Developing the Unified Accreditation System for Engineering and Technology Programmes in Russia

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INTRODUCTION

Programme accreditation run by engineering societies is considered to be an important tool of quality assurance of engineering education. Since 2002, the national system for accreditation of engineering programmes offered in Russian HEIs has been successfully developing by the Association for Engineering Education of Russia (AEER) [1] that represents the Russian Federation in the European Network for Accreditation of Engineering Education (ENAEE) and is a signatory of the Washington Accord. In 2013 the AEER accreditation criteria and procedure were updated and elaborated resulting in the development of the unified accreditation system for engineering and technology programmes leading to various qualification levels.

The AEER accreditation system provides a common approach to accreditation of technician training, applied bachelor degree, academic bachelor degree, specialist training and master degree programmes that stimulates the coherence of engineering and technology programmes delivered in Russian educational institutions. The programme compliance with the developed criteria shall ensure the quality that meets relevant national and international professional and academic standards and promotes ongoing improvement of the educational programmes.

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1 BACKGROUND

1.1 Context of engineering education quality assurance in Russia

According to the Russian Federal Law “On Education in Russian Federation” (Nr. 273-FZ), there are two types of accreditation namely state accreditation (run by the federal government) and professional accreditation (run by professional bodies). The state accreditation system is presented by integrated assessment of higher education institutions. Its main purpose is to conduct comprehensive analysis of HEI’s activities and to evaluate their compliance with the Federal state educational standards.

Professional accreditation falls under the responsibility of professional bodies. In obedience to the law (art. 96), “employers and their associations, as well as authorized by them organizations, may carry out professional accreditation of educational programmes delivered by the educational organization” [2]. The law defines professional accreditation of educational programmes as recognition of quality and level of graduate competencies as meeting the requirements of professional standards and the labor market. At the same time the results of professional accreditation should be considered by the process of state accreditation. Professional accreditation of educational programmes provides evidence of recognition of education quality by professional community and is aimed at improving education quality in accordance with industry requirements. Besides, external programme accreditation should allow professional bodies to contribute to the design of engineering and technology programmes according to their needs.

1.2 AEER accreditation activity

The leading role in professional accreditation of engineering programmes in Russia plays AEER, which being the ENAEE member is authorized to award a common European quality label (EUR–ACE Label). In 2012 AEER became a full member of the Washington Accord – the international agreement that recognizes the substantial equivalency of programs accredited by those bodies and recommends that graduates of programs accredited by any of the signatory bodies should be recognized by the other bodies as having met the academic requirements for entry to the practice of engineering [3].

The first set of accreditation criteria was developed in 2002 by the AEER experts based on the best traditions of national higher education and international experience of engineering education quality assurance. The Accreditation Centre and the Accreditation Board which consists of representatives of academia, science, industry and professional bodies were founded. The first set of the AEER criteria comprised the accreditation criteria for 3 levels of engineering degree programmes (bachelor, master, specialist) and included the requirements grouped in 9 categories, namely:

1. Programme objectives.
2. Programme content.
3. Students.
4. Faculty.
5. Professional qualification.
6. Facilities and resources.
7. Information infrastructure.
8. Financial policy and management.
9. Graduates.

In 2003 the AEER signed an agreement with the Ministry of Education of Russian Federation on the development of the national system of professional accreditation of engineering programmes, in 2005 the cooperation agreement with the Federal

Education and Science Supervision Service (Rosobrnadzor) was concluded. In 2004-2006 the AEER took an active part in running an international project aimed at the definition of EUR-ACE framework standards for accreditation of engineering degree programmes and development of European engineering programmes accreditation system consistent with the Bologna Process [4].

In spite of the fact that the AEER accreditation system has gained national and international recognition (several agreements with Russian authorities and professional bodies, ENAEE membership since 2006, full signatory of the Washington Accord since 2012) it had some weak points to be eliminated, in particular:

- the accreditation system was developed only for engineering degree programmes, whereas there was no accreditation criteria for engineering technician / technologist programmes;
- the term “professional accreditation” wasn’t defined and even mentioned in the Russian Federal Law “On Education in Russian Federation”;
- changes in national regulations and current trends in Russian engineering were not taken into account, e.g. the development of professional standards, the national qualifications framework, the national system of professional engineers certification and registration, etc.

The evaluation of the former set of the AEER accreditation criteria has identified the need to revise them and to develop a unified accreditation system for engineering and technology programmes in Russia.

2 RESEARCH METHOD

The research builds upon literature studies in the field of accreditation of engineering and technology educational programmes, including study of national regulations and standards as well as current issues of international standards such as EUR-ACE Framework Standards for Accreditation of Engineering Programmes [5] and IEA Graduate Attributes and Professional Competencies [6].

Besides, the AEER programme accreditation experience and former accreditation criteria were analysed and compared with the experience of other national professional bodies carrying out the process of programme accreditation in different countries, such as the Accreditation Board for Engineering and Technology (ABET), the Engineering Council United Kingdom (ECUK), Engineers Ireland, the German Accreditation Council (ASIIN), etc.

3 FINDINGS AND INTERPRETATIONS

The research conducted by the authors of this article has allowed exploring advantages and disadvantages of the former issue of the AEER criteria and procedure, and the recommendations for their improvement were identified. In 2013 a new set of accreditation criteria was developed by the experts of the AEER Accreditation Centre including the authors and approved by the AEER Accreditation Board. The new AEER criteria represent a coherent system of requirements for educational programmes awarding one of the following qualifications: engineering technician, applied bachelor degree, academic bachelor degree, master degree, specialist.

The new AEER accreditation system is based on the world best practices in engineering programmes quality evaluation and coherent with the international

standards of the International Engineering Alliance described in the Graduate Attributes and Professional Competencies applied within the Dublin Accor (for technician training), the Sidney Accord (for applied bachelor degree), the Washington Accord (for specialist training), and the EUR-ACE Framework Standards for Accreditation of Engineering Programmes for academic bachelor degree and master degree.

The AEER unified accreditation system for engineering and technology programmes shows certain advantages in comparison to the former set of the AEER accreditation criteria. The most important of them are listed below.

3.1 AEER accreditation system: a common approach for five qualification levels

The AEER unified accreditation system for engineering and technology programmes provides accreditation criteria for five qualification levels: engineering technician, applied bachelor, academic bachelor, specialist and master. For each qualification level the range of engineering activities is defined [2].

Technician training programmes are supposed to lead their students to mastering well-defined engineering activities which involves technical support of complex engineering activities in design, production, testing and operation of technical objects, systems and technological processes. Equipment and processing facilities are the main subjects for professional activities of technicians. The main types of technician activities are setting up, operation, maintenance, repair, etc. Solving well-defied engineering problems involves carrying out of standard operations, catalogues handling, measurements and other activities which imply standard methods and protocols.

Applied bachelor degree programmes lead their students to mastering broadly-defined engineering activities which suppose the use of new materials, techniques or processes in non-standard ways and involve a variety of resources (people, money, equipment, materials, information and technologies). Broadly-defined engineering activity requires knowledge of normal operation procedures and processes. Broadly-defined engineering problems involve a variety of factors and can be solved by application of modern technologies and well-proven analysis techniques. They are parts of, or system within complex engineering problems.

Academic bachelor degree programmes as well as specialist training programmes lead their students to mastering complex engineering activities. Complex engineering activity is challenging and multi-aspect. It includes development, design, production, and implementation of engineering products, systems and processes and covers complex engineering problems. Complex engineering problems are connected with investigations, analysis, and design of engineering products, systems and processes and must be solved using fundamental knowledge in mathematics, natural sciences, engineering, and other sciences, as well as advanced and interdisciplinary knowledge and skills relevant to the engineering specialization.

Master degree programmes lead their students to mastering innovative engineering activities. Innovative engineering activity supposes development and design of new engineering products and technologies that are highly in-demand, competitive, and achieve a new social and / or economic impact. Innovative engineering activity is multilevel, interdisciplinary, based on in-depth fundamental and applied knowledge and skills as well as ability to analyze and design engineering products, systems and processes using high-level mathematical methods. Ability to conduct complex multifactorial experimental investigations, draw conclusions of complex technical issues using in-depth knowledge and innovative methods to obtain required results is

of high importance for innovative engineering activity. Graduates have to demonstrate ability to design engineering products, systems and processes taking into consideration severe economic, ecological, social and other limitations.

The AEER accreditation criteria are grouped into seven sections, which headings are common for all five levels of engineering and technology qualifications:

1. Program objectives and learning outcomes
2. Program content
3. Education process
4. Faculty
5. Professional qualification
6. Program resources
7. Graduates

A common approach to accreditation of engineering and technology educational programmes at various qualification levels provided by the new AEER criteria stimulates the coherence of educational programs offered in Russian academic institutions.

3.2 AEER accreditation system: outcomes-based approach

The AEER unified accreditation system for engineering and technology programmes is outcomes-based. The outcomes-based approach was firstly implemented in EC2000 developed by ABET [7] and then was adopted by other accreditation agencies including AEER.

In comparison to the former set of the accreditation criteria the emphasis in the new issue has been shifted from input (educational process) to output (learning outcomes). In particular, the graduate attributes were revised and defined more exactly with a focus on the profession, whereas three accreditation criteria concerning input (Facilities and resources, Information infrastructure, Financial policy and management) were combined in one criterion “Facilities, finance and management”.

Learning outcomes that the programme graduates must demonstrate are listed in the criterion 5 “Professional qualification” and grouped in professional and general (non-technical) competencies. The graduate attributes are defined using twelve headings which are common for all five qualification levels covered by the AEER criteria, but identify the differentiating characteristic that allows the roles of technicians, applied bachelor, academic bachelor, specialist and master to be distinguished by range information.

3.3 AEER accreditation system: focus on profession

The AEER unified accreditation system for engineering and technology programmes has a focus on profession. By the development of the new AEER accreditation criteria professional standards and the national professional engineers’ certification and registration system were taken into account. For instance, the criterion 5 requires the development of learning outcomes corresponding to the professional standards. The criterion 7 “Graduates” identifies monitoring and assessing professional competencies throughout professional career of graduates including their registration as professional engineers as an important consideration in program evaluation. Besides, one of the professional competencies mentioned in the criterion 5 is “Specialization and labor market commitment”, which supposes ability to demonstrate competencies specified by problems, objects and activities associated with potential employers and relevant to the specialization.

4 CONCLUSIONS

Professional accreditation of engineering and technology programmes is an important tool of quality assurance of engineering education used worldwide. The accreditation criteria and procedure should be revised regularly in accordance with current national standards and regulations. However, to be competitive and to allow a worldwide recognition of accredited educational programmes the national accreditation system should take into account international frameworks and standards concerning graduate attributes.

In 2013 AEER developed the unified accreditation system for engineering and technology programmes in accordance with Russian engineering regulations, national and international standards, best world practice in engineering education quality assurance. This accreditation system is supposed to contribute to the development of coherent engineering and technology educational programmes for various qualification levels.

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