

Implementation Conditions for Project-Based Training as an Integrated Teaching Strategy in Higher Education

Nikitenko E.V.

International Relations and Region Studies Department
Novosibirsk State Technical University
Novosibirsk, Russia
e.nikitenko@corp.nstu.ru

Savina T.V.

International Relations and Region Studies Department
Novosibirsk State Technical University
Novosibirsk, Russia
tsavina2005@mail.ru

Abstract—The article determines the necessary conditions for the implementation of project-based training in the process of modernization of higher education. Today, higher education, as well as science, is socially oriented; therefore, it must meet the needs of the socio-economic development of the state. In this regard, higher school intends to actualize the “third mission”, where a university is not only a center of educational and research practices, but also assumes responsibility for the process of commercialization of the developed technologies. Therefore, a university combines the following functions: introduction of new teaching technologies and methods, modification of the content of educational programs in such a way as to introduce the latest achievements of science in the content of educational process; knowledge generation; commercialization of research projects. Project-based training, as an activity, contributes to fulfilment of the tasks that universities face in the framework of the “third mission”, as well as to structural-functional and institutional transformations of the higher school system. However, in order to develop the knowledge economy, it is necessary to join the state, universities, business, financial support for the innovation activities of universities, and build a special infrastructure for developing and introducing new technologies. There are problems in implementation of project-based training due to low motivation of stakeholders, isolation of research practices of university and large companies, the lack of structural changes in the institutional framework of higher education system, and inconsistency of the existing financial arrangements with new types of educational activities.

Keywords—*project-based training, conditions for implementation of project-based training, entrepreneurial university, university 3.0., university “third mission”*

I. INTRODUCTION

The competitiveness of the national economy today is largely reasoned by the need to increase the innovative potential of the country. It is important to understand that commercialization of innovations is the final stage of the innovation driven economic development. In a dynamically changing world, it is necessary to build conditions for training qualified personnel for ‘digital economy’ and other spheres of social life in knowledge economy.

Educational environment, which must meet the needs of society and the trends of economic growth, determines the value of human capital and its qualitative reproduction. In Russia, as well in the other countries, state, universities and business are becoming stakeholders in this process, so their activities should be coordinated and have mutual interests.

Project-based training as an educational strategy helps to bridge the gap between university education and the requirements of practical activities. However, the development of project-based training requires a structural, functional, and institutional restructuring of the higher education system, as well as changes in the content of educational programs.

Thus, the government scheme “Universities as Centers for Building Innovation Space” (2016) intends to build university centers of innovative, technological and social development of the regions of the Russian Federation. The Centers are regarded as the basis for project-oriented educational programs in Engineering, Medicine, Social Studies, Economics, Pedagogy and some programs in Science and Humanities [1].

In order to achieve these goals, it is important to build ready-to-work engineering centers, business incubators, small innovative enterprises. Technology parks, industrial sites, regional research centers should be willing to cooperate. However, some questions arise: do domestic companies that are involved in research projects meet the requirements of an innovation economy? Do companies only provide their industrial sites or are they ready to make additional investments to achieve the objectives of a project? Are companies interested in adjusting their research to university research initiatives?

It is necessary to take into account that innovative production is a sphere of risk capital, not only resources-requiring but also time-consuming. Taking risks when initiating projects with the uncertain results is one of the conditions for innovation. On the one hand, project-based training at a higher education institution intends to generate a real innovative product, which, however, does not always have marketing success. On the other hand, such a product presents only a model of real research practices. Thereby, it is extremely difficult to rely on project-based training as a key tool in

building an innovative economy, especially when introduction of project-based training becomes prescriptive.

Regional orientation of university and its impact on a region's economy largely depends on the regional economic infrastructure and the interests of production actors, as well as on the general state of the socio-economic development of the region. University has to focus exclusively on the needs of the market, while industrial companies are practically not interested in partnership cooperation, since they have already occupied the research niches of the market. Cooperation between universities and enterprises is possible, but now it happens only in particular cases, but not as the widespread practice.

This article identifies the features and conditions for the development of project-based training in higher education. The authors use the term 'implementation conditions for project-based training introduction to higher education' to describe the minimum set of factors that are sufficient for project-based training. The introduction of project-based training practices requires intra-organizational changes in higher education as a key stakeholder in development of the knowledge economy. Besides, it is due to the peculiarities of the social policy of the state, the regional specifics of innovative economic growth, the demand for highly qualified personnel in business communities, and the entrepreneurial culture of the population in the country and the region.

The structural-functional and institutional approaches are the methodological basis for the development of project-based training. Modernization of any sphere implies preliminary structural and functional, as well as institutional changes that must be implemented to all participants of any social institution modernization process. From a regulatory and legal point of view, the state has the right to define requirements for universities through institutional influence. In fact, the ideas of project-based training address the authorities need to ensure the convergence of key stakeholders: both educational organizations and businesses.

II. RESULTS AND DISCUSSIONS

The Buck Institute for Education, a world methodological educational center for project-based training, developed the Gold Standard PBL (Standard for Project-Based Learning). In Gold Standard PLB, projects focus on challenging problem or question, sustained inquiry, authenticity, reflection, peer review, and revision of research results when necessary as well as creating a social product [2]. Foreign experts emphasize that project-based training should involve real-world context interests and issues [3, 4].

The educational strategy is integrated because it involves searching for information from different areas of knowledge for successful project implementation, which means that project-based activity contributes to not only raising cognition skills or meta-subject connections, but also developing professional competencies that meet the needs of professional environment.

Thus, the focus of the learning process is changing. There is a shift from the traditional pattern of teaching: a teacher stops being just a knowledge translator - he becomes a facilitator of the educational process by building conditions for successful communication of participants in project activities. The main

functions of a teacher / university teacher are to set a problem, design project stages and set the time limits for doing a project, and then coordinate students' activities in reaching the goals. A teacher / university teacher does not determine the content of any project, but rather direct participants to the research process when making a project.

Project-based training is able to build conditions for generation and commercialization of knowledge, but under certain conditions: cooperation of stakeholders (state, university, business). For example, at Stanford University, project-based training takes place through the Department of Civil and Environmental Engineering Laboratory, founded in 1993. The task of the Laboratory is to attract post-graduate students, students, teachers, practitioners to interdisciplinary, joint projects. In developing projects, the Laboratory relies on partnerships with other universities in the USA, Europe and Asia, business representatives, including well-known companies, such as Nokia, Microsoft, Intel, etc. It also benefits from support of state authorities [5].

Undoubtedly, Stanford University, as one of the leading universities in the USA and the world, possesses the necessary infrastructure for developing innovative projects. However, at the same time, the experience of this university makes it possible to identify the appropriate conditions for learning through project activities as an effective educational strategy. Foreign experience shows that the effectiveness of project-based training depends on students' motivation, a focus on a real product of commercial value, and support from both state and private companies.

In Russia, project-based training comes to educational process as a tool for developing university investment projects in order to facilitate collaboration between university and business in the context of the modernization of higher education system. Modernization of higher education, according to the concepts of B. Clark and J. Wissema, changes the institutional design of modern university, since educational activities should focus on meeting the needs of society [6, 7]. According to B. Clark, the objectives of an entrepreneurial university include: generation and commercialization of new knowledge; diversification of sources of financing; change and development of an environment that supports entrepreneurial initiatives; development of a strategy to meet business needs. The process of developing an entrepreneurial university is endless because external challenges are changing, which means that university must evolve in accordance with rapidly changing requirements and have an organizationally flexible structure [6, p. 22].

The activities of modern university should focus on meeting the needs of society. In this case, it is involved in the system of relations between state, business, science, and becomes one of the elements of the cluster model of development. However, as J. Wissema emphasizes, University 3.0. should become the core of regional development, the backbone element of modern economic growth. University not only creates a new product and seeks to commercialize it, but also generates new industries in state's economy. University becomes a platform for startups, where the intellectual (research) potential of university and the research achievements of the country's industry collaborate and

gain the value [7, p.26]. All these points indicate the need to revise the institutional framework of university. In this case, university is involved in the system of relations between state, businesses, science, and becomes one of the elements of the cluster model of development.

It is believed that Russian universities restructuring, which includes a fundamental change in organizational culture (for example, willingness to take financial risks, or contribute to charity) should occur not only in Russian universities, but also in the business community itself. Businesses, however, are not yet ready to share financial burden of introducing innovations into a market economy with university and do not have a tendency to participate in setting up endowments.

In addition, other stakeholders, while making requirements for university and relying on university's research capabilities, however, do not demonstrate willingness to meet the criteria for innovative development, since research practices are mostly isolated from each other.

As for state administration of universities, bureaucratic dominance in regulation and unjustified scale of control over universities do not contribute to the development of horizontal links between universities and the business community, and shaping an entrepreneurial culture.

The requirements for transformation of higher education institutions into entrepreneurial universities (or universities 3.0) should be diversified and take into account the characteristics of different types of higher education institutions, their location and availability of the necessary infrastructure. Today in Russia there are universities with different levels of autonomy, and, accordingly, budget-legal mechanisms. These are federal universities joining the leading scientific and methodological centers, ensuring the integration of science, education and production, national research universities acting as research centers in their fields, academies, institutes, and also higher educational institutions — budget organizations. For example, Federal Universities have a special legal status regarding academic independence, as well as a special budgetary legal status as recipients of the government subsidies. One of the advantages of Federal Universities over other universities as budgetary organizations is the advantages of Civil Law forms of control over the activities of Federal Universities [8, p. 163]. It is essential for university to have real academic freedom, not only a formal institutional autonomy.

At the same time, while the availability of conditions provides more flexibility for the introduction of project-based training, however, they do not act as a criterion of success in developing project-based training at a university in order to promote the convergence of stakeholders in the development of an innovative economy.

Therefore, referring to the World University Rankings (QS), the authors see that 2 out of 10 Federal Universities entered Top 500 Universities in the world in 2018. However, there is positive dynamics in the development of these universities, shown in the Rating data. For example, the Kazan Federal University rose in the Rating from 450th place in 2017 to 441st place in 2018; the Ural Federal University according to the data of 2018 takes 491th place (it was 500 place in 2017) [9]. Two

research universities entered Top 300 QS Rankings in 2018: Bauman Moscow State University (291) and Novosibirsk State University (250).

Research Universities have to provide the economy with highly qualified researchers, as well as to combine educational activities with research, giving priority to the latter. Thus, illustrating the American experience of developing Research Universities, I.G. Salimyanov notes that most Research Universities in the United States are funded by the private sector [10, p. 16]. According to T. O'Connor, the vice-rector for Education of the National Research Technological University "MISIS", the largest international companies make investments in promising universities in order to get qualified and in-demand specialists in the future [11].

In Russia, a university that has Research University status receives state financial support for the development of innovative projects. There is also an opportunity to improve the innovation infrastructure, thereby building conditions for large-scale implementation of project-based training in the educational process of a university. However, the government financial support is temporary, serving as a starting capital rather than a long-term financial foundation. In this regard, there is an urgent need to attract private business as a key investor in the innovative activities of a university.

Financial support for other institutions of higher education depends on regional coefficients and generally accepted bonuses. Here, the opportunities of universities are undoubtedly limited. Financial support is a key factor that increases the interest of all subjects of educational activities in implementation of project-based training. It is prerequisite to develop up-to-date infrastructure in university and to incorporate project-based training into educational strategy.

An important condition in the implementation of project training, regardless of the direction of activity, is the creation of an innovative infrastructure of the university. Innovative infrastructure implies the provision of multilateral financial, industrial and technological, organizational, managerial, consulting support to an educational institution.

An important condition in development of project-based training, regardless a field of an activity, is the creation of an innovative infrastructure of the university. Innovative infrastructure implies the provision of multilateral financial, industrial and technological, organizational, managerial, consulting support to an educational institution. This support should be systemic. It should be determined by the requirements for higher educational institutions to build science centers, major methodological centers, active participation of all subjects of the educational process in applied and basic research, cooperation between science and business, education and science, and training of highly qualified specialists. To fulfil these tasks it requires the expansion of administrative staff of university.

In the context of higher education modernization, consistency principle is violated in educational institutions as budgetary organizations, which are the majority in the country. The innovation infrastructure has only organizational form, which implies a high involvement of teachers and students in

fundamental and applied research, generation of new ideas, and training a high-skilled researcher. It is mainly based on the own initiative of faculty staff.

Nevertheless, organizational consistency of university is not the only important aspect that matters for innovative development. It is also about access to financial sources, information resources, up-to-date equipment and other resources necessary for successful innovation. It is obviously that the infrastructure of university is a condition for its competitiveness in implementation of the “third mission” of a new generation university.

Project-based training is aimed not only at setting up investment projects, but also at development of professional competencies that meet the requirements of employers. In this regard, the principle of interdisciplinarity becomes the basis for project-based training implementation. Within the framework of the new “mission”, university needs to overcome disciplinary locality in teaching and research, and strive for interdisciplinarity.

However, there is an epistemological problem of interdisciplinary research, which requires a polytheoretical description. According to I.T. Kasavin, this problem cannot be solved. In interdisciplinary research, one of the disciplines from time to time assumes a creative, normative, or communication function [12, 13, p.13].

From an institutional point of view, interdisciplinarity is both a means of increasing investment attractiveness of a project and a tool of creating a professional environment. Project-based training uses the principle of interdisciplinarity in order to model real professional activities, gain practical experience in various fields, and develop competencies in project management, engineering and communication. Thus, according to the Ministry of Science and Higher Education (formerly the Ministry of Education and Science of the Russian Federation), Flagship Universities, which are currently carrying out 136 strategic projects in various fields and, simultaneously, solving the problem of improving the personnel, scientific, technical, innovation and production support for modernization of different branches of the regional economy [14].

The effectiveness of development of project-based training depends on a structural and organizational change of university that includes improvement of the system of financing and resource allocation, as well as the organizational and methodological provisions of the procedure for calculating teaching load of the teaching staff.

Teaching load of teachers includes contact hours of a teacher with students in various types of educational activities [15]. Contact hours, determined by educational activities of higher education institutions, today have such forms as lectures, seminars, workshops, laboratory works, course design, group and individual consultations, continuous and final assessment [16, p.18].

Traditional types of educational activities can use project-based training as a method of teaching students, but they cannot replace project-based training, since these are activities of different modality. In this regard, there is a need to include project-based training in university curricula as an

independent form of contact work at university. Moreover, the organizational and legal units of university allow reviewing the types of academic workload of teaching staff. The authors believe that a number of reasons determine this need, since the project-based activity includes several stages.

The preparatory stage implies searching for a relevant project topic, setting goals and developing specific tasks for project participants, searching for businesses that are ready not only to accept students, but also interested in the results of the research.

The main stage implies the actual work on the goal and objectives of the project.

The final stage involves the presentation of the project and an assessment of the results of project activities. Undoubtedly, this is a labor-consuming type of activity that requires accounting of working hours. Accordingly, it should be included in the norms for calculating workload of teaching staff.

However, the problem of introducing project-based training depends on not only the willingness of university administration to change the structure of teaching staff workload, but also, more importantly, to improve the qualifications of faculty staff in mastering the project-based activities. It is about the willingness of university teachers to work in the stream of project-based training. It requires searching for requests from employers, forecasting the relevant ideas and technologies of the future, concentrating internal resources for project management and / or project teams. This problem is especially acute for non-central universities.

III. CONCLUSION

In Russia, university still has a fiduciary structure, preserving institutional identity. New challenges of building a knowledge economy and involving universities in this process on a partnership basis require changing this identity. University stops being a community of scientists in the most general way - it becomes a tool for achieving national economy goals. At the same time, it should skillfully integrate into competitive markets that require a review of the regulatory and controlling functions of state to weaken them regarding the educational process.

The majority of Russian universities today are capable of performing only two main functions: to provide the regional and interregional market with qualified professionals and to have opportunities for research cooperation.

In fact, the practice of project-based training makes it possible not only to expand educational technologies in the training of qualified human resources, but also, more importantly, to use the benefits of this practice in capitalization of the internal resources of institutions of higher education. The social and economic effect of project-based training as an activity of investment value is that a university becomes a center for regional development and attracts business communities.

However, university at this stage has only one tool for introducing the practice of project-based training – the possibility to change the procedure for calculating the teaching load of teaching staff. As for other potential tools, it is not possible to achieve the desired result because of the lack of partner enterprises that are ready and able to support financially the research process. Besides, a vital point is research cooperation, demand for new products in the private and public sector, subsidiary support from state, a certain level of autonomy.

In the case when project-based training becomes a tool for development of university's innovation activity and further cooperation with the private sector, the role of state is, firstly, to fund educational institutions in the transition period to a new institutional identity. Secondly, state should develop approaches and tools for stakeholders' adaptation to the innovation system, the consistency of its application with stakeholders of this process. Third, state should regulate implementation of project-based training, but not prescribe.

Thus, the development of the concepts of project-based training takes place in the context of external challenges, the need to generate innovative ideas and technologies. Innovative breakthroughs are possible in the context of intersectorial cooperation, when state and non-state institutions share the values of innovative economy. In addition, the development of innovative economy is impossible without the transformation of various social institutions and changes in their goal-setting strategy. Educational institutions are not an exception, because they build the conditions for the development of new educational practices, create new networking system as a way of obtaining benefits, educate new type of professionals. They provide a necessary resource for creating innovations and their commercialization. The one thing which is needed is institutional differentiation, expansion of ways of partnership and cooperation within universities.

References

[1] The priority project passport "Universities as Centers for Building Innovation Space." Retrieved from: <http://static.government.ru/media/files/OnTUmegFLNj5Uqtac57y1WG1EtMG9ABe.pdf>

[2] Gold Standard PBL: Essential project design elements. Retrieved from: <https://www.pblworks.org>

[3] St. Bell, "Project-Based Learning for the 21st Century: Skills for the Future," *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, vol. 83 (2), pp. 39-43, 2010.

[4] N. Harmer, "Project-based learning. Literature review," Retrieved from: https://www.plymouth.ac.uk/uploads/production/document/path/2/2733/Literature_review_Project-based_learning.pdf

[5] PBL Lab. Retrieved from: <http://pbl.stanford.edu/>

[6] B. Clark, "The Entrepreneurial University: New Foundations for Collegiality, Autonomy, and Achievement," *Higher Education Management*, vol. 13, No. 2, pp. 9-25, 2011. Retrieved from: <http://www.oecd.org/education/imhe/37446098.pdf>

[7] J.G. Wissema, "Towards the Third Generation University Managing the University in Transition," Cheltenham, UK Northampton, MA, USA, 2009.

[8] O.A. Cheparina, "The Legal Status of the Federal University: the Ratio of Civil and Public Regulation," *Bulletin of Economics, Law and Sociology*, No. 4, pp. 162-165, 2013.

[9] World University Rankings (QS). Retrieved from: <https://www.topuniversities.com/university-rankings/world-university-rankings/2018>

[10] I.G. Salimyanov, "The Role of Research Universities in the Development of the National Innovation System," *Society. Environment. Development (Terra Humana)*, pp. 15-19, 2011.

[11] T. O'Connor, "Russian Higher Education: Comparison with the USA," *Pro et contra*, No. 3, 2010. Retrieved from: <http://polit.ru/article/2010/10/27/education/>

[12] I.T. Kasavin, "Interdisciplinary Research in the Context of Reflection and Habitus," *Interdisciplinary in the Sciences and Philosophy*, pp. 15-35, 2010.

[13] I.T. Kasavin, "Introduction," *Interdisciplinary in Sciences and Philosophy*, pp. 3-14, 2010.

[14] "Strategic Projects of Flagship Universities," *Proceedings of the International Forum "Flagship Universities - Drivers of Regional Development"*, December 13-14, 2017. Retrieved from: <http://flagshipuniversity.ntf.ru/events/1362>

[15] Order of the Ministry of education and science of Russian Federation of December 22, 2014, No. 1601 "On working hours (standard hours of pedagogical work for the salary) of pedagogical staff and on teaching load of pedagogical staff stipulated in an employment contract," Retrieved from: <http://rg.ru/2015/03/11/chasy-dok.html>

[16] "The Procedure of Organization and Implementation of Educational Activities in Educational Programs of Higher Education - Undergraduate Programs, Specialty Programs, Graduate Programs of December 19, 2013, No. 1367." Retrieved from: <https://minjust.consultant.ru/documents/9084?items=1&page=2>