

**PROFESSIONAL EDUCATION**

UDC 378.2

**Volodymyr Kharchenko<sup>1</sup>  
Dmitry Prusov<sup>2</sup>****STRATEGY FOR THE TRAINING OF HIGHLY QUALIFIED SCIENTIFIC PERSONNEL  
AT THE NATIONAL AVIATION UNIVERSITY**

National Aviation University  
Kosmonavta Komarova avenue 1, 03680, Kyiv, Ukraine  
E-mails: <sup>1</sup>kharch@nau.edu.ua; <sup>2</sup>prusov@nau.edu.ua

**Abstract.** *The new strategy for the training of highly qualified scientific personnel at the National Aviation University has been considered due to the European third-cycle engineering education within the framework of the International Tempus-Project implementation "New Model of the Third Cycle in Engineering Education due to Bologna Process" (NETCENG).*

**Keywords:** Bologna process; doctoral program; engineering education; third cycle.

**1. Introduction**

Social and economic environment of the new century, the development of the world science, the University's restructuring, the opening of new specialists training fields, on one hand, and involvement of highly qualified scientists of relevant scientific activity directions, on the other hand have led to significant restructuring of the University science, its subjects broadening, appearance of research complex on social, economic and humanitarian issues.

Significant impetus was in research connected to modern information technologies, use of possibilities of space industry.

The development of the University science is the logical continuation of significant achievements of earlier generations of scientists.

**2. The modern strategy of scientific development and scientists training**

The National Aviation University science development strategy principles are:

– maximum use of potential, accumulated in the past; saving and further development of the most important research fields;

– constant and efficient monitoring of the world science achievements (in aviation at the first place), searching and promoting new research fields, creating an enabling environment for informational search;

– organizational restructuring of science management, creating new, more efficient and mobile scientific departments, opening scientific institutes to focus efforts on practical fields;

– closed cooperation with the National Academy of Science of Ukraine, other scientific institutions, departments, creating joint scientific teams, attracting specialists of the National Academy of Science of Ukraine to work and teach at the University;

– productive cooperation with universities and scientific centers around the world;

– creating appropriate conditions for new generation young scientists bringing up.

Developing links between education and research based on a correct understanding of the meaning of the research work in the context of a market economy, increasing the flexibility of design and implement programs, as well as their focus on the needs of the labor market, increasing the employability of graduates, and as a consequence, increase the role of higher education in the engineering field.

The scientific concepts of the University cover such major fields: development of scientific and research projects; creation of industry and interindustry laboratories and centers; staff training; holding of the University events; participation in priority research programs.

The National Aviation University team of scientists has found its creative way and this is not just an artificial selection of thematic areas, but a prudent response to the needs of modern civilized society - a society where dominant is the human factor, not temporary technogenic achievements.

In recent years, the scientific structure of the university became more balanced and clearly outlined, the basic fields are:

- development of research projects;
- creation of applied-research and inter-industry laboratories and centers;
- participation in the priority research programs;
- conducting all-university research events;
- training of scientific personnel of highest qualification.

In addition to large-scale educational and scientific research in the field of advanced technology, solve another critical task – the creation of a new generation of young Ukrainian scientists.

Scientists working with the talented students of junior courses have the opportunity to study for years to identify inclinations and abilities of students and thus create the basis for their successful research activities in the future.

Serious attention to the scientific-pedagogical staff of higher qualification training through post-graduate courses is paid at the University.

As the availability of high scientific potential at the faculty influences greatly the level of specialists training, who are the future of an independent, powerful state, a country where great emphasis on the development of science is made.

Post-graduate courses at the National Aviation University were founded in 1951.

Since then, more than 6 thousands Candidates and Doctors of Sciences – highly qualified specialists for aviation, economic, chemical, and industrial sectors of our state and other 50 countries – have graduated from the University.

Among them are famous scientists, teaching specialists, military servants and specialists of high qualification in various areas of professional activity, heads of powerful companies, enterprises, organizations and institutions.

Due to the sharp increase of annual admission to post-graduate courses on the governmental credit basis, the lists of scientific specialties are constantly revised at departments and faculties, as well as new scientific specialties are planned to be open for post-graduate students.

Postgraduate training is over on 59 specialties, of which 33 – engineering profile.

There are 14 Specialized Academic Councils on thesis approval.

Scientific training at the National Aviation University is carried out in accordance with the Law of Ukraine “On Higher Education” (16.10.2012, N 5460-VI), the Ukraine Ministry Decree “On approval of the awarding of academic degrees and conferring academic titles” (24.07.2013, N 567), the

Ukraine Ministry Regulation “On the preparation of scientific teaching and research staff” (07.08.2013, N 538), the Regulation on the preparation of scientific teaching and research staff through postgraduate and doctoral studies of the National Aviation University (29.05.2013, N 1126).

### **3. The European system of doctoral education as the Bologna Process third cycle**

Across Europe, the early years of the Bologna Process were focused on introducing and consolidating the bachelor and master cycles.

Doctoral education as third cycle was formally introduced to the Bologna Process by Ministers meeting in Berlin in 2003 and has since become an increasing priority.

Conscious of the need to promote closer links between the European Higher Education Area (EHEA) and the ERA in a Europe of Knowledge, and of the importance of research as an integral part of higher education across Europe, Ministers consider it necessary to go beyond the present focus on two main cycles of higher education to include the doctoral level as the third cycle in the Bologna Process [3].

The European Research Area (ERA), launched in 2000, is a European Union initiative, involving about three quarters of the 46 countries participating in the creation of the EHEA).

Its ambitions, such as creating a borderless area for research and knowledge exchange in Europe and increasing research expenditure, have underpinned the growing focus of Education Ministers on the doctoral cycle.

With the Bergen Communiqué of 2005, Ministers stressed the importance of research and research training and recognised the need to improve synergies between higher education and research [5].

Regarding doctoral education, Ministers made the following statements:

- Doctoral level qualifications need to be fully aligned with the EHEA overarching framework for qualifications using the outcomes-based approach;
- Core component of doctoral training is the advancement of knowledge through original research;
- The normal workload of the third cycle in most countries corresponds to 3-4 years full time;
- Doctoral programmes should promote interdisciplinary training and the development of transferable skills to meet the needs of the wider labour market;
- More doctoral candidates should be encouraged to take up research careers within the EHEA;

– Participants in third cycle programmes are considered both students and early stage researchers.

On the basis of work undertaken by the European University Association (EUA), Ministers again put doctoral candidates high on the Bologna Process agenda when they met in May 2007 in London.

In the London Communiqué, they stressed the need to enhance provision in the third cycle and to improve the status, career prospects and funding for early stage researchers as preconditions for strengthening Europe's research capacity and improving the quality and competitiveness of European higher education [6].

Ministers invited EUA to support the sharing of experience among higher education institutions on innovative doctoral programmes emerging across Europe and on issues such as transparent access arrangements, supervision and assessment procedures, the development of transferable skills and ways of enhancing employability.

To provide a forum for sharing good practice and to contribute to the enhancement of doctoral education, EUA established in early 2008 a Council for Doctoral Education [2].

While acknowledging the value of diversified provision, the reform of doctoral programmes, in common with other Bologna action lines, requires firm commitment at top university management level.

Doctoral education must find its place in university strategic planning to ensure quality provision and a healthy research environment.

Institutional management of doctoral programmes also helps ensure proper coordination with the first two Bologna cycles.

In accepting responsibility for high quality doctoral provision, universities in many European countries have begun to develop programmes within innovative structural arrangements, integrating different types of public institutions, organisations, research institutes and companies.

The EUA Trends V report illustrated that many countries now have such structures in place for a large number of doctoral candidates, and this pattern looks set to develop further in the future [7].

The development of a European and wider international dimension in higher education is a fundamental aspect of the Bologna Process.

Attracting more international candidates to European doctoral programmes, expanding university research partnerships to other world regions, and retaining more of Europe's domestic research talent are critical issues in making Europe internationally more attractive and competitive.

Only internationalised doctoral programmes that attract candidates and faculty from all over the world can be truly responsive to the needs of today's globalised world.

Although mobility during doctoral programmes is already well established at many universities, considerable debate is underway about how to encourage more mobility at doctoral level as part of institutions' overall internationalisation strategies.

Prevailing cultural and funding mechanisms have traditionally determined whether doctoral candidates are regarded as employees who receive salaries or students who possibly receive student financial support.

The decision whether or not to treat doctoral candidates as employees has important implications in terms of finances and social security but also for their later career prospects.

More effort is now being undertaken to make the doctoral cycle and research careers more attractive, but also to ensure that doctoral graduates have a wide variety of career options in Europe.

Treating doctoral candidates as early stage researchers with an employee status makes the doctoral cycle more attractive and facilitates the transition into the wider labour market.

Transversal skills - acquired "on the job" or through specific skills trainings, which increasingly find their way into doctoral education - are relevant for research careers and for careers in other fields.

The notion that doctoral graduates are widely employable beyond research and academia still needs to be realised consistently across Europe.

One important task therefore is to make doctoral graduates and employers aware of the skills doctoral graduates possess, which ideally leave them well-prepared for a wide range of career paths.

If Europe is to meet its goals, the considerable effort involved in reforming doctoral programmes through innovative structures and practice, and more extensive international cooperation, must be adequately funded. Yet this is more easily stated than achieved.

Also the doctoral candidates need adequate funding, especially if suitably qualified candidates from lower income groups are to be encouraged, as the social dimension of the Bologna Process suggests.

However, there is considerable work to do if this goal is to be met, as doctoral candidates often face financial hardship from limited funding opportunities. Universities are therefore encouraged to create an employee status for doctoral candidates and to look into innovative funding practices, such as balanced

industry partnerships or partnerships with foundations and research institutes.

Since the 2005 Ministers' Conference in Bergen, that adopted the "European Standards and Guidelines for Quality Assurance in the European Higher Education Area", Quality Assurance (QA) of Higher Education has become a major objective of the "Bologna Process".

At present, QA Agencies (or analogous bodies) exist in practically every country of the European Union (and in most EHEA countries), and the "European Quality Assurance Register of Higher Education" has been established.

This is indeed a great positive progress for the contribution that QA can give to the general improvement of Higher Education.

However, QA often tends to assess more the "process" than the "contents" of the education: therefore, especially in subjects that lead towards a "profession" ("engineering" first among them), the practice of "accreditation" is also increasing throughout the world. In "accrediting" higher education different approaches are possible: in particular, "programme" and "institutional".

However, the two approaches are not in contrast, but on the contrary can usefully complement each other.

Two recent initiatives in programme approach will be quoted in the last part of the lecture.

First, the EUR-ACE® system for the "European accreditation of engineering programmes" at the Bachelor and Master levels, run by ENAEE since 2006.

Second, the foundation in November 2011 of the "European Alliance for Subject-Specific and Professional Accreditation and Quality Assurance", the European analogous of the older American "Association of Specialized and Professional Accreditors" [1].

#### 4. The International Project

National Aviation University became a member of the International Consortium for the International Tempus-Project "New Model of the Third Cycle in Engineering Education due to Bologna Process", that is accepted for execution during 2014-2016 years.

This Project has been funded with support from the European Commission.

The project goals and objectives is to ensure that the targeted Universities introduce pilot Doctoral Programs in Engineering in line with the Bologna Process, according to 10 principles of Salzburg and Bucharest Forum.

The specific project objectives are following:

- to develop, implement and accredit new core and transferable curricula including ECTS;
- to establish new structured Doctoral Programs in target area according to requirements of Labor Market;
- to develop innovative teaching/learning environment for Doctoral Programs;
- to bring the Higher Education Institutions of PCs closer to the Labor Market.

Target group is post-graduates, graduates, students, teaching, research, administrative staff; management of educational organizations, local community administration staff.

The Project performing includes the following Activities:

- Review current doctoral programmes and develop model for new structured doctoral programmes;
- Develop and accredit new core and transferable curricula;
- Establish innovative teaching/learning environment;
- Set up "Doctor Engineers in Labour Market (DLM) offices" to support Dr. Engineers in Labour Market;
- Sustainability through implementation;
- Quality control.

Principal outcomes and outputs of the Project are following:

- 8 new core and 3 transferable curricula developed, implemented, accredited;
- Innovative teaching and learning environment including Joint Web Platform, Doc Colloquium Rooms, Labs and Doctoral Summer schools established, equipped and open for operation based upon Master Classes and pilot operation conducted;
- DLM Offices to support Researchers in Labor Market based on pilot operation in function;
- Dissemination of project results.

Thus, the objectives of the project are to develop, implement, transfer and accreditation of training programs, including their adaptation system ECTS, installing new structured doctoral programs in the target area in accordance with the requirements of the labor market, the development of the learning environment for doctoral programs according to the Bologna process and bring Doctoral graduates of universities closer to the labor market and the urgent priority directions of science and technology.

Therefore, the Project is in line with national priorities of Ukraine in the engineering field, considering the priorities of all partner countries

universities, aimed at reforming the curriculum, the development and implementation of a new model of the third cycle in technical sciences.

The project partners have identified by an analysis inquiring the priority to develop the third cycle programmes in Engineering which is logically related to the fact, that the first cycle BA and the second cycle MA in Engineering are already successfully implemented. Ukraine have joint the Bologna process so it have to tune our Doctoral Education System to various aspects of the Doctoral programmes of European Knowledge Society.

An overview of the political decisions of the last few years shows that the objectives of the Project are shared in partner countries.

International Project Consortium consists of 22 institutions from 6 countries, including 14 universities, of which 3 - Ukraine National Aviation University, National Technical University of Ukraine Kyiv Polytechnic Institute and Cherkasy State Technological University.

Participating in the consortium partner institutions with different needs according to the stakeholder groups they represent, with varying experience of European projects, establishment of academic and non-academic consortium members in the project.

The project will have an important impact in the process of modernization and reform, meets the academic, professional and social needs of target countries, developing plans targeted universities, institutional and socio-economic support and political priorities of the target countries.

During the project partner countries universities must be accredited new curricula and new teaching materials at the institutional level following close to the subject project courses and disciplines, "System modelling and simulation", "Navigation in Transport Systems", "Sensoric in research", "Power electronics and systems", "Mathematical modeling", "Satellite images processing techniques", "Robotic systems", "Materials Science and Solidification Processing".

The methodology of the project based on the following principles.

The project represented all levels of key institutions, including universities, ministries of higher education stakeholders.

These horizontal and vertical linkages are to provide high quality and efficiency in the performance of the work plan.

Business plan consists of a series of stages, due to the implementation of which should be achieved measurable and tangible results are to be used in subsequent stages of the project.

Activity for the duration of the project is to ensure its efficiency and stability.

Particular attention is paid to project management and administration of each organization make up the consortium.

Great importance is the presence of perspective development plan of the University of introducing new subjects and research areas, close to the subject matter of the project departments targeted communications with stakeholders (the subject of the project) in the field of industry organizations, institutions of research and development activity, and related universities, given the presence of organizations interested in graduates with the academic title in the subject project [4].

## 5. Conclusions

Social and economic environment of the new century, the development of the world science, the University's restructuring, the opening of new specialists training fields, on one hand, and involvement of highly qualified scientists of relevant scientific activity directions, on the other hand have led to significant restructuring of the University science, its subjects broadening, appearance of research complex on engineering issues, and, as a consequence, to reform the system of highly qualified specialists training in the field of engineering education through the development and implementation of an experimental model of the doctoral program (PhD) in engineering and aerospace technology due to Bologna Process.

## References

- [1] *Augusti, Giuliano*. Quality and Accreditation in Engineering Education in Europe. Proceedings. International Symposium on Innovation and Quality in Engineering Education. Valladolid (Spain), 26–28 April 2012.
- [2] *Collaborative Doctoral Education – University-Industry Partnerships for Enhancing Knowledge Exchange*. Doc-Careers Project by Lidia Borrell-Damian. EUA Publications. 2009.
- [3] *Realising the European Higher Education Area*. Communiqué of the Conference of Ministers responsible for Higher Education. Berlin. 19 September 2003.
- [4] *Science and Innovation*. Kyiv, National Aviation University. 2009.
- [5] *The European Higher Education Area – Achieving the Goals*. Communiqué of the Conference of European Ministers Responsible for Higher Education. Bergen. 19-20 May 2005.

[6] *Towards the European Higher Education Area: responding to challenges in a globalised world.* Communiqué of the Conference of European Ministers Responsible for Higher Education. London, 18 May 2007.

[7] *Trends, V. Universities shaping the European Higher Education Area.* By David Crosier, Lewis Purser & Hanne Smidt. An EUA Report. EUA Publications. 2007.

Received 12 June 2014.

**В.П. Харченко<sup>1</sup>, Д.Е. Прусов<sup>2</sup>. Стратегія підготовки наукових кадрів вищої кваліфікації в Національному авіаційному університеті**

Національний авіаційний університет, просп. Космонавта Комарова, 1, Київ, Україна, 03680

E-mails: <sup>1</sup>kharch@nau.edu.ua; <sup>2</sup>prusov@nau.edu.ua

Визначено стратегічні плани реформування системи підготовки кадрів вищої кваліфікації в галузі інженерної освіти шляхом розробки та впровадження експериментальної моделі докторської програми в галузі інжинірингу та аерокосмічних технологій відповідно до положень Болонського процесу в рамках міжнародного проекту TEMPUS «Нова модель третього циклу в області інженерної освіти».

**Ключові слова:** Болонський процес; докторські програми; інженерна освіта; третій цикл.

**В.П. Харченко<sup>1</sup>, Д.Э. Прусов<sup>2</sup>. Стратегия подготовки научных кадров высшей квалификации в Национальном авиационном университете**

Национальный авиационный университет, просп. Космонавта Комарова, 1, Киев, Украина, 03680

E-mails: <sup>1</sup>kharch@nau.edu.ua; <sup>2</sup>prusov@nau.edu.ua

Определены стратегические планы реформирования системы подготовки кадров высшей квалификации в области инженерного образования путем разработки и внедрения экспериментальной модели докторской программы в области инжиниринга и аэрокосмических технологий в соответствии с положениями Болонского процесса в рамках международного проекта TEMPUS «Новая модель третьего цикла в области инженерного образования».

**Ключевые слова:** Болонский процесс; докторские программы; инженерное образование; третий цикл.

**Kharchenko Volodymyr** (1943). Doctor of Engineering. Professor.

Holder of a State Award in Science and Engineering of Ukraine.

Winner of a State Prize of Ukraine in Science and Engineering.

Vice-Rector for Scientific-Research Work, National Aviation University, Kyiv, Ukraine.

Head of the Department of Air Navigation Systems, National Aviation University, Kyiv, Ukraine.

Education: Kyiv Civil Aviation Engineers Institute with a Degree in Radio Engineering, Kyiv, Ukraine (1967).

Research area: effective management of complicated socio-technical systems, development and improvement of aeronavigation systems in Ukraine based on the application of the satellite systems.

Publications: 406.

E-mail: knarch@nau.edu.ua

**Prusov Dmitry**. Candidate of Engineering. Associate Professor. Senior Researcher.

Scientific Research Administration, National Aviation University, Kyiv, Ukraine.

Education: Kyiv National University of Construction and Architecture, Kyiv, Ukraine (1994).

Research area: new concepts in urban development and territorial planning for the urban territories engineering preparation, the creation of theoretical principles and new methodologies for objects research and processes mathematical modeling; reforming the system of scientific personnel training in the engineering education.

Publications: 100.

E-mail: prusov@nau.edu.ua