

ICEST 2020
**International Conference on Economic and Social Trends for Sustainability of
Modern Society**

**ENGINEERING BASIS OF INTERACTION OF UNIVERSITY
WITH INDUSTRY AND REGIONAL GOVERNMENT**

N. A. Knyazev (a)*, R. G. Buyankina (b), O. V. Letunova (c)

*Corresponding author

(a) Reshetnev Siberian State University of Science and Technology, Krasnoyarsk, 660037, Russian Federation,

«Krasnoyarsky Rabochiy» prospect, 31, E-mail: knyazev@sibsau.ru

(b) State Medical University named after professor V.F. Voyno-Yasenetsky, 1, partisan Zheleznyak ulitsa,

Krasnoyarsk, 660022, Russian Federation, E-mail: buyankinar@mail.ru

(c) Reshetnev Siberian State University of Science and Technology, Krasnoyarsk, 660037, Russian Federation,

«Krasnoyarsky Rabochiy» prospect, 31, E-mail: leto3105@mail.ru

Abstract

In the article there is a problem relating to the theoretical and methodological procedures for the broadcast of responsibility for the transfer, exchange and transformation of research between universities, industry companies and government agencies in the region. The exposition of this problem is relevant. Its solution helps to make clear the transparency and optimal organization of different groups of specialists. The article first draws attention to the disclosure of generalized scientific and technical parameters of a Flagship university in the aspect of its connecting partner essence. In this case, the scientific newness of our work is inextricably linked with the development of the concept of "Engineering". The methodological basis of the research tasks is concepts and theories post-non-classical stage of development of science, the principles of formation of the modern type of scientific rationality, scientists call "techno-science". The article deals with the detailed aspects of the interaction between the innovation centers of the region: the estimated capacity partners, optimizing the personal knowledge of the participants in the process of harmonious interaction between universities and industry; innovative criteria for cooperation and the application of these criteria to the social responsibility of each of the factors interacting in the project regions. The results of the research are really expanding the analytical space of empirical research, helping the Flagship university to use the latest theoretical levels of understanding of interdisciplinary and interdisciplinary realities.

2357-1330 © 2020 Published by European Publisher.

Keywords: Regional development, flagship university, engineering.



This is an Open Access article distributed under the terms of the Creative Commons Attribution-Noncommercial 4.0 Unported License, permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

1. Introduction

With the acceleration of the pace of scientific and technological progress, the links between the main innovative components of the region — university science, sectoral technological base, and power management structures — are becoming ever stronger and more complex. Without proper attention of specialists to the principle of unity between these components, it is impossible to obtain satisfactory forecasts regarding the effective return of socio-economic programs for the sustainable development of society. In the conditions of intensified economic competition, and in the conditions of the survival of regional economies, the state considered it necessary to establish “Flagships universities” in some regions of the country. Such an important management initiative obliges specialists of various levels to provide on the ground a special intellectual resource for studying the structural and functional characteristics of a supporting university in its interaction with the industry environment and the administrative apparatus of local authorities.

2. Problem Statement

In this regard, there is a problem about the theoretical and methodological clarification procedures, responsible for the transmission, exchange and transformation of research results between the university, industry businesses and administrative structures in the region. Formulation of the problem is certainly true, as the result of its decisions are assumed to conclusions about the transparency and the optimal organization of the system interaction of different groups of professionals involved in the single objective of sustainable development in the region. For the first time, we focus to the disclosure of the scientific and technical parameters of a flagship university, with the help of which its connecting essence is manifested in relation to the partner activity of each of the scientists participating in the project, in relation to the private capabilities, abilities and responsibilities of each specialist in the framework of solving the general tasks. It also follows from this that the scientific novelty of the article we presented is inextricably linked with the development of the concept of “engineering”.

3. Research Questions

The topic of the direct involvement of the flagship university in the unity of the structural elements interacting with each other (the university, the industry and the administrative structure of the region) was first considered in articles we previously published (Knyazev, 2018a; Knyazev et al., 2018b). They define such integrative features support the University as the optimization of forms of collective work of scientists, interdisciplinary relations, ways of interaction between universities and society, the authorities and business. At the same time, the entire range of cognitive and social parameters of the subject of engineering and technology activity has undergone qualitative changes, fundamentally updating the content of what is commonly called “engineering”. The modern development of partnerships in the framework of joint focused activities of the university, industry and the administrative structure of the region is a permanent task for specialists. Finally, corporate diversity of these interdisciplinary and inter-relationships is built up in particular (reference by flagship University) into innovation system. A notable point of this innovative system is that it is formed by the activity totally different from each other (on the principle of division of

labor) groups of researchers. Moreover, the search for such a creatively complex balance for a specific project is currently being implemented on an entirely new basis, different from existing forms of cooperation in the past (classical and non-classical) periods of development of science. In our opinion, this fundamentally new research situation, based on modern types of interdisciplinary integration, is very well explained by the authors of the article (Gibson et al., 2019). This article emphasizes that for all the importance for the development of national science and technology of the close interaction of innovative organizations such as a university, industry firm and regional government, their influence on the scientific activity of an individual scientist is not rarely studied in the literature. The fact is that each of the adverted innovative organizations are part of a complex system and differs from other partner organizations in the type of knowledge used, the type of organizational structures and the nature of the expected results. Therefore, the ability of each of them to maximize their contribution to the overall innovative result depends on the "clarity" of the ways of interaction, the smooth functioning of measurement systems designed to clarify the translation procedures for transferring research solutions. The authors have analyzed our article summarizing the developed target model of the interaction between the three organizations profiling. The simulation results are validated through consultations with experts. The model is illustrated by using data program Industrial Research Center of the National Science Foundation.

Another article from our review of foreign publications (Zhang et al., 2019) also notes a deficit to the study of the combined effect of the innovation system in the activities of individual members. In this article, Chinese scientists suggest that a comprehensive study of the system would fill the gap in understanding the interaction of industry research institutes with industrial enterprises and the "head" university. In that point of view, scientists have proposed the following option. The parameters of the dynamic model of bilateral and trilateral interaction of the Chinese Academy of Sciences with industries and universities are identified using the theoretical basis in the activities of the main participants in the innovation process. The results of such a study, the article argues, show that their bilateral (or trilateral) interaction not only significantly improves the scientific activities of the Chinese Academy of Sciences, but also stimulates a marked increase in investment in these studies. The scientist's assumption was also confirmed that bilateral interactions between industry research institutes and universities have a more positive and significant impact on scientific activity, both directly and indirectly, compared with bilateral interactions between research institutes and industries.

The study of detailed aspects of the interaction between the main innovation centers in the region is not less interesting, as it is combined by activities of the University. This is a study of the evaluative abilities of partners. This topic includes a wide variety of partnership characteristics that optimize the personal knowledge of participants in a coherent process of cooperation between the university and the industry. For example, the article (Lascaux, 2019) explores the elective particular partners, which are determined by the best criteria for assessing innovative results, designed for use in collaborative research projects. The lack of research of this criterion creates great methodological difficulties, in order to eliminate as much as possible of these procedures are subjective factors and secondary contradictions. In this connection, the authors analyzed articles we offer specifically to investigate the question of how industry firms and universities maintain a balance in the process of differentiation of the results of research and standards for their collection through a partnership of use. In the search for this balance, the influence of specific factors,

such as general trust, positive preliminary connections, cognitive proximity and cultural compatibility between firms and universities, is also considered. As a result of this study, theoretical and practical recommendations are formulated that optimize knowledge in the process of cooperation between universities and industry. In previously published domestic (Fetschenko et al., 2015; Kartashova et al., 2015), and foreign (Charron & Rothstein, 2016; Musaeva, 2015) articles, the issue of cooperation between universities and industry was considered in a slightly different aspect. The results of those studies were limited by the traditional framework of relations "university-industry" character. In particular, it was not adequately represented by the theoretical level of analysis of the results. In fact, the results were reduced to statements in their empirical format. In addition, the "university-industry" relationship was considered mainly without distinguishing between the statuses of a "classical university" and a "flagship university".

In publications of last years, in the aspect of the subject we are considering, fundamentally new analysis approaches have appeared. It states, first of all, that the theoretical approach confidently began to assert itself in an in-depth, differentiated analysis of the interaction between the university and industrial production. For example, Chinese scientists and engineers theoretical approach was used to determine the criteria of innovation and cooperation for the application of these criteria to the social responsibility of each of the factors interacting in the project subjects (Zhu et al., 2019). This situation has established in China with relation to the manufacturing industry. The manufacturing industry is considered the "cornerstone" of modernization of the economy and therefore is developing in the country so fast. However, the qualitative side of this development is still lagging behind quantitative indicators. The main reason for this, according to Chinese authors, is that the collective awareness of corporate social responsibility and the concept of development is inadequate. For this reason, industry experts involved in the evaluation of social responsibility factors of sustainable development of the manufacturing industry. This new document also took into account the parameters of regulation, education and supervision. In general, the document appeared aimed at to provide the Chinese manufacturing enterprises theoretical guidance to fulfill their social responsibilities, coinciding with the transformation of China's manufacturing industry into a highly developed industry. The factor of social responsibility and social capital is taken under special attention in other situations of interacting entities in the process of implementing innovative projects. This is evidenced, for example, by articles (D'Eusanio et al., 2019), (Grzegorczyk, 2019; Maxwell et al., 2019; Muscio et al., 2019).

The authors of these studies argue that organizations should be socially responsible, assessing their participation in the overall efforts to achieve competitive advantage. From this perspective, organizations should be aware of the various available methods and tools that can be used for making socially responsible decisions.

4. Purpose of the Study

The purpose of the study is to open the engineering aspect of the interaction of the reference university with its main partners for the development of the region. Under the engineering characteristics in the activities of the university, we understand its generalized scientific and technical parameters that form a coherent, system interconnection and interdependence of the three centers of sustainable development of society - the university (in this case the flagship University), industry and regional governance structures.

5. Research Methods

The methodological basis for the study of our tasks are the concepts and theories of the post-non-classical stage of the development of science, the principles of the formation of the modern type of scientific rationality, called by scientists "technoscience." Research work in this direction takes into account the following guidelines that determine the commitment of scientists to the post-non-classical values of science:

- 1) Transdisciplinarity as a higher level of integration of science, as a priority of the principle of convergence in the relationship between the individual disciplines, general scientific trends and innovative technologies;
- 2) Connection of fundamental types of research with the design and construction activities of specialists in the framework of ongoing projects. In publications of domestic scientists, for example, in the work (Chernikova & Chernikova, 2019), this landmark of "techno-science" is also called the merging of science and production, a cluster of sciences and production. The basis of ideas about the indicated direction of the development of "techno-science" is the socio-practical conditionality of knowledge.

Methodological standards and norms are supplemented by "techno-science" article theory of post-industrial society, as well as the provisions of the complex interaction of disciplinary, general scientific and socio-philosophical knowledge. Equally important for the study is the application of a systematic approach to the processing of empirical data obtained from current scientific publications.

6. Findings

In the process of studying the structural and functional characteristics of a flagship university in its interaction with the industry environment and the administrative apparatus of local authorities, our article actively used materials from foreign publications. These materials are aimed at revealing the generalized scientific and technical parameters of the reference university, with the help of which its connecting ability to understand and develop the partnership content of the scientists and specialists participating in the project was revealed. It also follows from this that the scientific novelty of the article we presented is inextricably linked with the development of the concept of "engineering". By the engineering basis in the university's activities, we understand its generalized scientific and technical parameters that form a holistic, systemic interconnection and interdependence of the three centers of sustainable development of society - the university (in our case, the flagship university), industry and regional governance structures.

The article presents a conceptual framework for describing balance sharing research results in cooperation between the flagship University, industry and government. The concept takes into account positive changes due to the influence of factors such as relative trust, preliminary constructive relationships (including cognitive), as well as cultural compatibility between company and universities.

7. Conclusion

As conclusions regarding the engineering specifics of the interdisciplinary and intersectoral unity "university-industry-regional government", we distinguish the following two generalizations.

Firstly, it is the presence of specific theoretical and practical recommendations in the presented concept that optimize scientific and technological knowledge in the process of cooperation between universities and industry. Secondly, it is the optimal correspondence between the design set of knowledge and the technological models of interaction between the flagship university, industry technologies and regional government, which organically fit this knowledge and which are in demand by modern standards of theoretical and systematic research of regional centers as innovative entities.

The results of the research obtained in the article really expand the analytical space of empirical research, helping the flagship university to use the latest theoretical levels of understanding of interdisciplinary and interdisciplinary realities.

References

- Muscio, A., Lopolito, A., & Nardone, G. (2019). Evaluating social dynamics within technology clusters: A methodological approach to assess social capital. *Land Use Policy*, 88, 104161. <https://doi.org/10.1016/j.landusepol.2019.104161>
- Lascaux, A. (2019). Absorptive Capacity, Research Output Sharing, and Research Output Capture in University-Industry Partnerships. *Scandinavian Journal of Management*, 35(3), 101045. <https://doi.org/10.1016/j.scaman.2019.03.001>
- Chernikova, I. V., & Chernikova, D. V. (2019). Metodologicheskie i strukturnye transformatsii v razvitiu sovremennoi nauki. *Vestnik Tomskogo gosudarstvennogo universiteta. Filosofiya. Soziologiya. Politologiya*, 49, 60-68. <https://doi.org/1017223/19988663X/49/7>
- Charron, N., & Rothstein, B. (2016). Does education lead to higher generalized trust? The importance of quality of government. *International Journal of Educational Development*, 50, 59–73.
- Gibson, E., Daim, T. E., & Dabic, M. (2019). Evaluating university-industry collaborative research centers. *University-Industry Research. Technological Forecasting and Social Change*, 146, 181-202. <https://doi.org/10.1016/j.techfore.2019.05.014>
- Fetschenko, V., Shadoba, E., Katkow, Y., Shchelikova, N., & Glushak, N. (2015). Management of Innovative Integrated Structures of Education, Business and Science at the Regional Level. *Procedia – Social and Behavioral Sciences*, 214, 243–251.
- Kartashova, A., Shirko, T., Khomenko, I., & Naumova, L. (2015). Educational Activity of National Research Universities as a Basis for Integration of Science, Education and Industry in Regional Research and Educational Complexes. *Procedia - Social and Behavioral Sciences*, 214, 619-627.
- Maxwell, K., Hubbell, B., & Eisenhauer, B. (2019). Institutional insights on integrating social and environmental science for solutions-driven research. *Environmental Science & Policy*, 101, 97-105. <https://doi.org/10.1016/j.envsci.2019.08.003>
- Knyazev, N. A., Buyankina, R. G., Zukov, R. A., & Piskorskaya, S. Y. (2018a). Social Paradigm of Russian Flagship Universities. *European Proceedings of Social and Behavioural Sciences*, 50, 592-600. <https://doi.org/10.15405/epsbs.2018.12.72>
- Knyazev, N. A., Buyankina, R. G., & Savelyeva, M. V. (2018b). Functions Of Flagship University In Regional Development. *European Proceedings of Social and Behavioural Sciences*, 35, 568-573. <https://doi.org/10.15405/epsbs.2018.02.66>
- Grzegorezyk, M. (2019). The role of culture-moderated social capital in technology transfer – insights from Asia and America. *Technological Forecasting and Social Change*, 143, 1-356. <https://doi.org/10.1016/j.techfore.2019.01.021>
- D'Eusanio, M., Zamagni, A., & Petti, L. (2019). Social sustainability and supply chain management: Methods and tools. *Journal of Cleaner Production*, 235, 178-189. <https://doi.org/10.1016/j.jclepro.2019.06.323>
- Musaeva, K. (2015). Research Organizations and Business: Interaction Barriers in the Context of Innovative Development Original Research Procedia. *Social and Behavioral Sciences*, 214, 201-211.

<https://doi.org/10.15405/epsbs.2020.10.03.3>

Corresponding Author: N. A. Knyazev

Selection and peer-review under responsibility of the Organizing Committee of the conference

eISSN: 2357-1330

Zhang, Y., Chen, K., & Fu, K. (2019). Scientific effects of Triple Helix interactions among research institutes, industries and universities. *Technovation*, 86-87, 33-47.
<https://doi.org/10.1016/j.technovation.2019.05.003>

Zhu, Y., Guo, J., & Wei, M. (2019). Construction of Social Responsibility Engineering System for Manufacturing Enterprise. *Procedia Manufacturing*, 30, 151-158.
<https://doi.org/10.1016/j.promfg.2019.02.022>