

# Education Quality Management at the Nizhny Novgorod State University of Architecture and Civil Engineering of the Russian Federation

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**Abstract** The article is dedicated to the quality management in education. The education quality specific features are described. The system of education is viewed as a large complicated system which is expedient to be managed on the basis of a system approach. A method of the system approach implementation is offered, permitting to optimize the education quality in a higher educational institution on the basis of a system analysis and synthesis. The method has been approved at the Nizhny Novgorod State University of Architecture and Civil Engineering (NNGASU). Application of the system approach, well-defined objectives and policy aimed at quality improvement allowed achieving practical results: perfection of the structure by creation of system links between all the fields of training, development of scientific researches and international cooperation in science and education. High competitiveness of the university, its successful passing of accreditation and licensing procedures, education quality management system certification to conform to the ISO 9000 standards (to ISO 9001-2000 in 2005 and 2008 and to ISO 9001-2008 in 2011), various awards, including international, may serve confirmation of the achieved results.

**Keywords** Education, Knowledge Quality, Quality Management, System and Process Approaches

## 1. Introduction

The quality of education, in a legal sense of this term, means the degree of its compliance with the State normative requirements and customer's needs[1]. In fact, the essence of the quality in education turns out to be more complicated, which does not comply with the meaning of the term "quality of production", which is aimed at gaining profits. The task of quality management in education is defined as a specific task of managing the quality of knowledge, when one party hands over knowledge to the other party that receives it in the course of activities called studies. The quality of the obtained knowledge depends largely on the individual's intellect and abilities. It makes it principally different from the relations existing in the sphere of commodity production, where the quality of products does not depend on the personal virtues of the customer, and the product manufacturing process does not suppose joint efforts of the both parties.

The key aspects of the education quality features are:

- level of professionalism and qualification of teachers;
- level of schooling, intellect and abilities of entrants;

- procurement of resources (literature, equipment);
- curricula and programmes;
- organization of training process.

The main aspect that ensures the quality of education is the level of professionalism and qualification of teachers, i.e. "cadres are the key to everything", including problems of quality maintenance for other aspects[2].

Each higher education institution solves this most complicated and multi-aspect task of achieving the quality of education in its own way. The Nizhny Novgorod State University of Architecture and Civil Engineering (NNGASU) always views perfection of the education quality as the main direction of its development. Systematic scientific researches are carried out in the university in this field, and their results are presented at international conferences and published in competent journals[3],[4],[5].

## 2. Management

The objective of NNGASU in the field of quality is the maintenance of its competitive capacity on an international level. The achievement of this goal is ensured by the university's policy aimed at integration of teaching, science and innovations in educational activities[9].

The main instruments of improving quality of education ensuring practical results at NNGASU are: realization of the system approach, application of science and innovations to

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the educational process, international cooperation.

The university's success in solving the quality management problem lies in systematizing and meeting the requirements to the education quality made by all the shareholders: the State, employers, students and their representatives, as well as in obtaining confirmation that the university's education activities conform to those requirements by means of accreditation and the quality management system certification. Therefore, as a method of solving the problem, a system approach has been chosen and ways of its practical use to achieve the goal have been developed.

Application of the system approach is a principle of the quality management. The system comprehension is a basis of the Total Quality Management (TQM) concept. But the Total Quality Management term has not been standardized, causing ambiguous understanding. From the systematic point of view, TQM is a concept of a comprehensive, targeted and well-coordinated use of systems and methods of quality control at all stages of product life cycle, from researches and designing to after-sale services, with participation of managers and employees of all levels and rational use of technical means[2],[3]. The TQM model does not suppose certification, because there are no specified requirements and, hence, the system standard.

International standards ISO 9000 are based on the system and process approaches. They comprise all achievements in the field of quality management, including statistic methods, quality planning, staff training, analysis and improvement. According to ISO 9000, the priorities of the quality management system are customers' satisfaction and responsibility of managers and all employees. The sphere of application of ISO 9000 is constantly widened. According to the agreement signed at the International workshop IWA 2, there appeared Quality management systems – Guidelines for the application of ISO 9001:2000 in education. The certificate of compliance to ISO 9001 issued to the university proves that it is capable to perform the education activity of the planned quality. NNGASU was one of the first among the Russian universities to have such a certificate.

It should be noted that neither TQM nor ISO 9000 specify requirements to the system approach, therefore, practical methods of its application in the quality management have not been developed thoroughly.

### 3. System Approach

A system is a combination of linked elements possessing a certain consistency.

The essence of the system approach supposes that the activity of any part of a system influences other parts thereof, and from this it follows, that to assess any decision, all essential interlinks should be identified. The system approach supposes working out a general optimal concept instead of solving specific individual tasks. The system approach is realized by means of a system analysis. The goal of the analysis, as a rule, is to find an optimal decision.

The main tasks of the system analysis are:

- decomposition, i.e. presentation of an initial system in the form of subsystems (elements);
- analysis, i.e. assessment of the environment impact on the system;
- synthesis, i.e. creation of a new system optimally meeting the set objective.

The analysis and synthesis of systems are carried out on the basis of the system analysis principles[20],[22].

In terms of system approach and system analysis the system of education is a large complex system with specific features that are attributed to this category of systems. They are:

- a common objective for the entire system;
- a complex hierarchy of the system organization providing for a combination of the centralized management with the autonomy of its components;
- a large size of the system, i.e. a large number of its elements (systems, subsystems) comprising the large system;
- availability of numerous structures belonging to one system.

The system of education includes:

- successive educational programmes of different levels and orientation, federal state education standards and requirements;
- networks of education institutions and scientific organizations they are implemented in;
- governing bodies in education;
- associations working in the sphere of education.

The objective of the system of education, proceeding from the definition of the term “education” and principles of the State policy in education, is the qualitative satisfaction of the society's needs in knowledge, skills, habits and competences.

Based on the general objective of the system of education and methods of the system analysis, a quality assurance system of the university educational process can be established as an integral part of the large system (the system of education).

On the first stage the task of decomposition, i.e. representing the initial system in the form of discrete elements, is being solved. To avoid a detailed elaboration, the decomposition is based on a modular approach (Figure 1).

Analysis and synthesis of the structured system are based on the following system analysis principles:

- final goal principle (in the given task the objectives of the initial system and of structured system coincide);
- measurement principle (the structured quality assurance system should function as a part of the system of education);
- module construction principle;
- development principle.

The first module (m1) in the initial system is a normative one, the correspondence of the second module (m2) thereto is achieved by means of the management module (m3) on the basis of evaluation (Figure 1).

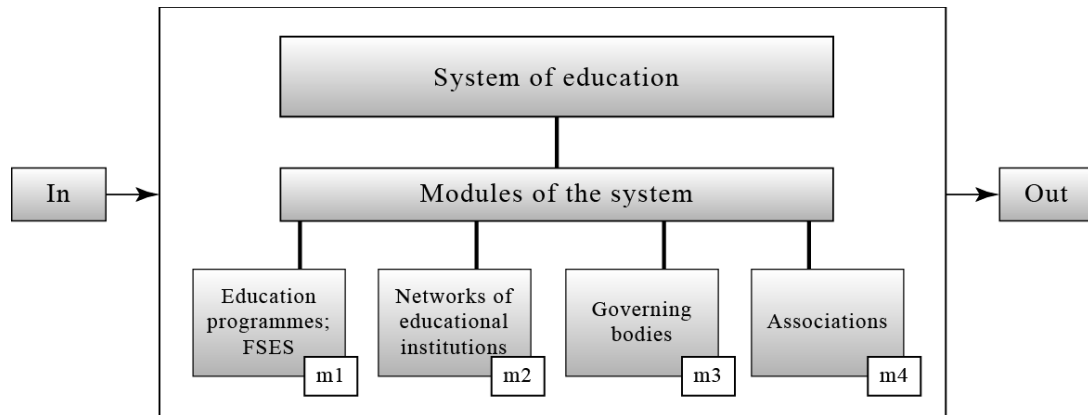


Figure 1. Modular presentation of the system of education

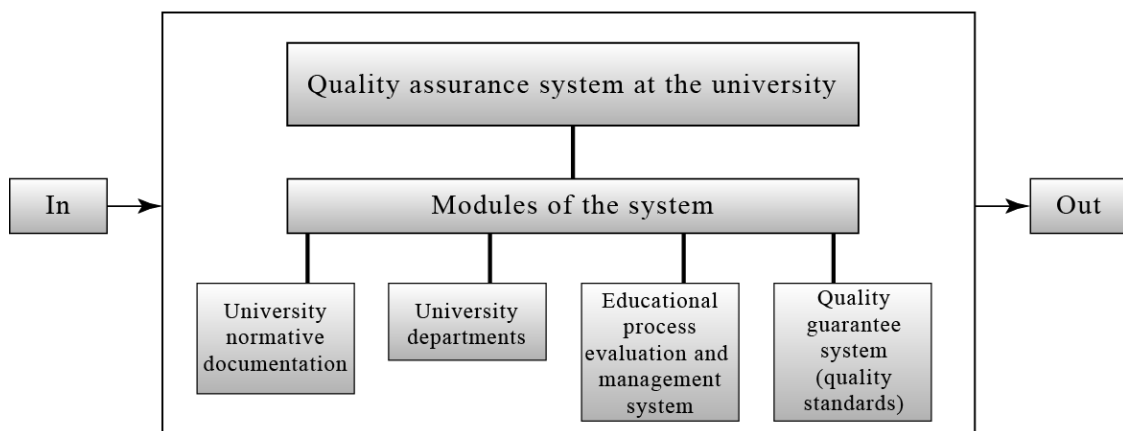


Figure 2. Modular structure of the university quality system

Due to the fact that the same objective is set for the structured system as for the initial one, the decomposition is carried out on the level of an educational institution, e.g. a university, according to the first three modules related directly to the set objective. The synthesized system is presented in Figure 2.

This method is universal, permitting to accomplish decomposition, analysis and synthesis of a system on a given level with regard to any module and for any purpose corresponding to the initial system's objectives[8].

#### 4. Perfection of the Educational Process Structure

Solving the strategic task of the university development has defined the core of the university, namely, the civil engineering and the courses associated with it: architecture, design, expertise and property administration, heat-and-power engineering, ecology and nature management, land utilization and cadastre, technosphere security, standardization and metrology, quality management, information systems and technologies. All training courses are related directly to the civil engineering and have building specialties in their programmes. NNGASU conducts training of specialists, bachelors, masters, post-graduate and doctoral students.

The current configuration of the educational process

structure provides for a system connection of all training courses due to the versatility of curricula and relevance of the offered disciplines. Students have a possibility to broaden their knowledge, skills, habits and competences by obtaining the second higher education: the Master's degree in any available field. Prospects of job placement and business foundation extend for the graduates. On the whole, NNGASU has considerably enhanced its competitiveness, and demand for its graduates has increased, too[10].

#### 5. Scientific and Research Activities

Teachers and researchers of the university take active part in fundamental scientific and research works financed from the State budget and grants of scientific foundations: the Analytical Departmental Target Programme "Development of the higher school scientific potential", the Federal Target Programme "Scientific and research-and-educational cadres of innovation Russia for 2009-2012", grants of the Russian Fund of Fundamental Researches (RFFI and RFFI-Povolzhje), grants of the President of the Russian Federation to support young Russian scientists – Ph.D. in science.

An important direction of the NNGASU's scientific work is carrying out of applied scientific researches and exploratory developments financed by business entities of the

Russian Federation, as well as from local budgets of Nizhny Novgorod and other regions that ensures strong ties of the university with public and business companies in the building sector – basic employers of the university's graduates, and raises staff qualification and level of the graduates' training.

The main directions of the applied scientific activities are the works on designing new objects of civil and industrial engineering and reconstruction of existing ones: waterworks, roads, objects of cultural heritage (historic and cultural monuments), examination and technical condition assessment of constructions and buildings, expertise of industrial safety of dangerous industries, testing and certification of building materials and constructions. Special methods, scientific developments of NNGASU's scientists, and unique measuring instruments are used for this kind of work.

Every year NNGASU presents its scientific and engineering developments and innovation projects at international, All-Russian and regional exhibitions and contests. In 2010 a complex innovation project for production of construction materials of local dolomite and gypsum available in the Nizhny Novgorod region became a prize winner of the regional contest held under the patronage of the Governor of the Nizhny Novgorod region [11].

## 6. International Cooperation

In 1996 in collaboration with the Cologne University of Applied Sciences (FRG) and Zuyd University of Applied Sciences (The Netherlands), the Nizhny Novgorod State University of Architecture and Civil Engineering introduced a new specialty: "Economics and enterprise management". For the project implementation, the International Institute of Economics, Law and Management, jointly managed by Russian, German and Dutch representatives, was established at the university.

The main task of the project was to convert the specialty "Economics and enterprise management" to a two-level system of Bachelor and Master training in the discipline "International business" with the following Russian and international accreditation of this educational programme.

The success of the project has ensured general improvement of quality of education in economics, including internationalization and language competence, improvement of qualification of Russian teachers, international acceptance of diplomas, consistent development of curricula and programmes by means of an e-learning portal (electronic exchange of teaching materials between students and teachers), development of international student exchange programmes East-West, West-East, development of scientific and practice-oriented cooperation.

The experience has been gained in the course of the so-called block classes (one week) conducted by foreign professors from the three partner universities of Cologne, Aachen and Sittard. In December 1999 the first 25

students-economists graduated from the institute. Thus, one of the largest projects of international cooperation of the EU Tempus-Tacis programme was successfully realized.

The university cooperates with more than ten partner universities of Western Europe, the USA, and Asia not only in education programmes, but also in scientific researches and consulting.

The advanced study of two foreign languages – English and German, international nature of the teaching process, participation of foreign professors in teaching, possibility to undergo familiarization and pre-degree externship abroad; practice-oriented education, joint projects with Russian and foreign enterprises and organizations can be considered specific features (and simultaneously competitive advantages) of the NNGASU's international cooperation. The university widely uses modern education technologies; an International information centre with teaching and professional literature in foreign languages has been established.

Since 2009 NNGASU in partnership with Zuyd University (The Netherlands) has been participating in the project "District of tomorrow". This is a project in which students, teachers, researchers and companies join their efforts in researching, designing and constructing sustainable buildings and constructions for the future. This is a field of activities where educational institutions (on every level of vocational and professional education), companies and authorities co-operate to establish the environment needed for studying sustainable technologies to be used in the project. Universities of Belgium and Germany also take part in the project. A successive stage of the project was accomplished in the 2011-2012 academic year. Under the supervision of the teachers of Zuyd University and NNGASU a group of NNGASU students designed a multi-storey dwelling house and a church.

Together with a number of universities led by the University of Lund, Sweden, NNGASU plans to participate in the development of Master programmes on renewable energy and energy efficiency in buildings in Central Asia and Russia within the frameworks of a scientific and educational Tempus project. In December 2012 a kickoff meeting of the project was held in Lund, Sweden.

The 14th International scientific and industrial forum "Great Rivers – 2012" was held on May 15-18, 2012 with participation of foreign specialists from Germany, the Netherlands, France, the USA, Finland and other countries. A number of conferences on environmental problems and energy saving, and expositions presenting technologies and equipment of industry, power engineering, houses and communal services, and transport were held within the frameworks of the forum, which took place at the Nizhny Novgorod Fair. The main criteria for the exhibits were modern requirements to the environment protection.

At the 14th International scientific and industrial forum "Great Rivers – 2012" the NNGASU UNESCO Chair "Ecologically safe development of a large region – the Volga basin" in collaboration with the Russian National Committee of the UNESCO International Hydrological

Programme (IHP) and under the support of the UNESCO Moscow office, organized the workshop “Ensuring sustainable development of the Volga river basin: inputs of biosphere reserves and local population” within the UNESCO/Coca-Cola Hellenic programme “Live Volga”.

A delegation of the University of Stuttgart consisting of Dr. V. Ressel, dean of the construction department Dr. Kranert, professors O. Pertschi and B.H. Graf visited NNGASU on June 18-22, 2012. During the visit they had meetings with the NNGASU deans and professors. The visit resulted in a draft agreement on cooperation in the fields of education science and culture: students and staff exchange, joint researches and scientific workshops, joint cultural events and projects, joint scientific meetings, symposiums, conferences, exchange of scientific materials, publications and information. At the moment the draft agreement is under examination of the German party.

In September 2012 NNGASU was visited by Prof. M. Radovanović, the Acting Director of the Geographical Institute “Jovan Cvijić” of the Serbian Academy of Sciences and Arts, and Prof. R. Bukvić. The visit resulted in signing an agreement aimed at establishment of a long-term cooperation in the sphere of scientific researches and education: organization of and participation in international scientific conferences and symposiums, organization of research projects, publication of joint articles in international and national journals, exchange of students, post-graduate and doctoral students.

Cooperation in the sphere of scientific researches will be carried out in the following fields:

a) ecology, cartography, geoinformatics, landscape and ecological geosystem mapping on the basis of the geoinformation technologies; assessment of destructive geoecological processes in regional and local geosystems; forecast of natural and man-induced emergencies; landscape design of protected natural territories;

b) tourism development, social and cultural services, handicrafts;

c) economics and management; sustainable development of socio-economic and socio-ecologic systems; crisis management; investment management; comparative study of country and region development;

d) education development.

New directions of cooperation can be developed in future.

The international “Russian Days of Building Science in Germany” were organized on November 11-18, 2012 under the auspices of the Russian Academy of Architecture and Construction Sciences (RAACS) and the National Union of Builders of the Russian Federation with an intention to integrate the Russian and German building schools for solving actual problems of construction. This event was attended by the scientists and specialists of leading construction universities, including NNGASU, research and design institutes, engineers of construction companies and firms producing building materials and constructions[12].

## 7. Attestation

Licensing and accreditation procedures are the bound forms of confirmation of the educational activity correspondence to the Federal State standards. Certification of the education activities for correspondence to ISO 9000 international standards is done on a free will basis. Anyhow, the licensing, accreditation and certification procedures in combination provide for the customers’ trust to the results of the education activities and creation of conditions for their acceptance on both national and international levels. The licensing and accreditation procedures are set by the normative documents of the Russian system of education [13],[14]. Methods of developing the quality system management inside an educational institution are defined by the institution itself.

NNGASU has developed an optimal structure of the education quality management system according to ISO 9001 provisions in the form of the interconnected graphical descriptions of the university processes[15] and standards containing requirements to the process realization.

The offered structure of the quality management system can function within the framework of the university standardization system. In such a form the system has been successfully functioning at NNGASU for more than 10 years. This is an open-end system, and it can be developed along with the organization, which is in conformity with the system principles of openness and development. As new processes appear and are identified, corresponding standards are elaborated by the organization. Being such, the system is not limited by the formal frameworks of the quality manual and is free from bureaucratization.

The education quality management system of the university comprises the interconnected internal system of normative documents, internal system of quality assessment, quality plans, standards to corrective and preventive measures, as well as corresponding elements of the system of education: external normative documents and external system of assessment.

Thus, the offered system of education quality management is based on the requirements of the system of education, representing its internal part; the system and process approaches are exploited in it, and it meets the European quality assurance requirements. The given model is effective, open-end and capable to develop.

The NNGASU quality system successfully underwent the first certification for correspondence to ISO 9001-2001 in 2005, as well as the following certifications in 2008 and 2011 for correspondence to ISO 9001-2008[16].

Awards and medals of various contests are substantial evidence of the high quality level of the NNGASU’s educational activities. In 2004, 2005, 2009 NNGASU became a gold medal winner of the “European Quality Education” contest in nomination “The 100 best higher education institutions of Russia”. In 2010 the university became a gold medal winner at the contest “100 best

organizations of Russia in science and education”, and NNGASU rector, Ph.D. in engineering, Prof. E.V. Kopusov was given the title “Scientist of the year”. In 2012 the university again was selected into the 100 best higher education institutions of Russia, and its rector was awarded an honorary medal “Rector of the year”. Moreover, NNGASU became a winner in nomination “The best higher education institution in international cooperation”.

Educational programmes of our university “Construction”, “Architecture”, “Land-utilization and cadastres” (specialist, Bachelor and Master programmes) were recognized as the “The best educational programmes of innovational Russia” in 2010, 2011 and 2012.

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