The role of the high school in the “Triple Loop” model: SCBIN technologies

V V Yankovskaya†* and S N Kukushkin†
†Plekhanov Russian University of Economics, 36 Stremyanny pereulok, Moscow 117997 Russia

E-mail: veronika28-2@mail.ru

Abstract. Subject / topic: In this paper, a study was conducted of the influence of the “triple loop” model on the Higher School, the university architecture of the organization. The role of convergent technologies in the educational environment and their relationship with the knowledge system, approaches, potential and communication of SCBIN technologies with the knowledge management system is discussed. In particular, the research explores IT and cognitive technologies that form a new space in higher education and provide ways to master it. In the paper, the authors also consider the role and influence of the “triple loop” model on the high school, along with the main tool for implementing SCBIN technologies.

1. Introduction

For the successful implementation of organizational design, it is necessary to have knowledge being integrated in a special area, i.e. the organization’s architecture. Metaphysics, in this case, implies the cognition of the world as a complete system, the coverage of the fundamental problems of real life, and the eternal search for their resolution. One era replaces another, and with it the notion of norms and established traditions for the architecture of organizations goes into oblivion. Perhaps these are the approaches and methods that were used previously and were once the highest achievement for organizational design. But the era has changed and the idea of the perfect form of the organizational architecture of an economic entity has changed. With the passing of the last century, the idea of a balance between the form and space of an organization has changed dramatically. The norms have become a potential opportunity to repeat, but in a more perfect form, the structure and system of an economic entity. To show their direct dependence on the possibility and necessity of using convergent technologies in the life of an economic entity. These problems, in the opinion of the author, can be attributed to the fundamental ones.

In the process of establishing an organizational design, considerable attention is paid to the professional training and retraining of personnel, followed by adaptation in the organization’s society. Any organizational design provokes the formation of specified requirements for an applicant for a particular position. With the help of them, an economic entity determines types and amount of knowledge, skills, and behavioral norms imposed on the applicant. And the Higher School should, taking into account the requirements of the economic entity, prepare a student. In connection with the transformations in the technological structure and changes in the socio-economic formations of Russia, the need for research results of convergent technologies and their practical application has increased dramatically. Russia took the direction of the formation of NBIC-economy, and this requires
an analysis of the potential of NBIC-convergence, taking into account the experience of joint development of NBIC-convergent technologies. Today, more and more questions are raised about the need for interaction between scientific and educational organizations, in order to implement the concept of the triple helix. We are talking about the need to create and implement new regional strategies to facilitate a faster transition to the sixth technological order. The bottom line is that the university moves from a purely educational and scientific institution to an innovative and entrepreneurial one. At the head of the main functions remain education and science, but in a different hypostasis. These will be other goals and objectives, new forms of creation, transfer and application of knowledge systems.

Despite considerable interest in this problem, interdisciplinary research, which is based on cognitive principles and is carried out by economists, faculty, researchers, managers, architects, psychologists, sociologists, designers, engineers, and specialists in IT-modeling, etc., has fully implemented not yet.

For the past 20 years, the term “convergent technologies” has been actively discussed and used in the scientific community. This term, like the concept itself, was proposed by American scientists and combines the development and use of four scientific directions, which are the basis of the new technological order, the lifestyle that has replaced the information order. At present, the return is to a single holistic picture of the world. The so-called “tetrahedral” concept of the relationship of convergent technologies. Nano-, bio-, info- and cognitive technologies underlie the new way of life, abbreviated as NBIC. Atom, neuron, gene, and bit underlie these technologies. They represent a rhombus (tetrahedron), on top of which is a nano.

Figure 1. Transforming the NBIC-technology into SCBIN-technology [26].

2. Analysis
Considering the relationship between the architecture of the organization and education, let us pay attention to the combination of the areas of activity “Science and Education” and “Architecture of the Organization”. Today, this may be already indicated as a scientific problem [24].

On the one hand, this includes design and experimental development and research, performed by the faculty with students in higher educational institutions. The results of these actions are essential for both education and science in practical terms. The directions of such research and studies are dictated by the level of development of science, futuristic research, scientific directions of schools and departments, tasks and problems of current practice of practicing companies, etc. Thus, research activity is a part of sectoral scientific activity and often considers the process of higher education education, its specificity, thereby differing from scientific practice by the depth of research, problems being solved and the scale.

On the other hand, academic studies, with regards to the educational process, in higher education institutions are conducted by the teachers themselves. Masters, bachelors, and schoolchildren, in this
case, are the subject of scientific research, participants in the experiment. The interaction and interdependence of all three concepts predetermine the thematic area of interdisciplinary research. Practice gives new knowledge science forms new theoretical knowledge, processes and systematizes, creating a system of knowledge, giving it to the education system. The introduction of current developments and results in the educational process leads to the emergence of new professionals. University is a fertile ground for the development of science and practice. The birthplace of new approaches, models, methods, and new formulas for design solutions. Setting goals for education stimulates the development of sectoral pedagogy, develops design practice. Sometimes, the results of research carried out within the framework of the university are claimed by practical and industrial science. But, in any case, they are valuable and of interest to the educational system and the educational process.

The relevance of the problems of education is growing, and the importance of the fundamental foundations of the profession is growing, and hence the role in education. The change of epochs in the conditions of global transformations, in the conditions of oversaturation with information and high mobility of the environment, provoking modernization processes, qualitative assessment of events obtained by expert, is inferior to the use of fundamental knowledge and cognitive technologies, scientifically based forecasts.

The ever-increasing amount of knowledge (information) requires the use of an effective management system that ensures the optimal activity of the company's personnel. Timely delivery of the required amount of information on time and place within the organization will be an effective solution to knowledge management, ensuring the coherence of activities. Thus, the system of knowledge and practical experience of existing companies form the basis for basic and applied research. In the conditions of the all-round distribution and widespread use of convergent technologies, multiple socio-economic processes, their development will ensure success and a decent level in any market.

According to representatives of natural science (Kurchatov Center, Institute of Applied Mathematics named after M. V. Keldysh), in the modern world, the NBIC is transformed into a more complex structure, which consists of five elements: meme, gene, bit, neuron, atom. This structure is a regular pyramid. Its name is abbreviated as - SCBIN (Socio-Cognito-Dio-Info-Nano). The leading role in this structure is to be played by social technologies, “... without which outstanding inventions and scientific achievements cannot be not accepted and realized by modern society, maybe it will bring great misfortunes to it” [26]. This transformation is shown in Figure 1.

In other words, Russian scientists understand by convergent technologies, natural-technological discoveries and their use, in which social responsibility lies not only for current, but also for future generations. Convergent technologies should contribute not only to the improvement of material well-being, but also spiritual development.

The main tool for the implementation of SCBIN-technologies, in the opinion of many scientists, should be the processes of self-organization, which gives an understanding of the functions, organization (structures and systems) and the direction of development of objects and processes. It should also be noted that the concept of SCBIN-technologies finds its practical application and implementation as the humanization of production (technologies), the humanization of education and other.

The vector of the quality of education is today another of the actual problems in higher education. This problem requires modified, non-standard methods, and solutions. Dynamically developing market generates fierce competition in the education system. Pricing policy, unfortunately, does not meet the level of services provided in this area. It concerns, above all, commercial educational institutions. The quality of education is strictly connected with the compliance of universities, in its educational activities, with the Federal educational standard. The quality of education should be considered from the point of view of a holistic process, which consists of small private processes [5]. Such as the quality of software, teaching aids, infrastructure, applicants and students, and more. This is an integral part of the quality of higher education, which, in turn, is the result of the quality
management of the general educational policy and all parts of the multidimensional and multi-level educational process.

Systemic use of cognitive technologies in the educational process will allow:

- Developing a student’s information competencies;
- Forming a favorable organizational climate in the group, on the stream;
- Accelerating the cognitive development of a student;
- Significantly increasing students’ results in the discipline.

The systematic use of cognitive technologies in the educational process can ensure accelerated cognitive development of students, which would lead to an increase in the quality of education.

Consequently, information and communication and cognitive technologies provide a new level of organization of the architectural educational process. In conjunction with the NBICS-convergence, which has an increasing role in the transformation and creation of the individual’s living environment [16]. Cognitive technologies will form a new space in higher education and provide ways to master it. The researchers argue that “the quality of life is ensured by the following parameters: the volume of physical labor and a comfortable condition for life. These parameters are characterized by the level of technological development” [16]. Nowadays, this is the NBICS complex. Information and cognitive technologies will have a major impact on the development of higher education [24]. Transformation of an individual’s habitat will, to a greater degree, be determined by a complex of SCBIN technologies [16; 25]. According to the architectural spiral “science, education, practice”, the role of science and education increases and changes, becoming the central component of all architectural activities. This determines the main vector of development of science and education.

The knowledge management system is a practical implementation of the concept of SCBIN-technologies in an organization. The knowledge management system is an integrated approach to the collection and use of information flows of an organization while using and enhancing the knowledge and experience of members of an organization. Conceptually, the knowledge management system consists of information technology (10%), organizational business processes (20%), organization personnel (70%) (Figure 2).

![Figure 2](image)

**Figure 2.** “Weight” of elements of a knowledge management system” [27].

The knowledge management system (KMS) is a process from the formation of knowledge, including new knowledge to the retention of knowledge in the organization (Figure 3). The mechanism of the knowledge management system includes the following: formation of knowledge; knowledge formalization; structuring and documenting; transfer and share knowledge; use of knowledge; retention and preservation of knowledge in the organization.
Table 1. Knowledge management system mechanism [27]

| Economic effects of KMS | The tasks of KMS technological solutions |
|-------------------------|-----------------------------------------|
|                         | Accumulation of excellence               | Dissemination of excellence | Transfer of excellence | Formalization of excellence |
| Increasing productivity by using best practices | Knowledge base | Corporate newspaper | Expert support of working groups on supporting business processes | Best practices |
| Increase decision-making reasonableness by attracting the competence of specialists | Expert base | Personal sections of experts | Expert decision making support for management requests | Maintaining a competence matrix of specialists |
| Development of production capacity through the use of internal and external technological experience | Bank of promising technological solutions | Collection of digests and abstracts, information and analytical articles | Expert support for technology development projects | Identification and registration of promising technological solutions |
| Reduced costs from duplication of research and development | Base of research results, development | The system of publication of the results of research and development | Expert support of research and development | Fixing opinions on the relevance of research and development |
| Reduce potential losses by preventing the occurrence of known errors | Emergency bank | Addressing a warning alert system | Expert advice to users in emergency situations | Fixing the results of working off emergency situations |

Figure 3. Knowledge management system.

When performing any actions in an organization (and not only), a person faces an unexpected situation, a situation when the lack of own knowledge and experience is observed. In this case, he turns to the system of knowledge of an organization, which in its essence represents an array of various information. In this “array”, an employee is able to (a) get necessary knowledge to make a decision or (b) get knowledge that may not give him a ready-made solution, but they can contribute to the formation of a new knowledge and to develop the necessary solution based on them.

This process and its results can be represented as the following mathematical algorithms.

1) \[ z_h \rightarrow z_{2-1} \rightarrow z_{2-2} \rightarrow z_{2-3} \rightarrow z_{3-1} \rightarrow z_{3-2} \rightarrow z_{3-3} \]

2) \[ z_h \rightarrow z_{2-1} \rightarrow z_{2-2} \rightarrow z_{2-3} \rightarrow z_{3-1} \rightarrow z_{3-2} \rightarrow z_{3-3} \]
3. Conclusions
The knowledge management system allows not only making high-quality, effective decisions. It allows one to make decisions in the mode of time close to real. Also, the knowledge management system allows one to make decisions at the place of the problem, which helps reduce costs.

Broad and comprehensive decentralization of management processes in the organization is necessary to improve the efficiency of the knowledge management system. The authority to make a decision should be delegated from a manager directly to her subordinate, a specific executor of any actions, work, and tasks.

But, just decentralizing decision making in an organization is not enough. Different organizational culture should be in place. Thus, organizational culture is the second factor in the effectiveness of the knowledge management system.

In previous management systems, the decision making process was the only manager’s prerogative, i.e. the product of management. In contrast, in organizations of the future (new organizations), the decision making process is delegated directly to the executives, and this happens thanks to cognitive technologies. Moreover, one should not forget that it is cognitive technologies that enhance the role of the human factor: employees’ qualifications, responsibility, discipline, etc.

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