

The result of this activity is enrollment targets, which the regional executive education authorities should form both fully for the system of secondary vocational education and partially for the higher education system. Correctly formed figures should serve as a project of management decisions aimed at bringing the vocational education system graduation into conformity with the needs of regional economies.

Due to the high complexity of these tasks, most regional executive authorities have significant difficulties. Attempts by some regions to solve these problems only on the basis of employer surveys give skewed results for the short term. This approach can not provide an adequate forecast in the context of specialties / areas of training and professions for 5-10 years ahead, which is necessary for the formation of enrollment targets, taking into account the terms of training 4-6 years. In addition, the regional authorities, in forming the enrollment targets, often consider their region in isolation, and do not take into account the educational migration of entrants and the labor migration of graduates between the regions of Russia.

Such non-trivial, highly scientific problems should be addressed not by ordinary specialists in the departments of regional executive authorities, but by teams of scientists specializing in research of the labor market and the education system, specialists in mathematical modeling and forecasting socio-economic processes with many years of practical experience in solving such problems.

In this regard, the author of this article proposes the creation of a unified information-analytical management system for the qualified personnel training to supply the

needs of the Russian labor market at the federal and regional levels, which would integrate existing developments and positive experience in this area.

II. METHODS

The research methodology is based on the combination of a systems approach to the description of system processes and an information approach to the implementation of the model of system. The information analytical system is based on the concept of a “transparent information environment”, which is aimed at improving information links between all interested labor market participants: employers, job seekers, educational organizations, graduates of the education system, entrants and high school students.

III. RESULTS

The implementation of the system is expected in the form of Internet portals and mobile applications (services) that interact with the system of modeling and forecasting the needs of the labor market for qualified personnel. The functional of services uses the principles of system analysis. A person in his activity has to solve two tasks – expert and constructive. The expertise task describes the past, the present and predicts the future on the basis of the available information. The essence of the constructive task is to create something with the given properties. Each of these two tasks is solved for himself by both the student and the employer in the process of searching for information about each other.

The intersection of their interests is shown in the following example. Expert activity for the student is reduced to the issue of building individual roadmaps for the growth of competencies, and for the employer to search for specialists for production. Constructive activity involves the solution of the inverse problem: for the student is to obtain a occupation in demand in the labor market, and for the employer is the choice of business, for which there will be no problems with personnel.

When building the system, the positions of behavioral economics are also used, including the simultaneous combination of factors of the growing informatization of society and the psychology of mass consumption:

- striving for comfortable consumption of services;
- delegation of the right to think for yourself and make decisions;
- following to fashion and mass hobbies;
- wide spreading of mobile devices;
- optimization of education expenses.

The most important science-intensive component of the information-analytical system is the subsystem of forecasting the needs of the economy and the labor market for qualified personnel. At the same time, for a correct forecasting of the personnel needs of industries, an integrated approach is needed. Its essence lies in the fact that when forecasting for the near future, the microeconomic method is used, which is implemented by the personnel departments of the surveyed enterprises in order to clarify the professional and qualification structure of workers and personnel needs. When forecasting for the long term, a macroeconomic method is

used to forecast the needs of the economy for personnel [1]. The methodology is based on the normative principle implemented by the Center for Budgetary Monitoring of Petrozavodsk State University (CBM PetrSU). The CBM of PetrSU are the leading research center in Russia in forecasting staffing needs, whose employees constantly improve the forecasting methodology in their works [2, 3, 4]. As a result of the complement of methods each other, the accuracy of the forecast of needs increases at all time intervals.

The macroeconomic forecasting methodology was developed taking into account the best foreign experience (Bureau of Labor Statistics of the US Department of Labor [5, 6, 7], MONASH Australia [8, 9], UK MDM [10], Germany INFORGE and IFO [11] and others). The basis of the methodology is a unified approach for all regions of the Russian Federation, based on projected estimates of economic growth rates, labor productivity and investment by type of economic activity and the necessary number of labor resources to achieve the planned indicators. The concept of forecasting needs is based on a system approach from the general to the particular, during which there is a consistent decomposition of the forecast trends of the type “total staffing need” – “additional staffing need” – “detailing the additional staffing need”. The basic calculated indicator is the annual additional personnel need of the economy, which depends from the retirement of workers by the natural-age; from changes in the number of people employed due to changes in the volume of production and labor productivity; as well from an increase in the number of employees during the implementation of investment projects [12].

In 2010, professor at the Massachusetts Institute of Technology P.Daymond, a professor at Northwestern University in Evanston D.Mortensen and professor at the London School of Economics and political science K.Pissarides (P.Daymond [13], K.Pissarides [14], D.Mortensen [15]) were awarded with the Nobel Prize in Economics “for their analysis of markets with search frictions”. They were awarded prize for the development of the theory of search, which is an alternative to the model of demand and supply for a long time dominated the economy.

It is known, that in the field of supply and demand in the labor market there is a problem of information channels inefficiency, so people when searching for a job does not always agree on the first sentence, and are looking for a better job, and the same applies to the employer. As a result, the employer and employee cannot find each other for a long time, despite the fact that it is much in need. As a result of poor information permeability there is no connection between the employer and graduate, or it occurs too late. The results led to the idea of creating a concept of a transparent information environment, designed to establish links between all stakeholders of the labor market [16].

One definition of a "transparent information environment" is that it refers to any information about the size, state of the labor market or any part of the labor market, how a part or all of the labor market operates, the problems, opportunities it provides, and the intentions associated with employment or the aspirations of those who are part of the labor market [17]. The author of this work understands the transparent information environment of the labor market as a

set of interrelated subsystems that provide collection, analysis, processing of information about the past, current and future state of the labor market for individuals, employers, representatives of authorities and the education system [18]. Thus, a transparent information environment of the labor market can be used to increase the effectiveness of vocational education institutions, orient their graduates to the needs of the labor market.

The purpose of the transparent information environment of the labor market is to answer the questions of users [19]. For the education system, the main issues in the transparent information environment of the labor market will be [6]:

- How many and in what specialties do graduates prepare?
- What changes in training programs should be made when preparing students to take into account the requirements of employers?
- What competencies are most in demand now on the labor market and will be in demand in the future?
- Should attention be paid to vocational guidance of pupils and students?

Ideally, labor market information should play an important role in the education and training system in the following aspects [6]:

- intended training programs;
- curriculum development;
- access to information about career and education to build a career path.

The need to create such a transparent information environment is based on the European experience of creating an “Early Warning System”. They implement the concept of continuous monitoring of the compliance of the competencies of demand (employer) and supply (educational programs). It is stated that when a change in demand is necessary to adjust the change in supply that takes time (Fig. 1).

That is why it is important beforehand for business, state, population to possess updated data on current and perspective labour market. The “Early warning system” (developed with assistance of the European Training Foundation (ETF), European Centre for the Development of Vocational Training (CEDEFOP), International Labour Office (ILO) is aimed at such data dissemination and bridging labour market. The necessity of such systems development was discussed in Prague on the 6-7th of March 2014 at international workshop «Validation Seminar on Methodological Guides for Skills Anticipation and Matching» [20].

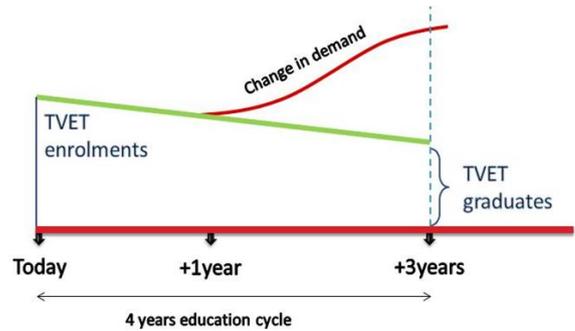


Fig. 1. Changes in supply for hard skills

The concept of a transparent information environment of the labor market in the form of information systems based on Internet portals is successfully implemented by the Center for Budgetary Monitoring of Petrozavodsk State University.

In Russia, the first experience of implementing such tools was the Internet resource "My Career", which was developed by the CBM PetrSU by order of the Ministry of labor and employment of the Republic of Karelia.

Purpose and key functions of the "My Career" system:

- forecasting the personnel needs of the region for 5-10 years in advance, taking into account the development strategies of the region, industries, large employers, the implementation of investment projects;
- human resource planning and development in the region;
- informing the population about the current and future state of the labor market in the region from the position of "Live, learn and work in your native region";
- vocational guidance of the population for in-demand occupations and specialties.

In 2017, an improved version of this system was developed and created for the Rostov region. Interest in this system is growing on the part of the Executive authorities of various regions of Russia. Thus, in 2018, similar systems were developed for the Vologda region and the Yamal-Nenets Autonomous district. As a result, four successful projects were implemented in three years (Fig. 2).



Fig. 2. The main pages of the regional Internet portals "My Career"

IV. DISCUSSION

The use of modern service "My Career" allows students to learn more about their professional inclinations, to get acquainted with the priority sectors of the economy of the native region and the characteristics of its labor market. Learn about the right now and in the future occupations and their important characteristics such as salary, mass and demand. To see what educational organizations in the region are trained in the specialties corresponding to the chosen occupations. To form a circle of potential employers who indicated the need for these occupations. To build, in the end, your personal career trend [21].

The concept of building a personal career trend was published in the works of foreign and domestic scientists [22, 23]. As an example of the implementation of such a toolkit, the SmartCareer information-analytical system (<https://smartcareer.pro>) was developed, allowing the construction and selection of a successful career path to any interested individual user [24]. The development of the system is aimed at creating a mobile application that allows building personal career trajectories of individuals in an automated mode, will contribute to the effective professional

realization of the individual in the modern conditions of the transition to the digital economy. A concomitant positive result of using the toolkit is that the user selects professions and specialties that are really in demand in economics, improve the employment performance of graduates of the vocational education system, increase the balance of the labor market, and increase personal income.

In continuation of the experience gained, it is proposed to develop and create an all-Russian information-analytical system for the management of professional training at the Federal level, combining regional systems "My Career" with the Federal database of official statistics and a single service of employers' surveys. The novelty of the proposed system will be a single integration between the subsystems "My Career" in the form of an Internet portal and "Smart Career" in the form of a mobile application. In addition, the Federal system will fully take into account the flows of educational and labor migration, which is problematic to implement within the regional systems. The results of such a system of forecasting occupations in demand and competencies can be used by educational organizations of vocational education to adjust their curricula [25] in order to bring their graduates in

line with the needs of the economy. Experience in the development of labor market information systems that go beyond one region, developed by the CBM PetrSU in the form of career guidance portals of the Federal level (Fig. 3)

"Staffing for the development of the Arctic zone of Russia" and "Start your career with the Arctic and the Far East."



Fig. 3. Main pages of Federal career guidance Internet portal

The proposed information resource will be a fundamentally new innovative product, representing a unified end-to-end expert-analytical system, connecting from one end the employer to his needs for qualified personnel, and from the other to the student in a broad sense (school student or graduate of a vocational education institution).

This system will integrate sequentially interrelated components:

- subsystem of development of traditional and innovative economy of the region, taking into account the implementation of investment projects;
- subsystem of forecasting the labor market needs for professional personnel;
- forecasting subsystem of demanded competences of employees;
- graduates employment forecasting subsystem\$;
- subsystem of forecasting the number of graduates of vocational education organizations;
- subsystem of predicted vocational guidance for schoolchildren;
- subsystem of forecasting the consequences of management decision-making.

The proposed system will be implemented in the form of a line of mobile IT-services of professional employment, including both regional Internet portals "My Career" and mobile application "Smart Career".

V. CONCLUSION

As part of the digitalization of the economy, the irreversibility of the processes of informatization of modern

society becomes apparent - the number of consumers of electronic services through web portals is increasing, the number of users of mobile devices and applications is also steadily increasing. On the other hand, there is no doubt about the growth of the psychology of mass consumption in modern society. More and more citizens strive for comfortable consumption of services, follow fashion and mass hobbies, willingly delegate the rights to think for themselves and make decisions. These trends instill confidence in the wide demand for the proposed product among a growing audience of users of electronic services, in particular, young people.

The proposed toolkit will contribute to improving the performance of vocational education institutions, orienting their graduates to the needs of the labor market, increasing the level of employment of graduates in their specialty. Thus, a digital approach to improving the balance of the labor market by increasing the efficiency of managing the formation and use of labor resources will be implemented.

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