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Analysis and Organizational Model for Monitoring of the Training of Workers and Specialists with Secondary Vocational Education for Innovation-Oriented Enterprises of Russia

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Abstract

Currently, a significant part of industrial enterprises in Russia faces the problem of shortage of skilled workers. The article presents the analysis of the current state of personnel training for innovation-oriented enterprises of Russia. The drop in the quantity and quality of staff is registered, particularly in relation to the workers and specialists with secondary vocational education. Also in the article the authors develop an organizational model for monitoring of the training of qualified workers and specialists with professional education for innovation-oriented enterprises of Russia. The participants of the monitoring and their interaction order are determined, as well as the goals and objectives of its execution. The main stages of the implementation of the organizational model and the work to be done at each stage are examined. In particular, the whole set of indicators to be used during the monitoring process is suggested.

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1. Introduction

Current geopolitical situation poses new challenges for Russia. The US and EU sanctions imposed on Russia are meant to hit the key sectors of Russia’s economy – innovation-oriented industrial enterprises, energy generation and

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finance. Without downplaying the importance to national economy of the last two sectors we would like to touch upon the problems of the innovation-oriented manufacturing sector.

Innovation-oriented enterprises (IOEs) – are those manufacturing enterprises which are focused in their activity on a systematic and continuous identification and assessment, creation and accumulation, as well as effective use of their own innovative potential with regard to specificity and level of their self-development so that to increase their efficiency and competitiveness. Innovation-oriented enterprises are those, which manufacture medical equipment, measuring instruments, optical devices and apparatus, flying craft, including space, machinery and hardware, electrical machines and equipment.

The choice is explained by the role which innovation-oriented enterprises (from now on IOEs) play in the Russian national product production in terms of its high-tech component, in protecting Russia’s geopolitical interests on the international arena, in the generation of technologies and products, which could be used not only in the defense but in the civilian sector of economy as well.

Among the numerous significant problems of IOEs today we would like to mention the problem of staffing. The drop in quantity and quality of personnel (especially the workers and specialists with secondary vocational education (SVE) in combination with the limited capabilities to correct the situation through search in the labor market, led to serious staffing shortages.

In this regard, there arises an actual scientific and practical task to analyze and develop the organizational model for monitoring of the training of workers and specialists with SVE for IOEs of Russia.

2. Objectives, methodology and research design

2.1. Purposes of the study

The purposes of this study are: (1) to analyze the training of workers and specialists with SVE for IOEs of Russia; (2) to develop the organizational model for monitoring, enabling to get the data on the training of qualified workers and specialists with SVE from the educational organizations engaged in the process; and (3) to assess the potential of educational such institutions in terms of training of the mentioned personnel as regards to the professions and specialties that are in demand of IOEs of Russia.

2.2. Research material and methods

The present study is based on the analytical materials reflecting the current status of the system of personnel training for IOEs of Russia, contained in scientific journals and publications, periodicals, and the Internet. In order to study the problems of qualified personnel provision for IOEs and the steps planned and implemented in this direction at the state level, some fundamental state documents were put under scrutiny.

Analysis of normative documents was chosen as one of the key methods of research. The application of this method involves conducting qualitative and quantitative content analysis of the legislative framework in order to identify or measure various facts and trends. Thus, during the formation of the list of SVE professions and specialties for the training of skilled workers and mid-level specialists, used in the 1st stage of the monitoring, the analysis was conducted of the list of professions and specialties identified in the regulations (Ministry of education and science of the Russian Federation, 2013; Government of the Russian Federation, 2014). Also within the framework of the study the methods of conceptual modeling of processes and the method of evaluation group indicators’ formation were used.

2.3. Methodology and research design

The current situation in the labor market of professionals demanded by IOEs can be illustrated by the following data. The shortage of engineers in the industry is about 17%, engineers-designers - 22%, workers of different specialties - 40%, i.e. almost half of the total demand in this category of workers. While the average age of workers in IO industry ranges from 50 to 56 years (Grigoriev, 2010; Grigoriev & Kirillova, 2011).
To analyze the trends and measures planned at the state level and designed to reverse the current negative situation, a number of documents, defining targets for the development of IOE personnel potential have been studied. "The concept of long-term socio-economic development of the Russian Federation for the period up to 2020" provides for modernization of the educational system with the aim of training qualified personnel, including high-tech industries, possessing the necessary competence and meeting modern requirements of the economy.

As noted earlier, innovation oriented companies have a significant need for operating personnel and professionals with SVE. A number of measures to improve SVE programs for the employees of IOEs were planned and have been carried out, especially within the national Defense-Industrial Complex (since almost all companies incorporated into the Complex are innovation-oriented). However, this issue remains problematic in the broader context since the training of workers and specialists with SVE for IOEs requires solving the following tasks (Yeleneva et al., 2014; Grigoriev, 2015):

- definition of staffing needs of IOEs for the current period and in perspective;
- expansion of IOEs’ participation in the implementation of educational programs, including teaching of subjects and modules within educational programs; taking part in the evaluation of effectiveness of the programs taught (participation in the work of State Examination Commissions); participation in the practical training of students with the provision of material and technical base, places, practices, and others;
- organization of training for teachers on the IOEs research-and-production base, as well as participation of IOEs’ leading specialists in professional skills upgrade of pedagogical workers from the educational institutions engaged in training for SVE professions;
- expansion of participation of IOEs in the formation of modern material-technical base and infrastructure for the implementation of educational programs, including acting through joint academic-industrial-educational projects, both on the basis of educational institutions and IOEs.

The analysis of the current state of the system of training of workers and specialists with SVE revealed an acute shortage of blue-collar workers, including those having particularly sophisticated professions for the industrial enterprises introducing high technology. This problem is related to the fact that currently IOEs are experiencing growth due to the process of active modernization, introduction of new technologies, including automated methods of technical systems control. This in its turn leads to a higher level of intellectualization of the worker’s labor and growth of his personal responsibility for the efficient use and condition of equipment (Grigoriev, 2013; Grigoriev et al., 2014; Grigoriev et al., 2013). Thus, we can talk about changing the professional functions of a worker: from simple manufacturing to the management of automated systems, producing complex, high-precision and expensive products, but also about the changing of requirements of job givers to the competencies that should be possessed by highly qualified workers.

However, a significant part of the professional educational organizations, previously transferred under the regions’ jurisdiction, mainly engage in the training of workers and specialists with SVE with regard to the needs of regional labor market. Meanwhile economic and financial capacities of regional and municipal budgets, as a rule, do not allow a full-fledged personnel training for IOEs, meeting modern requirements (Yeleneva et al., 2014).

A significant part of the professional educational organizations conduct training using worn-out and obsolete equipment. This is due to the fact that the budget financing of the professional educational institutions in the volume provided today, does not enable to acquire the necessary amount of modern educational equipment as close as possible to that used by leading enterprises of the industry. The situation is aggravated by the use of educational programs, usually not coordinated with employers and their needs (Bondarenko & Latkin, 2012; Grigoriev et al., 2011). All this negatively affects the quality of training.

Thus, it is possible to speak about the existing gap between the supply on the market of graduates who have mastered SVE programs, and the need for operating personnel and professionals with SVE in IOEs (Grigoriev, 2009).

This raises the task of monitoring the implementation of the basic programs used by the educational institutions engaged in training for SVE professions, demanded by IOEs. The purpose of the monitoring is to obtain data on the training of skilled workers and specialists with SVE for IOEs, as well as to evaluate the potential of educational institutions in terms of training of these personnel in trades and professions, demanded in IOEs.

The monitoring goal is specified in the list of current tasks:
obtaining of data on the range of SVE professions and occupations, popular among IOEs, which are taught in educational institutions;

obtaining data on the number of students enrolled in the SVE professions and specialties, in demand by IOEs, including those students enrolled within the framework of target training contracts;

obtaining data on the employment of graduates, including those hired by IOEs;

obtaining data on the participation of representatives of employers (IOEs) in the development and implementation of educational programs;

obtaining data on the presence of structural units of educational institutions in IOEs (e.g., base chairs);

processing of the data obtained and the formation of analytical reports on the training in educational organizations, SVE occupations and professions, demanded IOEs.

The collection and analysis of data are done in the following respects:

with regard to the directions of training - profession / specialty; aggregated groups of professions / specialties;

with regard to the types of educational organizations - professional educational organizations / higher educational organizations;

with regard to the territorial subjects of the Russian Federation / Federal districts.

The actors of the monitoring of training of qualified workers and specialists with SVE for IOEs are:

- the Ministry of Education and Science of the Russian Federation;
- bodies of state power of the subjects of the Russian Federation in the sphere of education;
- professional educational and higher education organizations, engaged in the training of qualified workers and specialists with SVE for IOEs.

The monitoring is carried out in 3 stages. Its organizational model is presented in Fig. 1.

**Stage 1. Preparation of initial data for monitoring**

The aim of the first stage of the monitoring study is to determine the object of monitoring, as well as the list of indicators that are monitored.

The objects of monitoring are the basic educational programs implemented in the educational institutions, aimed at training skilled workers and specialists with SVE for IOEs.

Taking into account the above goals and objectives of the study, the list of indicators enabling to obtain the necessary data about the state of training of skilled workers and specialists with SVE for IOEs is determined.

The list of indicators for monitoring (all figures are considered over the years in terms of: profession/specialty; integrated group of professions/specialties, if not expressly) is the following:

**1st group** - quantitative and qualitative composition of contingents of students in educational institutions:

- contingent of students in 2011-2014;
- number of students admitted to an educational organization in 2011-2014;
- number of graduates in 2011-2014;
- maximum potential number of students that can be admitted by an educational organization with its own resource base.
2nd group - indicators of employment of university graduates:
- number of graduates in 2013 and in 2014, employed by IOEs;
- number of graduates in 2013 and in 2014, employed by other organizations;
- number of graduates in 2013 and in 2014 continuing education in SVE and higher educational programs;
- number of graduates in 2013 and in 2014, drafted into the Armed Forces of the Russian Federation;
- number of graduates in 2013 and 2014 that were not employed.

3rd group - indicators of employers' participation in the implementation of educational programs:
- IOEs which participated in the implementation of educational programs in the 2013/2014 academic year, in respect to: participation in the development of educational programs; participation in teaching subjects/modules of an educational program; participation in the state examination commissions; providing working places for internship.

4th group - indicators of the infrastructure of training in the basic educational programs:
- number of units operating in 2011-2014, established within the structure of educational organizations (with the help of IOEs) or IOEs themselves;
- types of existing structural units established jointly with IOEs for the implementation of educational programs.

5th group - indicators of the quality of educational programs:
- number of graduates who passed final state examinations and got "good" or "excellent" marks;
- number of staff involved in the teaching of professional disciplines and professional modules of an educational program;
- number of staff involved in the teaching of professional disciplines and professional modules of an educational program, and having got advanced or internship training at IOEs;
- availability of professional-public accreditation of educational programs (in respect to professions/specialties of aggregated groups of professions).

The electronic templates designed for generated set of indicators, are entered into the Unified information system supporting the activities of the Ministry of Education and Science of the Russian Federation and are filled in by the participants of the monitoring through their personal accounts.
**Stage II. Research (data collection) in educational organizations**

The objective of stage II of the study is to obtain statistical data from educational organizations on their implementation of training in SVE trades and professions, demanded by IOEs.

The study is an online survey through a Unified information system to provide the activities of the Ministry of Education and Science of the Russian Federation. Gathering of information onto the level of the Ministry is carried out directly by educational organizations through their personal accounts within the Unified information system. The basic requirement for the provision of the records is their reliability.

For the purpose of data collection a letter of the Ministry of Education and Science is sent to the state power bodies of the subjects of the Russian Federation in the sphere of education, which contains:
- information about the aims and objectives of the monitoring study;
- information about the timing of the monitoring;
- the concept of the organizational model of the monitoring of training of skilled workers and middle managers with SVE for IOEs;
- the list of professions and occupations act, to be monitored;
- request for the provision of data for the list of professional educational organizations, providing training of workers and specialists with SVE professions and specialties represented in the list for monitoring.

On the basis of collected data a list of professional educational organizations, and educational institutions of higher education subject for monitoring, is formed.

According to the generated list of these organizations the Ministry of Education and Science of the Russian Federation issues a letter containing:
- methodical instructions for completing online forms;
- the timing of the monitoring.

Generalization of the data collected is accomplished automatically within the database of the Unified information system providing the activities of the Ministry of Education and Science of the Russian Federation.

**Stage III. Collected data processing and analysis**

The objective of phase III studies is to obtain statistical data on the training in educational institutions, SVE professions and occupations, demanded by IOEs.

According to the results of statistical data processing, the following results are provided:
- the list of SVE professions and specialties aimed at the training of skilled workers and mid-level professionals, implemented in higher education institutions (in terms of subjects of the Russian Federation);
- the contingent of students in 2011-2014;
- the number of students admitted to an educational organization in 2011-2014;
- the number of graduates in 2011-2014;
- the maximum potential number of students that can be admitted in an educational institution while maintaining the existing resource base in an organization;
- the number of educational structures, active in 2011-2014, which were created together with IOEs on the basis of an educational organization or by an IOE (over the years in terms of: on the basis of an educational organization / on the basis of an IOE);
- the structure of employment of graduates in 2013 and 2014;
- the structure of employers' participation (IOEs) in the implementation of educational programs.

And the following indicators are also calculated:
- the potential growth of the contingent of students;
- the proportion of graduates in 2011-2014, having successfully passed state examinations and received "good" or "excellent" marks;
- the share of the teachers in 2011-2014, having taken part in the teaching of professional disciplines and professional modules of educational programs, and trained and/or got internship at IOEs.

The analytical report on the results of monitoring contains aggregated statistical data with the usage of tools of visual representation of information (tables, charts, diagrams), which are accompanied by comments and analytical conclusions.

The results of the monitoring will be used by:
The Ministry of Education and Science of the Russian Federation in respect to:
- assessment of the current status of training of skilled workers and specialists with SVE for IOEs;
- planning of admission figures for SVE professions and specialties, demanded IOEs (in terms of the subjects of the Russian Federation);
- assessment of the degree of implementation of the state plan for training for the IOEs for SVE specialties (in respect to the groups of specialties).

The state power bodies of the subjects of the Russian Federation in the sphere of education in respect to:
- the assessment of the current status of training of skilled workers and SVE specialists for IOEs.

The Ministry of Industry and Trade of the Russian Federation, the ROSCOSMOS Federal Space Agency, the Rosatom Atomic Energy State Corporation and other stakeholders, in respect to:
- the assessment of the degree of implementation of the state plan of training for the IOEs in SVE specialties (in the context of groups of specialties);
- the creation of requests for the training of qualified workers and specialists with SVE (in the context of groups of specialties and the subjects of the Russian Federation).

3. Discussion of the research outcomes

3.1. Results of the monitoring

During the analysis of the monitoring data there were the following findings:
1. Currently educational programs on 215 SVE professions and specialties (80.5% of the total number of educational programs covered by the monitoring), are being implemented. Data were obtained on the directions of training in professional educational organizations in the context of subjects of the Russian Federation, and in higher educational organizations respectively. It should be noted that educational organizations have started work on professional-public accreditation of educational programs (about 1% of educational programs have professional public accreditation in addition to state). The main bodies engaged in professional public accreditation are the Agency of control over the quality of education and career development (ACQEC) based in Moscow and the Trading-Industrial chamber of the Russian Federation.

2. The actual cooperation of educational institutions with IOEs is noted to be in 58 subjects of the Russian Federation. Experience of such cooperation has been confirmed in 33.4% of professional educational organizations and more than 50% of higher educational organizations.

3. The proportion of graduates employed in 2013-2014 is slightly more than 50% of the total number of graduates from professional educational organizations and 58.4% - from higher educational institutions. However, IOEs hired 65% and 71% of the graduates respectively of those educational organizations that have already established partnership relations with IOEs.

4. The main forms of IOEs’ participation in the implementation of educational programs are the provision of venues for internships of students and participation in the development of educational programs. Thus, according to the Monitoring during the 2013/2014 academic year more than 60% of SVE educational programs in educational institutions of higher education were provided with venues for internships of students training in IOEs and more than 55% of the educational programs were developed with the participation of IOEs.

5. There is a positive trend in the number of contracts for targeted training concluded with IOEs over the last three years (an average growth of 15-20% per year).

3.2. Discussion of research results

The developed organizational model for monitoring of the training of workers and specialists with secondary vocational education (SVE) for innovation oriented enterprises (IOEs) of Russia is an open and easily reconfigurable system. The proposed order of interaction of participants and the correlation of performance indicators for the monitoring are originally oriented onto the specific needs of IOEs, but can be used for similar purposes within the framework of monitoring of other forms of training and for other groups of potential employers.
The list of monitoring indicators can potentially be supplemented and expanded, but today it seems to be comprehensive and meet the goals and objectives of the monitoring study. The presented work aims to initiate further activities in this area, serves to establish a common vision for the problem under study and can be considered as an invitation to further discussion.

4. Conclusion

The analysis of the current state of the system of the training of personnel for the IOE industry and, in particular, of the training of workers and specialists with SVE revealed an acute shortage of marked categories of workers. In addition to the current imbalance of supply and demand (and the lack of reliable information for the production of forecasts) on this segment of the labor market there is also dissatisfaction of employers with the quality of training. This fact is explained by the weak material and technical base of many educational organizations, outdated educational programs of training, often inappropriate to modern conditions of production, lack of places for practical training, outdated knowledge of teachers. It is obvious that in order to reverse the current negative situation, a comprehensive collaboration of educational institutions and IOE stakeholder organizations is required.

The information base needed for organizing such work is relevant and reliable data on the key indicators in quantitative and qualitative aspects of the training of workers and specialists with SVE for IOEs, as well as the best practices in this area, available for replication. Using this array of information, it becomes possible to make valid conclusions about the current situation in the field of training of workers and specialists with SVE for IOEs in respect of training directions and the subjects of the Russian Federation, to take rational management decisions on the organization of interaction between educational institutions and IOEs, develop the common policy in the sphere of personnel training for IOEs sector. It should provide a constant flow of skilled workers and specialists with secondary vocational education knowledge and skills which will enable to produce quality and competitive products and bringing profit IOEs.

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