


## **Métodos de análisis en los mercados regionales de educación, investigación e innovación para establecer el programa de desarrollo estratégico para las universidades**

### **Methods of the current situation analysis in the regional education, research, and innovation markets in order to establish the strategic development program for universities**

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#### **Resumen**

El artículo describe la experiencia de conformar un programa de desarrollo estratégico analizando la situación actual e identificando posibles formas de interacción entre la Universidad y la región. Al analizar los documentos de desarrollo estratégico de la Región y documentos del Ministerio de Educación y Ciencia hacia instituciones subordinadas, datos estadísticos sobre la situación en el mercado regional de educación, ciencia, innovación, el potencial de la universidad, el artículo informa sobre sus resultados. y la posibilidad de una alianza efectiva con las autoridades y las mayores corporaciones de la región y del país en la capacitación y readaptación de personal e investigación científica, considerando las tendencias de desarrollo de la región. En conclusión, la reforma de la Universidad Industrial de Tiumen es oportuna y relevante. Sin embargo, el artículo también destaca una serie de problemas relacionados tanto con el mayor desarrollo de la marca de la universidad como con la necesidad de ajustar el desarrollo a la demanda de la región para ampliar los programas de capacitación y reciclaje, desarrollar nuevas tecnologías en el negocio del petróleo y el gas, y materiales y estructuras de construcción. Los resultados permiten elaborar un programa para el desarrollo estratégico de la universidad de forma más cualitativa y profunda.

**Palabras clave:** educación regional, investigación e innovación, programa de desarrollo estratégico, mercado de la educación, mercado de la ciencia y la innovación.

#### **Abstract**

The article describes the experience of forming a strategic development program by analyzing the current situation and identifying possible forms of interaction between the University and the region. By analyzing the strategic development documents of the Region and documents of the Ministry of Education and Science towards subordinate institutions, statistical data on the situation in the regional market of education, science, innovation, the potential of the university, the article

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reports on its results and the possibility of effective partnership with the authorities and the largest corporations of the region and the country in training and retraining of personnel and scientific research, considering the development trends of the region. In conclusion, the reform of Tyumen Industrial University is timely and relevant. However, the article also highlights a number of problems related to both the further development of the university's brand and the need to adjust the development to the demand of the region to expand training and retraining programs, develop new technologies in the oil and gas business, and building materials and structures. The results allow for drawing up a program for the strategic development of the university in a more qualitative and deep way.

**Keywords:** regional education, research and innovation, strategic development program, education market, science and innovation market.

## Introduction

The project, “Flagship Universities 2016-2022”, was announced in 2015 by the Ministry of Education and Science of the Russian Federation. Competition among higher education institutions for financial support from the development programs for federal/state higher educational institutions from the federal budget in 2016 to 2018 existed. This project’s purpose was to select programs aimed to provide socio-economic development of the subjects of the Russian Federation. In 2016, Tyumen Industrial University (University) was among eleven winners. The University must implement a university development program, which is significant for industrial and socio-economic development of the Tyumen Region.

The Tyumen Region is included in the Ural Federal District (UFO) and is located in the south of Western Siberia. In terms of the area, the Tyumen Region is the largest in the Ural Federal District and ranks the third in the Russian Federation. In terms of population, at the beginning of 2015, it was in second and the ninth place, and the fourth and the 72nd in terms of population density (Official portal of Tyumen Region Authorities, 2017). A good basis for long-term investment and successful business is formed due to a favorable geographical position, natural and climatic conditions, mineral resources, land, forest, and water resources, and unique historical and cultural monuments, in addition to the well-developed engineering, telecommunication, and transport infrastructure, systems of legal and economic support, investment incentives, a highly qualified workforce, positive demographic trends, and interethnic concord (Andreeva et al., 2016; Boush, 2010; Butrin, 2014; Kolomiychenko and Rokhchin, 2003). A distinctive feature of the Tyumen Region, including the Khanty-Mansi and Yamal-Nenets Autonomous Areas, is a high prevalence of individual clusters in the regional economic structure. Most of the gross regional product (over 60%) results from oil and gas production and construction industries.

The strategic goal of the Tyumen Region development is to increase the living standard of the population by means of the innovative socially-oriented development of the Tyumen Region according to the mobilization scenario, which includes the optimal use of

natural economy, production, scientific, technical, and human resources, and competitive advantages, as well as the improvement of the spatial organization of the productive forces of the region.

The establishment of a flagship university will contribute to intellectual resources promotion in the mobilization scenario of the regional development, to a profound qualitative change of its role in the development of the global competitiveness of the region, and the improvement of the living standards of the population (Bachiev *et al.*, 2017; Malganova *et al.*, 2018).

### **Methodology**

The pool of statistical and analytical data is formed both through open sources, which are represented by the results of the Monitoring of the performance of universities, conducted by the Ministry of Education and Science of the Russian Federation in 2011-2015. (Donaldson and Preston, 1995) and information from Rosstat of the Russian Federation, and with the help of own marketing research conducted in 2015-2016. Analysis of the current situation using the above-mentioned sources of information and tools for developing the strategy of an educational institution (Figge and Schaltegger, 1999; Foss, 1999) was carried out in the markets of educational programs of higher education, programs of additional professional education and the market of science and innovation of the Tyumen region.

The current situation analysis in the regional education market included clarification of the structure of demand for basic educational programs and was carried out using quantitative and qualitative analysis of data from the standpoint of highlighting the share of the number of students of Tyumen Industrial University in the number of students in the Tyumen region in terms of areas of training. The next stage of the analysis was to clarify the structure of demand in the region for educational programs of basic and additional education and determine the status of Tyumen Industrial University as a leader in the training of engineers for leaders of key industries in the region.

An analysis of partners, competitors and an analysis of the functioning of the university in relation to regional development became necessary from the point of view of the requirements of the methodology. The analysis results are based on objective data from statistical sources, as well as target programs for the strategic development of the region.

The methodology of the “Analysis of the current situation in the regional market of science and innovations” section consisted of analyzing trends in the development of science in the field of construction and oil and gas business based on the materials of analytical reviews (Foss, 1999), questionnaires and surveys of leading scientists of Tyumen Industrial University (a total of 25 people were interviewed - doctors and candidates of

sciences in the field of construction, building materials and structures, oil and gas business, information systems) on the possibility of integrating scientific research of scientists into solving problems in the relevant production areas of the region.

### Results

The number of students at the University at the beginning of 2015 was 27,914 people, which corresponds to 45.2% of all the students of the higher education system of the Tyumen Region. The share of the higher-education teaching personnel of the flagship university in the total number of teaching staff of the universities in the Tyumen Region is 37.3%, academic specialists - 62%.

Due to its unique competencies, technical regional flagship university has occupied a special niche in the system of engineering training, covering the basic needs of the regional economy in the following areas of educational activities:

- Metallurgy, Engineering and Material Processing (100%);
- Instrumentation and Optical Engineering (100%);
- Civil Engineering and Architecture (98.3%);
- Geology, Exploration, and Development of Mineral Resources (98.1%);
- Vehicles (90.6%);
- Management and Automation Systems (84.9%);
- Electric Power and Electrical Engineering (Energy Efficiency, Energy Conservation, Nuclear Power, Electric Power and Thermal Power Engineering) (32.2%);
- Other technical areas.

The University performs the functions of an industry methodologist in the Oil and Gas Industry, Civil Engineering, and Architecture:

- 1) The publication of textbooks, learning guides, and monographs;
- 2) The development of regulatory documents of the federal, regional, and industry levels (Construction Norms and Specifications, Technical Specifications, Company Standards), technological regulations, and project design documentation;
- 3) Innovative products patenting;
- 4) The development and implementation of industrial educational programs.

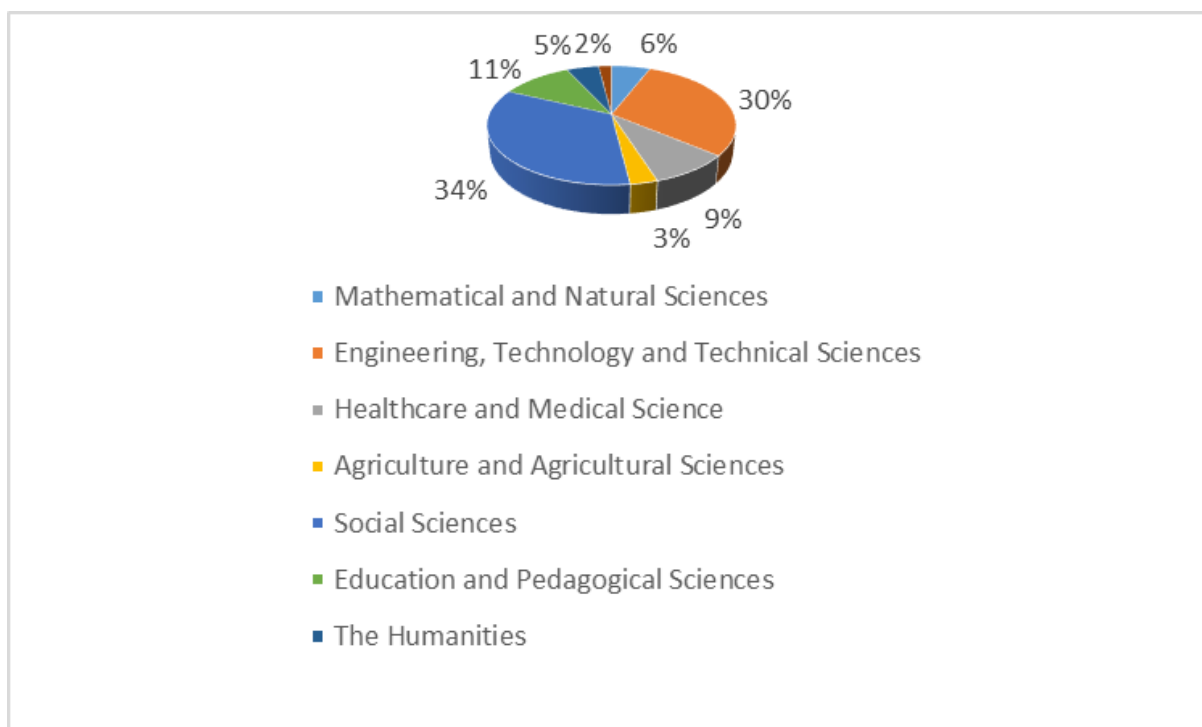
The development concepts of the region and national districts assume an active role of the flagship university in the strategic development of the territories. The University provides technical and technological solutions for the implementation of long-term targeted programs for the region development:

- 1) Strategies for socio-economic development of the Tyumen Region, Yamal-Nenets Autonomous Area (YNAA), Khanty-Mansi Autonomous Area (KMAA) - Yugra;

2) Housing construction programs for the Tyumen Region, KMAA and YNAA, development of transport infrastructure in the Tyumen region, housing and utilities complex and energy efficiency improvement, development support for the enterprises of building materials industry and industrialized housing construction; 3) Main directions of environmental protection of the Tyumen Region.

Thus, the analysis of the pattern of demand for basic educational programs showed that despite the fact that the regional vocational training system is in the stage of adaptation to the new patterns of demand in the labor market (Leshukov *et al.*, 2016), the demand for economic and legal training is high (34.4% of the total number of the students of higher education programs). Taking into account regional industry specifics, the need for training programs for engineering specialists is 30% (Figure 1.).

Despite the fact that the State seriously supports the engineering training development (50% of the total number of government-subsidized enrollment are engineering disciplines), we observe a serious discrepancy between the number of specialists employed in some industries and the number of students.



**Figure 1.** The structure of the students' population at higher educational institutions of the Tyumen Region, introducing technical training programs

In particular, 49.4% of all the specialists employed in the regional economy are involved into manufacturing, construction, mining, transport and communications, electrical power production and distribution (as of 2015). Whereas, only 36.1% of the students, who are able to work in these areas, obtain higher education. In terms of the contingent of students, the market leader, occupying the largest share of the educational

services market in higher education in the Tyumen region, is the Tyumen State University.

The share of students is 35.8% (Table 1).

**Table 1.** Structure of the students' contingent in the context of branches of science (as of Jan 01, 2016), people

Branches of science	TOTAL	Tyumen Industrial University	Tyumen State University of Architecture and Civil Engineering	State of Tyumen State University	Northern Ural Agricultural University	Trans-State University	Nizhnevartovsk State University	Surgut State University	Yugra State University
Maths and natural sciences	3,364	101	0		2,096	301	159	371	336
Engineering, technology and technical sciences	30,157	18,493	5,245		1,050	987	889	1,690	1,803
Health and medical sciences	954	0	0		0	0	0	954	0
Agriculture and agricultural sciences	2,924	0	0		100	2,824	0	0	0
Social sciences	28,843	3,671	1,660		16,091	2,114	626	2,656	2,025
Education and pedagogical sciences	8,916	0	0		6,648	0	1,817	193	258
Humanities	3,763	0	0		2,326	0	430	551	456
Arts and culture	33,179	45	0		77	0	91	118	0
<b>TOTAL</b>	<b>52,252</b>	<b>22,310</b>	<b>6,905</b>		<b>28,388</b>	<b>6,226</b>	<b>4,012</b>	<b>6,533</b>	<b>4,878</b>
Share of higher educational establishment students in the total number of students, %	-	28.2	8.7		35.8	7.9	5.1	8.2	6.2

It was revealed that the Tyumen Industrial University, which is the legal successor of Tyumen State Oil and Gas University and Tyumen State University of Architecture and Civil Engineering, is the market leader in terms of the student population, having the largest share of the education market in the sphere of higher education in the Tyumen Region, including engineering training. The share of university students is 35.8%, in the sphere of engineering training - 61.3% (as of 01.01.2016). The University provides higher education training in the sphere of Engineering and Technical Sciences for 13 Integrated Groups of Training Areas / Specialties (IGTAS) out of 17 implemented in the Tyumen Region. Market

contenders for increasing the market share are in due sequence Yugorsk State University, Surgut State University, and Nizhnevartovsk State University.

Tyumen Industrial University has no competitors in engineering training in the Tyumen Region in the following IGTAS: Photonics, Instrumentation, Optical and Biotechnical Systems and Technologies; Mechanical Engineering; Chemical Technologies. The University maintains leadership in such IGTAS as Architecture; Construction Techniques and Technologies; Industrial Ecology and Biotechnology; Materials Technology; Land Transport Techniques and Technologies; Technical Systems Management.

The industry specialization of the University determines the corporations for partnership establishment. These are the largest corporations of the Oil and Gas sector of the economy, namely: Rosneft, Gazprom, Lukoil, Transneft, as well as Tobolsk-Polymer, Tobolsk-Neftekhim, and Sibur Holding. The educational and production practice for investment projects of large construction and machine-building enterprises has been formed. According to the analysis of the interaction experience between higher education institutions and employers (Lukichev, 2005; Muller et al., 2003; Arrow, 2009; Brown, 2000), including the authors' one, the University can maintain a leadership position in the field of engineering personnel training.

The pattern of demand for programs of additional professional education (APE). The analysis of the demand for professional retraining and advanced training programs contributes to the conclusion that, nowadays, a large number of programs, which are implemented in the region, meet the needs of the market and are mostly targeted to meet the needs of the society (individuals) in short-term programs of a general education level (computer, legal literacy). The University also provides highly specialized programs in the field of Construction, Oil and Gas Engineering, Management and Economics.

Competitors. Each university in the region has its own subdivision units that implement professional programs, which are in demand in the market, including relevant programs in the field of Occupational Safety, Management, and Economics. The main competitors in the field of APE are Tyumen State University, which implements programs in Economics and Law, and Tyumen State Institute of Culture (Tyumen State Academy of Culture Arts and Social Technologies (TSACAST)), which is developing in the field of management personnel retraining. Tyumen Industrial University (TIU) is the leader in engineering programs and implements the retraining programs in the following fields: Construction, Housing, and Communal Services, Management, Economics, Psychology; Oil and Gas Field Development and Operation; Project Development, Engineering and Operations of Gas and Oil Lines and Storage Facilities; Machinery and Equipment for Oil

and Gas Fields; Chemical Technology of Organic Substances, Occupational Safety, and Ecology.

Correlation with regional development. The University fully covers the regional need for retraining, although it is necessary to take into account the estimated pattern of demand according to the analytical research data and develop courses for advanced training and retraining in the following areas: Legal Literacy; Business Courses; Financial Literacy Fundamentals; Computer Literacy Courses; Management and Marketing; Interior Design, Floristics; Sales Manager; Regional Tourism Development; Accounting; Oil and Gas Industry; Construction; Records Management, Document Flow; Healthcare Programs; Cyber technologies; Foreign Language Courses; Mechanical Engineering; Legislation in the field of Housing and Communal Services; Environmental Engineering; Ecology.

Traditionally, we face difficulties in terms of finding the information sources for analyzing the current situation in the regional research and innovation market (Donaldson and Preston, 1995; Figge and Schaltegger, 1999; Kochan and Rubinstein, 2000). Thus, the analysis in the area of “Research and Innovation” is based on the surveys and questionnaires of the leading scientists of the University:

The research and innovation market is currently being significantly influenced by new industrialization (Kleiner, 2017; Lazhentsev, 2016) and the state program of import substitution. In accordance with the plan for promoting the industrial import substitution, approved by the Decree of the Government of the Russian Federation dated to 30/09/2014 No.1936-r, the Ministry of Industry and Trade of Russia developed “Schedule of the Support for the Import Substitution in the oil and gas engineering industry of the Russian Federation”. According to the plan, in the technological area of “Drilling Equipment” the share of import in consumption is estimated to be reduced from 83% in 2014 to 60% in 2020; in the area of “Rock Destruction tools” – from 60% to 45%; in the area of “Services for Drilling, Cementing, and Workover” - from 67% to 20%.

In terms of import substitution plan in the Oil and Gas Engineering, the University implements an innovative approach to the research work commercialization basing on the principle of continuous generation of new knowledge starting from a problem setting to the developments commercialization by means of the potential of all objects and subjects of the process (Deev and Sokolov, 2016; Mityukov and Busygina, 2013).

The main industrial facilities of the innovation infrastructure of the University are the “Experimental Drilling Equipment Plant” and the Research and Design Institute Neftegazproekt, created jointly with PJSC Lukoil Oil Company. These subdivisions of the University carry out service, design and development of new technologies in drilling, construction and development of oil fields in the region. There are only four factories carrying out such developments in the Russian Federation. The competitiveness is formed



with the in-house innovative developments, technologies and modern equipment. All oil companies are the consumers of the core aspect of the Plant's work.

To solve a research and technology objective in the field of drilling, such as accounting of the hydrocarbons produced from different "horizons", a technology is being developed for manufacturing a well assembly at the point of divergence. Such as Schlumberger, Halliburton, Baker Hughes foreign companies provide these technologies, although the cost of their services is unacceptable for the majority of subsoil users. The implementation of the project for the technology development is carried out in terms of Federal Targeted Program (FTP for "Research and Development in Priority Areas of Development of the Russian Scientific and Technological Complex for 2014-2020", event 1.3.), which was Approved by the Decree of the Government of the Russian Federation. LUKOIL's subsidiary KogalymNIPIneft and a production company SOKOL (Perm) are industrial partners in the project.

The implementation of the project "Development, Design, Manufacture and Installation of a Line for Protective Coating Application" is carried out in cooperation with LLC "Production Company Sokol" according to the Resolution No.218 of the Government of the Russian Federation of April 9, 2010, i.e., "On Measures of State Support for Development of Cooperation between Russian Higher Educational Institutions and Organizations Implementing Complex Projects for Creation of High-Tech Production". Some plants in the European part of Russia and the Perm Territory introduce traditional technologies of coating application. The competitiveness of the new technology is determined by the absence of additional costs, the increase of the product wear resistance by 10-12 times, and an increase in the product (rotor) operation up to 6,000 hours.

TIU is traditionally regarded as a strong performer in the regional market of the technology's development for new building materials and structures. There is a steady demand for effective building materials and structures, which are compliant to regional conditions. The following materials and technologies were developed and implemented:

- Effective types of foundations and new types of metalwork fabrics of low material consumption for industrial and civil buildings, which are compliant to difficult engineering and geological conditions of Western Siberia, i.e., swampy territories, permafrost, weak water-saturated soils; severe natural and climatic conditions; transport infrastructure features; remoteness from the building industry bases for agglomeration and industrial areas;
- Materials, structures and technologies for the construction and operation of highways and airfields for swamp territories and permafrost zones of Western Siberia such as Yamburg, Yamal, Uvat, and Middle Ob Area;

- Materials and technologies for gas and oil producing in severe Arctic conditions; technologies for the quality of products improvement: silicate and ceramic products, finishing materials, decorative coatings (Invest-silicate-stroyservis, Ltd, Tyumen); projects for the reconstruction of the leading regional construction material factory ZHBI-5, and technologies for the implementation of energy-efficient materials, products and structures (LLC “Vinzilinsky Plant of Expanded Clay Gravel”).

### Discussion

The prerequisites for the launch of the "Development of a network of flagship universities" project was the initiative of the Ministry of Education and Science of the Russian Federation, based on a number of key problems of the regions: the outflow of talented applicants (25%) to the capital cities, the lack of research centers related to the development of the regions, the small choice of programs magistracy. According to such scientists as Arzhanova et al., (2017), the creation of a flagship university should be implemented according to a model associated with the choice of the priority of the development of the region. Other authors like Baryshnikova et al. (2019) investigated 4 models of formation of reference universities based on the analysis:

- Technology leader in the region (TLR);
- Multidisciplinary regional university (MRU);
- Industry leader (industrial university) (IL);
- University in a cross-border region (UCBR).

The models were formed taking into account the analysis of the concepts of university development, which were carried out on the request to link the university development with the regional development (regionally engaged university).

The foreign practice of creating regional higher educational establishments has led to the formation of the following development models (Baryshnikova et al., 2019). In the UK, Sweden, and Austria, four models of the regional role of the university are identified: 1) entrepreneurial university model; 2) a university included in the regional innovation system model; 3) a university operating according to the mode 2 university model; 4) engaged university model.

Based on the models studied, it can be assumed that the model of the Tyumen Industrial University was chosen as an entrepreneurial university and a technical leader in the region, created as a center of attraction for the development of the regional economy in the field of training for the oil and gas industry, construction, IT industry, and mechanical engineering.

The main problem in determining the role of a flagship university in the innovative development of the city of Tyumen and the region is the combination of the vector of development of the education sector of the Russian Federation, which today is undergoing profound institutional reforms, both in the field of management and in the field of restructuring and harmonizing the content of federal state educational standards of educational programs and the vector of development region. Undoubtedly, the university, having a high scientific potential, chooses a development strategy that is inextricably linked with the regional one.

Higher education has consistently been attuned to the problems of economic crises. Periodically, it has sustained reversals as some programs proved unpopular, and others were no longer in demand. Moreover, some specialists were regarded as too focused or narrow and others too broad. On the one hand, the decision to organize flagship universities aims to improve the universities' competences, and, consequently, the competence of their graduates.

On the other hand, the united universities have lost their unique branding (Jusuf *et al.*, 2020). As a result, some employers who were accustomed to a particular brand may express doubt about hiring graduates of a new university founded based on two well-known academic institutions. The employment pattern is being distorted. Some departments with similar specializations can be reorganized, which will lead to the loss of highly qualified personnel. Evidently, time will clear the air about the creation of a flagship university in the Tyumen Region.

### Conclusions

The analysis of the current situation in the education, research, and innovation markets in the Tyumen Region revealed the following trends: The demand for engineering training is insufficient in contrast to the emerging dynamics of growth in this field. Tyumen Industrial University is the undisputed regional leader in the field of engineering training. Its collaboration with the largest corporations in the region and the country will provide an increase in demand for engineering training and strengthen leading positions in regional higher education.

The University confidently occupies a niche in the implementation of specialized programs of APE in the sphere of Construction and Oil and Gas Engineering. Considering the growing demand and the need for regional development in other areas, it is possible to expand the subject "geography" of APE. Successful commercialization of research work in the sphere of Oil and Gas Engineering confirms the demand for this kind of work. Coupled with traditionally worthy technological developments in new building materials and structures, they open up excellent prospects for promotion in the regional market.

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