Current Trends Affecting the Formation of the Pedagogical System of Training of an Engineer-Manager for High-Tech Industry in Terms of Polyvalent Reformation of Education

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Abstract

Background/Objectives: To determine needs of knowledge-intensive industries of Naberezhnye Chelny and Republic of Tatarstan in qualified personnel and development of specialist model, which provides breadth of expertise in related professional fields

Methods/Statistical Analysis: Survey, expert survey, analysis of secondary information. We conducted expert interviews with specialists of recruitment agencies of the Republic of Tatarstan and heads of large enterprises of the region, questioning graduates in the period from 2010 to 2014. The sample of the study amounted to 639 graduates and 45 experts. During the processing of empirical data statistical methods, system analysis, methods of ranking, classification, and grouping were used.

Findings: The results of the survey indicate a lack of professional training of specialists for science-intensive industries. In addition, the experts marked the following issue: qualified engineers are trained professionals in the field of design and technological developments, but do not have the skills of a Manager, and, on the contrary, professional managers there is no engineering training, no knowledge of technological processes. Features and development trends of high-tech industry define new requirements to training of specialists for this sphere. The Manager prepared for the high-tech industry, is designed to combine engineering training with knowledge in the field of Economics, organization and production management in a market environment. The proposed model of a specialist is the combination of personal characteristics, professional qualities of an engineer-Manager, types of his professional activities and facilities development in the process of professional training. In the system of higher professional education must be the training of interdisciplinary profile that has the skills of a researcher, which owns adjacent fields of knowledge and highly innovative technical, managerial culture.

Application/Improvements: The results can be taken into account in the development of programs for prediction of professional activity Manager and also used for professional selection, counseling, training of leaders.

Keywords: Engineer-Manager, Formation, Polyvalent Reformation of Education, Development, Pedagogical System of Training

1. Introduction

Modern trend of world economic development is the increasing role of knowledge-based, competitive industries. In the development Strategy of science and innovation in the Russian Federation for the period until 2015 one of the priority directions of science, technologies and techniques of the Russian Federation is the scientific and technological development due to the formation of the technological base of the economy and

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knowledge-intensive industries. In the paper the attention is focused on the integration of scientific and educational activity, which aims at improving the quality of education and training scientific and technical personnel with advanced knowledge on the latest achievements of science and technology and practical experience of participation in scientific research, obtained in the learning process.

In the presidential Decree No 537 of 12 May 2009 on the national security strategy of Russian Federation until 2020 for solving problems of national security in the sphere of science, technologies and education in the medium and long term need to develop competitive technologies and samples of high-tech products, to organize high-tech industry. The economic situations in Russia today, the need for the inclusion of our country in the global economy require a transition to a new technological way. In these circumstances, a key resource for the dynamic economic growth becomes the human resources must be able to competently solve management, production targets of high-tech industry and to ensure its effective functioning and development. Therefore, to ensure high-tech industry specialists of a new type of strategically important is the improvement of the system of higher professional education.

Effective solution of problems of improving the system of higher professional education possible, based on the knowledge of the characteristics of and trends in the development of high-tech industry, the main of which are:

- focus on production, which has high performance and techno-economic characteristics, using high technology;
- lowering the quality of the personnel and technical capacity in knowledge-intensive industries (for example, Russia is lagging behind the US in R & D spending 17 times, from the European Union – 12 times, from China – 6.4 times, India – 1.5 times);
- low efficiency of high-tech industry in the conditions of uncertainty of the market environment;
- increased innovation and technological mobility enterprises with less risk and in a short time to develop and implement high-tech products;
- intellectualization of production;
- integration of education, science and production;
- the complexity of employee motivation on knowledge-intensive enterprises;
- complex automation of technological processes in procurement, primary and secondary production;
- complex nature of organization, management of knowledge-intensive industries;
- implementation of high-tech industry into the following chain: planning – research – design – process design – test – serial production;
- the existence of a quality management system;
- high innovation potential, serving not only the industry, but also other sectors of the economy, generating a “chain reaction” of innovations in the national and global economy;
- high growth compared to other sectors of the economy;
- large share of value added in the final product;
- life cycle of high technology products is considered as long time interval from idea to production, which greatly complicates management.

The above features of high-tech industry determine new requirements for training. The main direction of professional training for high-tech industry should be fundamentalization of professional education, giving invariance in the training of specialists, providing a breadth of expertise in related professional fields.

2. Materials and Methods

The author in the period from 2010 to 2014 is conducted interviews with experts of personnel agencies of the Republic of Tatarstan and heads of large enterprises of the region, a survey of graduates. The sample of the study was 639 graduates and 45 experts.

The purpose of this study is to determine the needs of knowledge-intensive industries of the city of Naberezhnye Chelny and Tatarstan in qualified personnel.

Objectives of the study:

1. To review the literature on studies of the quality of training.
2. To analyze the results of sociological research.
3. To draw conclusions and to develop the elements of the model of the engineer-Manager.

Research methods: survey, expert survey, analysis of secondary information. In the processing of empirical data, applied statistical methods, system analysis, used methods of ranking, typology, and grouping.
3. Results and Discussion

The emergence of new related areas, causing the emergence of new professions and specializations, the complexity of industrial activity, leading to changes in its content, change the role of the specialist in the manufacturing process, lead to the necessity of training skilled professionals, able to solve complex tasks that require specialists greater mental mobility, ability to solve production problems in a new environment.

The current state of science, engineering and technology in knowledge-intensive industries today requires competent engineers. For example, in the U.S. the distinguishing feature of the professional engineer is the ability to fasten produce calculations, drawings, reports, personal signature and seal, which means accept legal responsibility for any consequences of using the proposed technical solutions.

National doctrine of engineering education determines the factors affecting the development of engineering education: the radical reformist developments in the scientific, technical and socio-economic sphere; the goals and values of the engineering activities of the future; a forecast of substantial and structural changes of production, science and culture of the country and the educational needs of the population[6]; the formation of the mixed economy of the country and directions of development of regional economies; philosophy of vocational education; the engineering labor market and intellectual production; personal orientation young people into the engineering profession.

Engineering work is differentiated – V. Dahl, author of the famous Explanatory dictionary, distinguished military engineers and civil engineers. Thus, among the latter he highlighted the railway engineers, mining engineers, ship, and mechanical engineers.

Modern engineering work differs not only in areas of application, but also on the nature of the activity (engineer-manager, designer, researcher, designer, technologist, test, production worker, etc.).

Creative engineering work in conditions of modern market economy requires engineers who not only have basic fundamental knowledge, but also able to put and to solve problems in the development of scientific and technical sphere.

The engineer is a specialist with higher professional technical education, Creator of information about the architecture of the material means of achieving the goal or method of making the tool (product), methods of testing and commissioning of the facilities and its material embodiment, and exercising management and control over the manufacture of the product.

The development of new industries is based on the latest achievements of scientific and technological progress results in more complex engineering activities. The existing training engineers are often based on the qualification characteristics of specialist. Modern engineers have to solve problems that are constantly changing, becoming more complicated, so it needs:

- to have professional knowledge and skills in engineering, be guided by the requirements of technical rationality and professional standards;
- to be responsible for the results of their work and its implications professional activity;
- to have analytical thinking and technical abilities;
- be able to invention;
- to have the skills of technical creativity and communicative competence;
- be able to perceive a large amount of information, compare and analyze a variety of disparate facts;
- to navigate in related fields of knowledge;
- to be able to apply computer aided design and perform calculations on modern computer technology with the use of ready-made objects mathematical software;
- to be independent, to be able to make decisions, able to give their own assessment of any source of information;
- to possess self-discipline, self-control, activity in the chosen field of activity;
- to constantly increase their level of professionalism.

Engineers must have a broad academic knowledge, to be able to work with the information.

Often almost any engineer the company is also the owner. This is the second side of the engineering profession, although for some it becomes the first. Becoming chief, he should know the latest technology, and be able to organize the work of staff, the production, to be able to defend the interests of his company at the highest level.

To ensure the competitiveness of knowledge-intensive enterprises in the conditions of transforming society is particularly necessary for effective management across the value chain of production and sales. Special role to play in this professionally trained intellectual resources.
Main requirements to the Manager of the knowledge-based enterprise are:

- common knowledge in the field of business management;
- competence in production technology of the firm;
- skills of not only administration, but also entrepreneurship, the ability to control the situation in the markets, to take the initiative and actively reallocate resources enterprise in the most profitable areas of application;
- have practical experience and knowledge in the field of analysis of economic situation in the markets;
- the ability to analyze activities of competitors;
- the ability to foresee trends in the development of economic conditions, characteristics of demand, measures of state regulation of economy in his country and in other countries, the markets for which the firm seeks to strengthen or hold their positions;
- ability to work with subordinates according to their abilities and capacity to carry out specific work entrusted to them in the interests of the company I. D.

Among the core activities of a Manager stands out: organizational management, research, design, analytical, commercial-economic, socio-psychological, diagnostic.

In order to perform various functions assigned to the Manager, he must be set accordingly. Experts often distinguish 3 groups of qualities: personal, professional and business. In the foreground in the process of training should be paid attention to the formation of business and professional qualities, as personal qualities in General are no different from other professional groups of employees and require high moral standards, high level of internal culture, honesty, etc.

Modern Director high-tech industry must have economic thinking, which allows you to see the future, to anticipate developments and efficient construction process control. Providing intensive enterprises competent leaders, possessing technical knowledge and skills to apply them in practice is possible only with a systematic approach to training new quality.

A special role is granted the knowledge of experts at the junction of the directions. For example, an important role in knowledge-intensive production is industrial management, whose main task is the organization of high-tech industry, the exploitation of high-tech products, its repair, the withdrawal from the production, utilization6.

For modern high-tech industry increasingly requires professionals, ready to perform a comprehensive research and design work and safety of complex technical systems.

The specialist for high-tech industry must be able to establish, review and evaluation of business relationships, expertise and flexibility of thinking, innovation activity and susceptibility. Therefore, the training system should focus on the constant changes occurring in the economy, science, engineering and technology.

To determine the needs of knowledge-intensive industries of the city of Naberezhnye Chelny and Tatarstan in qualified personnel conducted a survey of experts 20 recruitment agencies, as well as an expert survey 25 managers of different levels of management of large enterprises of the region. The results of the survey indicate a lack of professional training of specialists for high-tech manufacturing. In addition, the experts indicated the following problem: qualified engineers are trained experts in the field of design and technological developments, but do not have the skills of a Manager, and, conversely, the professional managers no engineering training, no knowledge of technological processes. All this necessitates the training of engineers, managers who combine administrative, engineering and manufacturing knowledge.

Study in the USA is showed that the greatest success in your career seek graduates that combines engineering with science, or with training in business administration. They account for approximately 25% of the graduates of engineering programs.

In November – December 2012 the survey was conducted among graduates of IEML to identify employment needs. The sample of the research consists of 639 people, including 124 graduates in the specialty “engineer-Manager”. Was used proportional to the sample, allowed to interview of 28.64% of the General population?

Among all graduates over the past 5 years occupied 88,29% of respondents, among engineers and managers in the figure above: 92,16% of the graduates in full-time education and 95.9% of the graduates who have studied by distance learning, which may be indicative of the demand for the specialty. A survey of 124 graduates of full-time and correspondence forms of education that have received the qualification “engineer-Manager”, is identified the main problem in the system of professional training - lack of practice-oriented training. The greatest number of all proposals graduates (37.87% of respondents) concerns the organization of practices on the basis
of enterprises and organizations of not only the city but also the region. Alumni invited to create the conditions for combining study and work, to adapt the curricula for the modern market challenges, introduce new disciplines that help to prepare for employment. Engineers-managers believe that it is necessary to give more technical knowledge, including knowledge of instrumentation, to pay attention to study the state Standards, strengthen the focus on IT technology.

Respondents draw attention to the fact that the richness of the educational process is weakly focused on the preparation of students to overcome the threshold of “study-work”, not created the conditions for a smooth combination of study and work students. There is a need for such a training process that would allow future graduates to acquire practical inventive and research experience, as students. And for this you need to create a system of partnerships and business cooperation with major high-tech enterprises of the city and the Republic.

4. Conclusion

In Russia, long overdue need in the preparation of versatile professionals able, on the one hand, deeply understand the very high-tech business object, able to justify and manage the life cycle stages of high-tech products, on the other hand, possess the knowledge and skills of a Manager.

Training of specialists for high-tech industry combines a set of engineering and technological knowledge and skills, and practical skills in the field of management. Thus, engineer-Manager should receive interdisciplinary training.

Preparation of an engineer Manager for a modern economy requires the preparation of such a specialist who not only knows how to conduct a feasibility study of various projects, designing new facilities, etc., but also to skilfully manage the workforce, production and business in General. Engineer-Manager needs to have good information training, due to the increase in the volume of scientific and technical information, changing and improving means of engineering work, the widespread use of computers and the use of various software applications to solve complex engineering tasks of collecting, processing and storing information. He should have knowledge in the field of modern information technologies, including CALS-technologies, to know the methodology of structural analysis and synthesis of integrated information models, to be able to design computerized integrated manufacturing system. Engineer-Manager for high-tech industry should combine professional engineering preparation with knowledge in management, Economics and organization of production.

One of the important qualities of specialists for high-tech industry should be the mobility and adaptability to constantly changing conditions, requirements, etc.

Modern state of the human capacity for knowledge-intensive production, structural change requires transition to a new system of relations. Competent personnel should be not just engineers and managers, they must be leaders, able to actively search for a customer, funding sources, developing contacts, including foreign.

Thus, the characteristics and trends of knowledge-based development define new requirements for the training of specialists for this sphere. The Manager prepared for high-tech industry, is designed to combine engineering with knowledge in the field of Economics, organization and production management in a market environment.

The proposed model of a specialist is the combination of personal characteristics and professional qualities of the engineer-Manager, types of his professional activities and facilities development in the process of professional training.

In the system of higher professional education must be the training of interdisciplinary profile with skills of the researcher that owns related fields of knowledge and with high innovative technical and managerial culture. This requires the improvement of existing and creation of new mechanisms aimed at radically changing the content, process and the quality of domestic education that meets modern requirements of high-tech industry.

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6. References