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**RUSSIAN ENGINEERING EDUCATION IN THE CONTEXT OF
GLOBALIZATION AND EDUCATIONAL SERVICES EXPORT**

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Abstract

The article addresses the issues of the specialist training quality in the dynamically changing global economy. The advantages and disadvantages of the globalization process in education, the risks and promising ways of development of domestic education are studied. Issues of influence of globalization process in education on development of national economies of individual countries are considered. Factors challenging the thesis of equal opportunities for economic growth for countries with different levels of economy in the era of globalization are presented. The decisive role of engineering education and regional technical universities in the economic growth and industrial production of the country has been proved. The most popular methods of assessing the effectiveness of the university, including at the international level, were considered; their advantages and disadvantages are estimated. Ways to improve the quality and competitiveness of domestic education are proposed, such as the universality of initial training in technical universities, which will increase the mobility of students within the country, the development of export of educational services, the convergence of education and industry, the development of targeted training. Approaches to the development of methods of management of innovation activity of the university in terms of organization of international cooperation and export of educational services are proposed.

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Keywords: Academic mobility, engineering education, economic globalization, education export, globalization of education, industrial placement.



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1. Introduction

The globalization of all aspects of our life is already an accomplished objective reality. Despite the fact that the term “globalization” appeared relatively not long ago, namely in 1983 in the article “Globalization of markets” by the famous American economist Theodore Levitt, in fact this phenomenon comes from K. Marx’s works, from his ideas of materialistic theory of history understanding. The topic in question was also thoroughly studied and reflected in the works “Imperialism as the Highest Stage of Capitalism”, “Imperialism and the Split of Socialism” by V. Lenin. One can only wonder how true the classics’ theses are in relation to the modern history of the world.

Today, scientists state the fact of global changes in the life of society, analyze the advantages and disadvantages of this development path. The process of globalization is a characteristic feature of the actual world at the beginning of the 21st century, the main trend of which has become the course of all mankind, its economy, politics, culture, relationships on international integration and unification (Arakelov & Aliyeva, 2014). Often now, the process of "globalization" is called the process of "Americanization." There is some truth in this. With inevitable growing integration of national economies in the activities of transnational financial, economic, information structures and corporations, the control over this process is transferring from national governments to supranational institutions such as the World Trade Organization, World Bank and the International Monetary Fund. However, it is the USA, having the power to influence certain decisions, that play a key role in all these organizations. It is obvious that the role of the “world banker”, the holder of the world reserve currency allowed the United States to become the leader in the global economy, meanwhile the European countries, being worn out by wars, were restoring their industries, science, education, and financial sectors. It is not surprising that it was in America where the intensive process of globalization began. Effacing the borders, opening the markets, commercializing all aspects of our lives that, in fact, result in universal unification, at the same time show interesting results: rich countries are becoming richer while poor countries are getting poorer.

2. Problem Statement

Advantages and disadvantages of the globalization for the national development of particular states

However, the American scenario of globalization, according to which the United States become the control center of world markets not only for finance and economy, but also for mineral reserves, therefore, the United States is not only the first and the only superpower on a truly global scale, but also and most likely, the last one (Brzezinski, 1998), where other countries are assigned the roles that satisfy the US doctrine, such as cheap labor market in Southeast Asia or the role of the “world gas station” for the Russian Federation, in recent years has been failing. Almost every stage of this scenario has ended in failure.

1. The allocation of production in the Southeast Asian countries, in order to increase the competitiveness of the products, has caused an unprecedented expansion of the Chinese economy and the emergence of a major exporter in the world, China. Apart from this, the economies of other countries in the region have also set out on the path of dynamic development.

2. An attempt to establish its influence in the Middle East countries, in order to place control on natural resources trying to apply the theory of “controlled chaos” in practice, met resolute opposition of the Syrian government and President Assad.

3. The participation of the Russian troops, at the invitation of the Syrian government, in suppressing the spread of Islamic terrorism was the starting point of Russia's ascension as a leading player in the international political arena.

Many examples can be given, but the main discredit of the globalism theory a la American style was a deviation from the rules, from international law for the sake of the national interests of one country. All of us live here and now, during the time of change, the time of disappointing in American excellence. The policy of sanctions pursued by the US government violates all regulations of the World Trade Organization, but allows obtaining competitive advantages in the international market by eliminating the main competitors. One can also mention the trade war that the United States launched against China, affecting even their allies, i.e. countries of Western Europe. The fight for the first place in this global world is happening not only in the economic sphere, but in sports, culture, science and education as well.

Knowledge, training, information are becoming new types of raw materials in international commerce, sources of power, important components of individual and corporate wealth (Schelkunov, 2008).

Globalization of education is a process of increasingly adapting the training system to the global market economy demands (Schelkunov, 2008).

Obviously, during the globalization era not only financial and commodity markets but also labor market become common. The global economy, with innovations and new technologies continually being introduced and implemented, is intensifying the competition between companies, corporations and even states. Highly qualified, dedicated specialists who are capable to work with rapidly updating technologies, in searching for new goods, under constant modernization of the production organization system, are in demand. Employees offer their competencies, experience, skills to whose, who provide them with best living and working conditions. Again, it turns out that with the visible equal opportunities for all countries, a single labor market and universal education, more affluent countries can afford to recruit best specialists from around the world, while poorer countries suffer from “brain drain” problem. In these countries, the level of human capital assets, which are the engine of the country's economic growth, is decreasing, since it is human capital that generate innovations, implements new technologies and brings a creative start to the manufacturing process management. The human factor can influence the development of the latest NBIC technologies and human-oriented production systems (Kolbachev & Kolbacheva, 2018a). The decelerating countries will remain as they are unless they develop their own strategy and find their way in this rapidly growing world of global integration.

Certainly, under the globalization of labor market, the education system, being the main supplier of specialists to this market, cannot remain indifferent to the changes. If the market requires unified competences and qualifications of employees, education is forced to set a course for the globalization.

One of the attempts to integrate the domestic higher education system into a single European system was the introduction of the Bologna two-stage system in the educational programs of our universities and academies (Stepanova, 2007). We will not rest upon the assessment of this system and

the degree of its need for national education in Russia. Many works have been written on this subject and an infinite number of opinions, sometimes quite harsh, have been expressed. Despite the abundance of organizational innovations being introduced, one of the fundamental issues of modern Russian education remains unaffected that is the content of new format training programs that meet the requirements of the time, the socio-economic development of the country and the needs of Modern Human (Elizarov, 2009). The discussion about the need to reform domestic education started almost immediately after the Soviet collapse. The country was at the door of a new era. From a planned, state-regulated economic system, we fall overnight onto the abyss of market relations. The Universities gained unprecedented freedom of their scientific, educational and economic activities not thanks to some outstanding democratic liberties, but due to a reduction in state funding. The last century 90s-style education system in Russia was a spontaneous merge of classical Soviet system and new market trends that enabled educational organizations to survive. Education turned into a separate sector of the economy with its supply and demand. Universities opened new specialties, departments, faculties, branches. The number of universities increased dramatically. The graduates of some prestigious specialties were mass-produced. Lecturers, scientists, highly trained specialists from the countries of the former Union were looking for job and proper environment for scientific activities abroad.

As regards the quality of domestic education, it is slipping lower and lower according to all criteria, despite the fact that the time of the market element has passed. Nowadays, the reformation of education as well as its modernization is regulated by the state, with the course of these innovations being set to the integration into the international European system (Vasilieva, 2016).

3. Research Questions

The role of modern Russian engineering education in increasing national human capital assets.

Why was the Soviet education system, highly valued in the West, and our experts were in demand by science and industry of the developed countries? What did the early 90s-massive "brain drain" evidence, despite the fact that the system was not an integral part of world education system, and the "Iron Curtain" was keeping the scientific and academic circles from moving and cooperating freely?

What is the phenomenon of Soviet education? Our world is certainly changing every single moment, primarily due to information globalization, which allows us to see the diversity of our planet, get acquainted with the masterpieces of world culture, discover new achievements in science and technology, communicate and exchange experiences with international and domestic colleagues. This new reality leaves no chance to return to the past. Nevertheless, it is vital to analyze and learn the best experience in order not to lose the values that have been accumulated over the years and are applicable specifically to our national characteristics, taking into consideration that the Soviet system originated from the education system of the Russian Empire. However, the graduates were not just focused specialists, but well-educated people who later were promoted as officials (University charters of 1804, 1835, 1863, 1884 years secured the advantages of a university diploma for the civil service), applied themselves as teachers and scientists (Kropachev et al., 2019). When training experts in Russia, such factors as diverse cultures, the economic development level, climatic zones, geographical reliefs, population density were taken into account, not to mention that our country is huge and consists of many different regions....

A Russian engineer, and then a Soviet one, was a specialist in mechanics, electricity, civil engineering, and in emergency case, he was able to give first aid. Our domestic features stipulated the need for such competencies, when it was hardly possible to provide all villages and remote corners of the country with a wide range of dedicated specialists.

With no denying the benefits of the integration processes that impose certain obligations on our educational system, we propose to develop our own rules for the modernization of our education and international cooperation in this field rather than follow blindly the path indicated by European and American partners. This will not prejudice our national interests, but will bring competitive strengths and economic benefits to our country. The sociological studies conducted by Russian scientists (Kolbachev, Borovaya et al., 2019) showed that the specialists trained in regional technical universities, in particular not in the main cities of the regions, tend to become the key elements for the development of our industry.

In the process of this study, a survey and questioning of employees of industrial enterprises of different specialization was carried out. The study was conducted at 137 enterprises located in the cities of Rostov region (Rostov-on-don, Novocherkassk, Taganrog), Volgograd region (Volgograd, Kotelnikovo, Volzhsky), Krasnodar region (Krasnodar, Armavir, Novorossiysk) and the Republic of Adygea (Maykop). The study involved 2,138 specialists of different specialties and different levels of management. This allows us to consider the study data representative. The study was conducted mainly in large enterprises and business groups (with more than 650 employees). The largest studied workers belonged to the enterprises of mechanical engineering (among them were included, also, metallurgical enterprises and enterprises producing metal structures) and the chemical industry (among them were included, also, enterprises producing cement and some other building materials). About half of the enterprises studied are located in small and medium-sized cities. The majority of professional personnel of these enterprises got education in technical universities of the region, which confirms our opinion that the development of the economy of the country and its human capital is directly related to the innovative development of regional technical universities.

Sector of the economy	Number of the examined enterprises	Percentage of employees who have received vocational education in:				
		Moscow and Saint-Petersburg	cities of the Southern Federal District	towns of the Southern Federal District	other regions of Russia	foreign countries
Engineering departments						
Mechanical engineering and metallurgy	10	1,3	32,4	38,3	22,3	5,7
Chemical industry and production of building materials	8	2,1	19,4	36,9	24,4	17,2
Food industry	11	0,3	18,4	38,1	12,3	7,1
Agriculture	14	0,6	12,3	58,4	15,6	13,1
Building	8	0,7	21,2	53,1	14,3	10,7
Transportation	8	0,5	21,4	56,7	12,1	9,3
Trading	10	0,6	24,2	49,3	13,6	12,3
Banks and insurance	12	1,3	37,4	32,2	21,2	7,9
Economic departments						
Mechanical engineering and metallurgy	10	0,9	25,4	31,3	18,4	
Chemical industry and production of building materials	8	1,1	26,4	30,5	19,2	22,8
Food industry	11	0,6	21,3	32,0	16,3	29,8
Agriculture	14	0,1	18,4	40,1	13,4	28
Building	8	0,4	19,3	41,2	22,3	16,8
Transportation	8	0,5	18,7	43,1	26,1	11,6
Trading	10	0,6	20,1	47,4	20,1	11,8
Banks and insurance	12	0,9	19,8	30,6	19,1	29,60,2
Managers						
Mechanical engineering and metallurgy	10	0,2	20,3	51,7	17,3	10,5
Chemical industry and production of building materials	8	0,3	21,1	45,7	21,1	11,8
Food industry	11	0,2	20,1	46,9	20,1	12,7
Agriculture	14	0,1	19,3	65,9	10,3	4,4
Building	8	0,2	20,3	51,8	17,9	9,8
Transportation	8	0,3	19,2	49,3	20,3	10,9
Trading	10	0,1	38,2	51,6	17,3	10,4
Banks and insurance	12	0,2	39,3	32,7	19,3	8,5

Figure 01. Composition and structure of employees of enterprises of the South of Russia by place of their professional education

Source: Kolbachev, Borovaya et al. (2019)

Manufacturing enterprises become aware of the quality of university graduates thanks to joint work with universities, in the framework of scientific and industrial cooperation, practical training of students and professors, and advanced training of operating personnel.

The closer the ties between the institution of higher education and industrial enterprises, the higher the level of innovative development of the university that effects positively the competitiveness of the domestic economy (Kolbachev, Perederiy et al., 2019). Moreover, the theory of erasing borders and the emergence of cosmopolis of universal civilization that will destroy all local and national differences and deprive people of their distinctive features (Elizarov, 2009) does not pass serious exams, such as the worldwide spread of COVID -19 (coronavirus), forcing countries to close their borders and turn to internal industrial and social reserves.

Today, many countries, having become disillusioned with the direction for development as a post-industrial society, are setting sights on reindustrialization. Russia that has richest natural and mineral resources, despite the noticeable damage inflicted in the 90s, traditionally continues developing industrial production. Our education, quality of which also suffered during the years of restructuring (perestroika),

managed to retain the foundations of traditional engineering education. Russian universities (primarily polytechnic) play a crucial role in solving the problem of increasing human capital assets in the country (Perederiy et al., 2019).

4. Purpose of the Study

Ways of improving the quality and competitiveness of domestic education

Considering all the above, in our opinion, the reform of national education and training of a specialist for the future should be conducted on the following scenario:

1) The priority should be given to general engineering training. A modern specialist is expected to possess a vast store of classical knowledge coupled with the current must-have skills, namely in information technology.

2) Curricula and work programs of technical specialties should be unified at least for the first two years of study. Unfortunately, today a student inside the same university, in case he wants to change his major after one academic year, is to pass 10-12 subjects additionally. The universality of initial training in technical universities will contribute to the mobility of students within the country that may be quite beneficial to the economy since the production enterprises and educational centers are dispersed throughout the vast territory. The Bologna process allows our system to integrate into the pan-European education system, increasing international mobility. However, the output for our own economy from this process is not as visible. Students-participants of international programs, when traveling, despite the financial support of the organizers, bear significant costs; therefore, not everyone can take the opportunity to study abroad. However, the introduction of international standards has led to the understanding that our educational system may be attractive to students from abroad. Export of our education is one of the ways to improve and develop it.

3) The degradation of our education is also due to the widening gap between higher education and the real economy. The ways of education and production rapprochement are formal, as a rule. To reverse the trend, it is necessary to alter the approach to the training of academic staff, the principle of ranking both universities and professors, as well as to consider production experience and cooperative developments advanced to the manufacturing.

4) The practice of employer-sponsored education in Russia proved effective both for Russian students at local plants, and for foreign trainees at foreign enterprises. Here, students get motivation and a real career path in a particular company. Meanwhile, the enterprise obtains a source of personnel educated in Russian cultural environment, who speak Russian and are ready for business with Russia.

5. Research Methods

Cognitive methods and their roles in improving the modern engineering education system.

In recent years, various ratings of higher educational institutions are becoming increasingly popular. Our universities are new to this market, just starting to learn the rules of the game and the evaluation criteria of individual universities. The ranking of universities is mainly based on educational technologies and scientometric indicators. In our opinion, the standard of domestic education should be

assessed by the level of innovations and research, which are reflected in the educational process and implemented in the manufacturing system.

As a management methodological basis for the functioning and development of a modern polytechnic university, the well-known system paradigm of Kornai-Kleiner (Kornai, 2002; Kleiner, 2002). can be applied, which successfully combines modern integration trends in economic theory with the system approach principles. The results of these works were used and interpreted in a number of research and development, carried out mainly in Russia (Kolbachev, Halas et al., 2019; Kolbachev & Kolbacheva, 2018b; Kolbachev et al., 2018; Kolbachev & Salnikova, 2019; Kolbachev, Sidorova et al., 2019). Solving the problems of university innovative development requires cognitive methods of training and managing the scientific processes, followed by the building of an artificial cognitive system. In their works, Kolbachev, Sidorova et al. (2019). study the management methods for establishing and development of production (in fact, socio-technical) systems in various manufacturing sectors. This experience suggests the possibility of applying the control system paradigm to the building of technical systems and facilities, creation of new technologies and solutions to other engineering problems in the environment of NBIC convergence.

Adaptive behavior methods (Mace & Critchfield, 2010; Staddon, 2016) can also be included in the methodological base, as well as other applied approaches, among which one can distinguish the main theory of inventive problem solving (TRIZ). The author of this theory is Altshuller (1984). His students Zlotin and Zusman (2006), Zlotin et al. (2011) continued developing his ideas.

And, of course such research methods used by the authors as survey, analysis, induction, derivation, analogy allowed to determine the decisive role of technical regional Universities in the growth of the national economy (Figure 01). And the study and application of cognitive methods in the innovative development of these higher education organizations allows to note the improvement of the quality of human capital and competitiveness of this university. An example is the South Russian State Polytechnic University, which in a short period made a jump in the rating of the independent agency Expert from 97 to 69 places (Top-100 Russian universities by Expert RA, 2017; 2018).

Apart from this, the methods of functional-cost analysis and cost-based design are also cognitive, and they are good examples of the positive impact of economic methods on the formation of technical solutions (Miles, 1989). It is worth noting that the above methods had been developed in the Soviet Union, with some of them being further supplemented and built in modern Russia. Undoubtedly, this can and must become the basis for managing the functioning and development of modern engineering education, as well as its competitive advantage in the international educational services market.

6. Findings

Despite the rapidly growing integration processes, based primarily on innovative information technologies, each state implements its own economic development program, the increasing in the country's human capital assets being a part of it.

In order to ensure successful economic growth and training of specialists for the future, who will contribute to this growth, it is necessary to use all positive and creative educational system experience of previous generations to supplement and enrich it by applying the latest methods and technologies.

The quality of the innovative and international activities of the university depends largely on the application of cognitive methods of managing innovation and development. The priority here is the Kornai system paradigm and the methods obtained by elaborating it.

Russian engineering education, technical universities, especially those located in the provinces, have a high profile in maintaining and increasing the level of human capital assets of the Russian people.

7. Conclusion

The work studies the advantages and disadvantages of the globalization in the development of national education. The role of higher engineering education in increasing the human capital of the country is considered. Ways of improving the domestic higher education and methods for the formation, management and development of the innovative system of the modern Russian polytechnic university are given.

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