

23rd CIRP Conference on Life Cycle Engineering

## Higher Education for Sustainable Development: Challenges in Russia

Alina R. Kankovskaya\*

*Peter the Great St. Petersburg Polytechnic University, Polytechnicheskaya, 29, St. Petersburg 195251, Russian Federation*

\* Corresponding author. Tel.: +7-812-545-4248; fax: +7-812- 545-4248. E-mail address: [kankowska\\_alina@mail.ru](mailto:kankowska_alina@mail.ru)

### Abstract

Sustainable development must be the basis for the development of a national innovation system in the transition to a knowledge economy. The article analyses the spread of the concept of sustainable development in Russian higher education as a subsystem of the national innovation system. We have analysed state educational standards and educational programmes of universities and identified problems in the implementation of the concept of sustainable development in Russian higher education, and formulated principles for the national innovation system based on the concept of sustainability.

© 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the scientific committee of the 23rd CIRP Conference on Life Cycle Engineering

**Keywords:** Higher education; sustainable development; national system of innovation (NSI)

### 1. Introduction

Sustainable development is the only possible basis for the progress of the national economy in the context of the deepening of global human problems. It is necessary to discuss and to create a system of principles that implement the concept of sustainable development in all sectors of the economy. Primarily it is essential in the sphere of education, knowledge and innovations, because the development of a national innovation system (or national system of innovation) plays a key role in the transition to a knowledge economy.

Sustainable development has a number of definitions, but the most frequently quoted definition is from *Our Common Future*, also known as the Brundtland Report [1].

In our opinion, this definition quite clearly describes the purpose and objectives of education for sustainable development. The need for activity in the field of environmental education was recognized a long time ago, but “education for sustainable development” is a broader concept. The main objectives of it were formulated in Resolution 57/254 of the General Assembly of the United Nations (2002) [2], which established that education is an indispensable element for achieving sustainable development and

proclaimed the ten-year period from 1st January 2005 to be the United Nations Decade of Education for Sustainable Development.

Russia takes an active part in the regional Strategy on Education for Sustainable Development. On the one hand, Russia is rich in natural resources. On the other hand, there are many plants causing irreparable damage to the environment. So the problem of education for sustainable development has a special importance for Russia.

The history of education for sustainable development in Russia is discussed in detail by Pavlova [3] and Zhevlakova [4]. We agree with them on key problems:

- The role of the government is extremely small.
- The narrow approach – programmes of environmental education, the teaching of natural sciences and different activities in the field of ecology are called “education for sustainable development”.
- A lot of educational projects of all sizes have been realized in Russia, but they have had a local character, used small resources and therefore could not give a systemic effect.

Crotty and Hall [5] note the importance of school education and workplace training, and the necessity of informal routes for persons who have graduated from the school system, such as through non-governmental organizations. In our opinion, these organizations cannot be the backbone in education for sustainable development in Russia, because the Russian social model needs strong government backing.

Thus the goal of the paper is to identify problems in the implementation of the concept of sustainable development in Russian higher education and to formulate principles of the national innovation system based on the concept of sustainability, because higher education is one of the main subsystems in the NSI.

The following tasks are to be done to achieve the goal:

- to examine existing federal state educational standards from the position of the concept of sustainability;
- to analyse programmes of higher education in terms of sustainable development;
- to formulate proposals for the development of higher education as an NSI subsystem based on the concept of sustainability.

## 2. Overview of Russian national educational standards and educational programmes: data and results

Analysis of higher education in terms of sustainable development in Russia needs the following data sources.

In the Russian Federation, the first level of the system of state regulation of education is the Federal Law on Education in Russian Federation (the newest version—No. 273-FZ—was adopted on 29th December 2012 and came into force on 1st September 2013)[6].

The second level is the system of Federal State Educational Standards, which sets out requirements for learning outcomes in education, including areas of professional activity, objects and types of professional activity and development of competences [7].

The third level is the universities' level, so it is necessary to examine universities' sites and various educational sites to identify admission quotas and the content of educational programmes.

Our analysis of the system of Federal State Educational Standards shows a very narrow approach to the understanding of sustainable development.

The competence model in Federal State Educational Standards includes three types of competence: general cultural, general professional and professional (instrumental). Curricula and content of courses are defined by this set of competences. So if any standard contains a competence, it will certainly be implemented in the learning process. If the standard does not include the competence, we can hope only for the professional standard and teacher with a global perspective. However, the concept of sustainable development is little known in Russian society, as confirmed by Salimova et al.'s research [8]. Understanding of the idea of sustainable development is at a very low level.

The main part of higher education (except medicine) includes 54 groups of educational programmes in eight areas. The total number of educational programs is 179.

We can find sustainable development as an area of professional activity only in four educational programmes: Ecology and Nature Management, Geography, Cartography and Geoinformatics (a group earth science), and Landscape Architecture.

In the next step, we investigated admission quotas to universities. When data were not available for a programme on the university website, we used the averaged data of various educational sites (Table 1). The number of budget places is an important characteristic of Russian higher education, because it shows the government's educational and professional politics.

Table 1. Education in the sphere of sustainable development in Russia.

Educational programmes (Bachelor degree)	Universities	Budget places
Ecology and Nature Management	128	1245
Geography	58	915
Cartography and Geoinformatics	16	397
Landscape Architecture	24	678

An analysis of the list of universities which realize these educational programmes has shown that:

- Predominantly classical universities have Geography and Cartography and Geoinformatics programmes.
- Ecology and Nature Management is realized mainly in biological and geographical faculties. Efforts to implement this educational programme in the economical universities are not supported by the government.
- Landscape Architecture is realized in agricultural and forest technical universities.

Thus, we see a very narrow approach to education on sustainable development at bachelor's level.

At Master's level, these four educational programmes are continued by most universities. In addition, several universities in Moscow and St. Petersburg implement programmes for sustainable management, but in most cases these programmes are double degree programmes with foreign universities, expensive and not very popular. Individual graduates cannot form a new approach to sustainable development.

The leading Russian universities have the right to develop their own educational standards, but this does not bring about a fundamental change in the overall picture. For example, the Moscow State University has an Ecology and Natural Resources programme for the integrated Master's (in fact, it is one unified six-year programme, Bachelor + Master's). Educational standards at the Peter the Great St. Petersburg Polytechnic University are aimed primarily at enhancing professional competence, not at interdisciplinary links.

So, education for sustainable development is concentrated only in a few educational programmes in the field of earth sciences. The National Strategy on Education for Sustainable Development in the Russian Federation [9] declares the aims

and objectives but has no connection with the educational system.

### 3. Challenges in Russia

#### 3.1. Higher education and national system of innovation

The problem of sustainable development is closely related to the development of the national system of innovation.

The national innovative system of the country consists of three main components: the research and development sector, the business sector and the education sector, being the system of higher and postgraduate education. The link between these components that determines the national model of the NSI in Russia is a very knotty problem at the federal and regional levels in consequence of the revolutionary transformation of the economic system in the 1990s. Now the national economy consists of many elements with conflicting interests, and this conflict is particularly acute in different phases of the economic cycle. At the same time, these actors do not include sustainable development in their system of principles and strategies.

Research [10-12] shows the most important problems of Russia's national innovation system and its weaknesses:

- The lack of economic incentives.
- Decision-makers are aiming at innovation (or indicators of innovation) instead of providing fertile ground for innovation.
- The development of an innovation environment is seen as a bureaucratic idea.
- Weak connections between elements of NSI.
- Underdeveloped market of innovation intermediaries.

In these circumstances it becomes necessary to form and develop an innovative system in Russia and to increase its effectiveness. In the 1990s, the Russian innovation system experienced a strong influence of destructive processes of different natures, especially socio-political and socio-economic. In Russia now we can see some elements of the innovation system with the destruction of functional relations between them. Consequently, the formation of the innovation system prioritizes economic growth, which means consolidating disparate elements together to determine the strategic goal of the NSI.

At present, the institutions of the NSI and the state innovation policy ignore the existence of obsolete technologies and industries, as they are focused on finding and developing innovations in breakthrough industries. Quantitative indicators for them are more important than long-term socio-economic efficiency.

Therefore, urgent tasks of the national system of innovation and its sectoral subsystems are the transfer of production to a qualitatively new level and the transition to a knowledge economy and sustainable development. Thus, as substantiated in detail in [11], a partnership between business, government and universities on the basis of the triple helix, accompanied by the combination and interpenetration of their competences,

appears. This facilitates an innovative breakthrough and provides stable sectoral and national competitiveness.

The higher education system is a key element of the national system of innovation. The uniqueness of the higher education system lies in its ability to participate in all the subsystems of the NSI, realizing one or more of its functions within the NSI: education, research, innovation and stimulation. Research organizations, innovative enterprises and innovation infrastructure, which are also elements of the NSI, are usually only responsible for one of the stages of the innovation process—research, commercialization of research results, mass production of innovative products. Universities are involved in the implementation of all phases of the innovation cycle, from preparation of highly qualified personnel to commercialization of research results. Since the functions implemented by the higher education system in the NSI are closely interlinked, development of the higher education system on the basis of the concept of sustainable development should occur in all four functional areas and lead to a multiplier effect.

The transition to higher education for sustainable development will not require significant financial resources (as opposed to pre-school and school education), because, first of all, it needs to use the existing organizational resources:

- Inclusion of principles of sustainable development in the main part of educational programmes as general cultural or general professional competences.
- Inter-disciplinary approach and connection of economic, human and engineering disciplines in educational programmes.
- Inter-faculty integration in the realization of teaching plans and educational programmes.

Thereby students of the existent project and research initiatives will have a much higher level of development and awareness in their future careers.

#### 3.2. Sustainable development in the system of NSI principles

The principle of sustainable development should be implemented into the system of principles of functioning and development of the national system of innovation. We agree with Hargroves and Smith [13] that sustainable development is a fundamentally different approach to the development of NSI, proposing to arrange the principle of sustainable development above the set of national principles of functioning of the NSI.

This set varies considerably from country to country and in the same country at different stages of economic development. For Russia now it includes:

1. The principle of national security. The processes of globalization and the weakening of control over research activities on the part of the government are accompanied by an increasing influence by other countries and multinational corporations. This kind of influence can have a negative impact on the national socio-economic development and, consequently, on the innovation system. The lack of effective mechanisms to control the transfer of scientific and

technological developments in Russian practice leads to the loss of many breakthrough projects. Systematic government activity on the orientation of scientific potential for the benefit of society is therefore necessary.

2. The principle of consistency of the priorities of different levels. The multilevel nature of the NSI on the one hand, and the social and economic priorities of the country on the other, determine the need for hierarchical prioritization of the NIS.

3. The principle of the elimination of bottlenecks. Deficiency of any resource on a micro or a macro level leads to losses and inefficient use of the existing scientific, technological and productive capacity. As a Russian, it takes on special significance for a transformed NSI. Therefore, the government needs to take measures to identify, analyze, identify priorities, develop and implement programmes and, as a consequence, to eliminate bottlenecks. In the context of sustainable development, this means using indicators of long-term socio-economic efficiency and determining sustainability as a goal.

4. The principle of a level of technological innovation in compliance with a level of technological cycle. In some cases, the formulation of priorities of innovation development and industrial policy is reflected in the government's support of certain industries. However, the sectoral approach is less effective than a project approach: funds should be allocated not to industry but to the enterprises and project organizations of scientific and production chains. In this case, inclusion of the concept of sustainable development in higher education will give a positive multiplier effect, since it will bring together the priorities of the government and members of the chain.

5. The principle of international scientific and technical cooperation. For each country it is necessary to participate in projects which are important in terms of co-evolution.

6. The principle of indicative management of scientific and technological development in implementation of the priorities of the scientific and technological sphere. Access to information on government priorities for business reduces uncertainty and makes possible a more efficient use of time and financial resources. We should emphasize the key role of government support due to the special nature of higher education and innovation. Among the tools of that support, indirect measures of influence, such as tax incentives, development of innovation infrastructure and cooperation, are the most effective in that they contribute to the creation of a competitive environment, forcing business entities to improve their performance through continuous innovation. Moreover, these tools are more focused on the development of relationships between participants in the innovation process.

As already noted, this group is very dynamic and includes a variety of principles. However, the position of the principle of sustainable development as a top principle ensures the development of a national system of innovation, which is socio-economically effective in both the short and long term.

#### 4. Conclusion

The aim of this paper was to formulate the principles of development of NSI, and higher education as the main

subsystem in NSI, based on the concept of sustainable development, taking into account the current state of higher education in Russia. The conditions of the higher education system in Russia requires the study of the laws and regulations in the field of education and existing educational programmes. Our study of the Federal State Educational Standards of Higher Education and admission quotas reveals an extremely narrow approach to the interpretation of the concept of sustainable development as a biological and geographical problem. There is no connection between the National Strategy on Education for Sustainable Development in Russian Federation and the Russian educational system.

As a result of our investigation, priorities are formulated for the development of a sustainable approach to Russian higher education, including incorporation of principles of sustainable development in the main part of educational programmes as general cultural or general professional competences, an inter-disciplinary approach and inter-faculty integration in the realization of educational programmes.

Since higher education is a leading subsystem of NSI, it is necessary to include the principle of sustainable development above the set of national principles of the function of the NSI, in conjunction with the development of higher education on the basis of sustainability.

Identified problems suggest that it is advisable to devote time in further studies to examining the constraining factors in the development higher education for sustainable development.

#### References

- [1] World Commission on Environment and Development. Our common future. New York: Oxford University Press; 1987.
- [2] UN Resolution 57/254. United Nations decade of education for sustainable development. Agenda item 87a. Document A/RES/57/254 Available at <http://www.un-documents.net/a57r254.htm> (accessed December 2015).
- [3] Pavlova M. Education for sustainable development in Russia. Technical and vocational education and training: issues, concerns and prospects; 2009; 10: 175-192.
- [4] Zhevlakova M. The state of education for sustainable development in Russia. In: Bobylev S, Perelet R, editors. Sustainable development in Russia. Russian-German environmental information bureau; 2013. p. 105-112.
- [5] Crotty J, Hall SM. Environmental awareness and sustainable development in the Russian Federation. Sustainable Development 2014; 22: 311-320.
- [6] Federal Law on Education in Russian Federation (No. 273-FZ). Available at <http://zakon-ob-obrazovanii.ru/> (accessed December 2015).
- [7] Federal State Educational Standards of Higher Education. Available at <http://fgosvo.ru/fgosvo/92/91/4> (accessed December 2015).
- [8] Salimova T, Guskova N, Neretina E. Education for sustainable development in Russia: problems and challenges. Int J. Innovation and Sustainable Development 2015; 9 (3/4): 246-261.
- [9] Kaartemo V. Russian innovation system in international comparison—the BRIC countries in focus. Electronic publications of Pan-European institute 2009; 22. Available at [http://www.tse.fi/FI/yksikot/erillislaitokset/pei/Documents/Julkaisut/kaartemo\\_russian\\_innovation\\_system\\_in\\_international\\_comparison\\_2209%20web.pdf](http://www.tse.fi/FI/yksikot/erillislaitokset/pei/Documents/Julkaisut/kaartemo_russian_innovation_system_in_international_comparison_2209%20web.pdf) (accessed December 2015).
- [10] Khvatova T. Russia's national system of innovation: strengths and weaknesses. Studying the business sector of Russia's NSI. Proceedings of the 5th International Ph.D. School on Innovation and Economic Development, Globelics Academy, Tampere; 2008. Available at <http://hdl.handle.net/1853/43538> (accessed December 2015).

- [11] Kankovskaya AR. National innovation system in the economic cycle: principles and perspectives. In: Seliger G, editor. Sustainable manufacturing: shaping global value creation. Springer: Berlin Heidelberg; 2012. p. 371-375.
- [12] Ranga M, Etzkowitz H. Triple helix systems: an analytical framework for innovation policy and practice in the knowledge society. *Industry and Higher Education* 2013; 27(4): 237-262.
- [13] Hargroves K, Smith MH. The natural advantage of nations: business opportunities, innovation and governance in the 21st century. Routledge: Oxford; 2006.